SCIENTIFIC AMERICAN

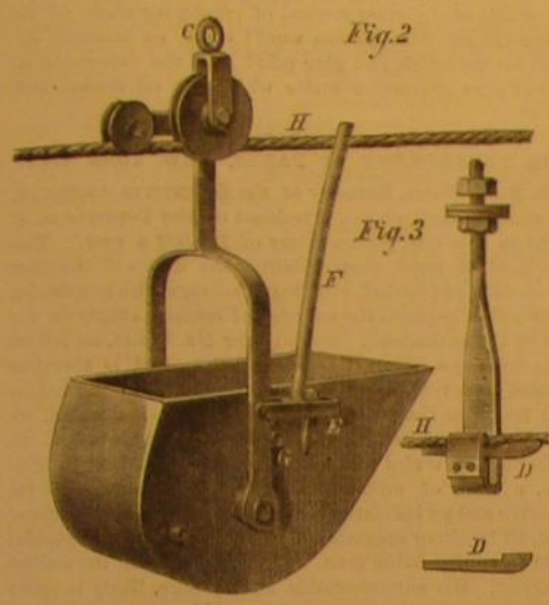
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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HAVENS' AUTOMATIC WIRE ROPE RAILWAY.

Our illustrations represent a novel and ingenious invention, or rather combination of devices, having for its object the speedy, cheap, and economical transportation of merchandise, of any description, directly from vessel to storehouse, yard, or dock, or between different points of the latter localities. It consists chiefly in a suitably supported

Fig. 2



wire rope, over which, by the action of gravity alone, buckets slide to the desired place of deposit of their contents. Discharge follows, and then, by an ingenious switch arrangement, the receptacle is shifted to another rope, along which it returns to its starting point to be refilled. There are other devices, for sending the charged bucket from the end of the first rope as a center to any part of a yard or other storing place, which will be explained as we proceed.

In our large engraving, which gives a general view of the apparatus in operation, the invention is represented as in use as a coal railway, taking the coal directly from the barge and dumping it at a considerable distance away. Two tall poles, it will be observed, are placed close to the edge of the wharf. One is provided with a platform on which a workman is standing, and also a suitable support to which the outrigger, A, is pivoted, so that the latter, moving only in a vertical plane, can be swung into a perpendicular position.

Fig. 4

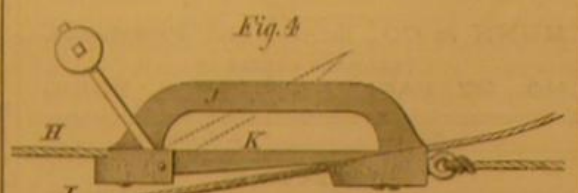
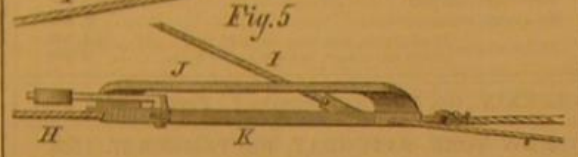


Fig. 5



The other and taller pole carries at its upper extremity a pulley, over which the hoisting fall passes. This rope leads from the drum of the hoisting engine (which, by the way, is of a novel and improved form, and is also the invention of the originator of the apparatus we are describing) through a block on the ground up over the pulley on the pole, and thence through a sheave or similar arrangement on the end of the arm, A. The end of the rope is hooked to the ring, C, of the bucket, shown in Fig. 2. The engine being set in motion, the filled receptacle is hoisted from the barge until a knot, cast in the rope, takes against the pulley on the arm, A, preventing the further passage through of the line. Movement is thus imparted to the outrigger, and it is swung from its horizontal to a vertical position, thereby bringing the bucket directly over the upper of the two wire ropes shown in the engraving. It will be observed, from Fig. 2, that the bale of the bucket is connected to an iron bar

Fig. 6

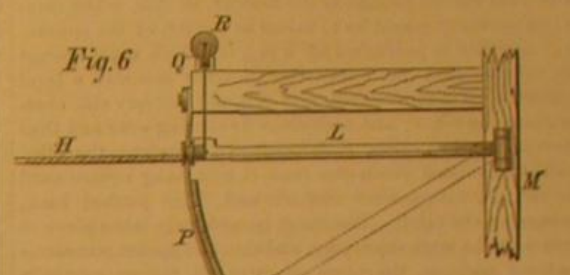
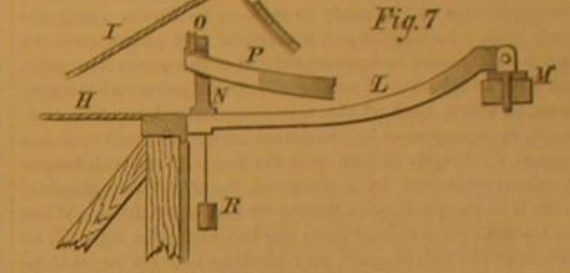
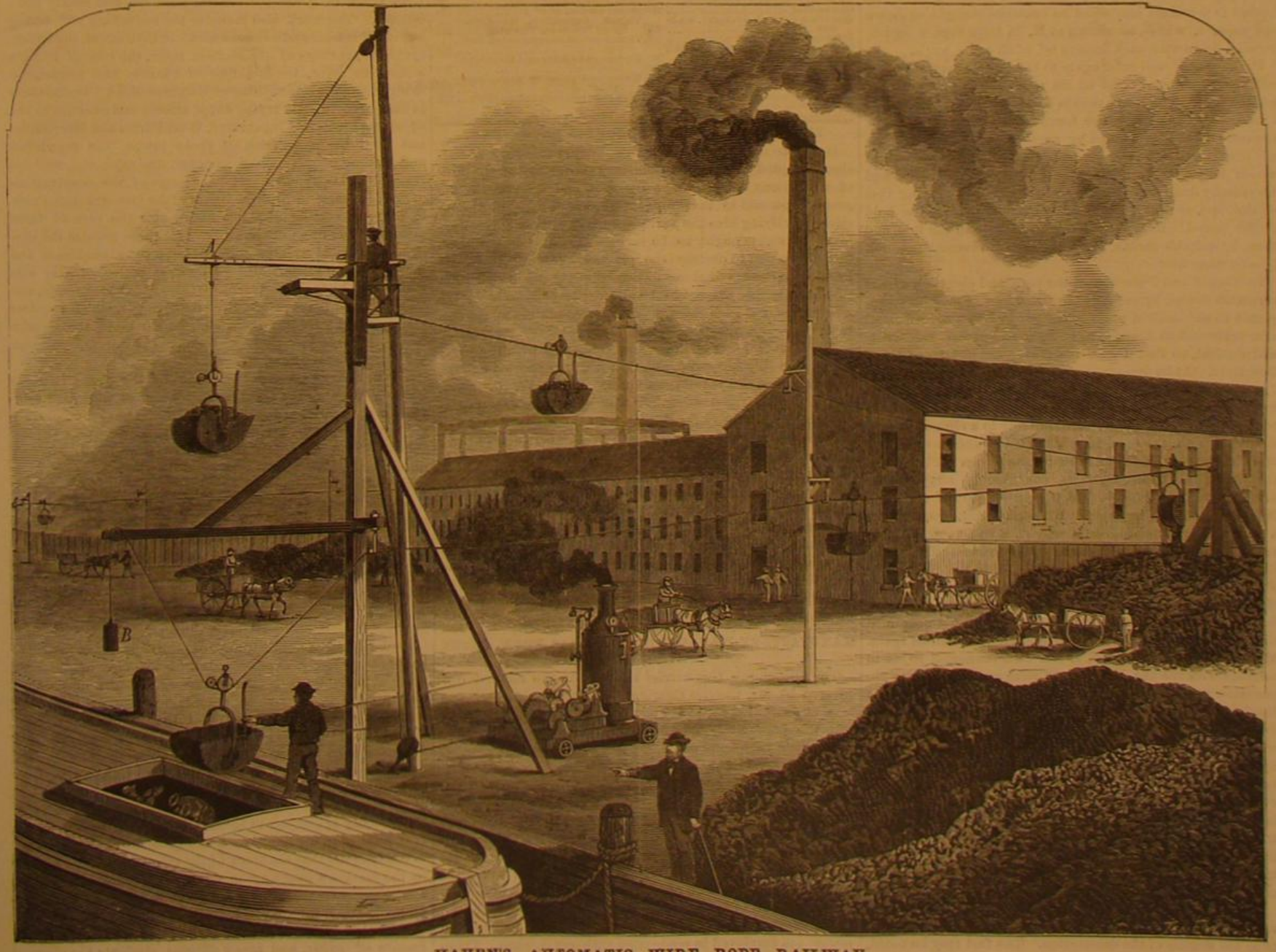


Fig. 7



which terminates above in two rollers, the smallest of which serves to guide the larger, as both rest upon and glide over the rope. The receptacle being in the position above described, the hoisting fall is slackened, and the workman on the platform guides the rollers directly on the wire rope, and then removes the hook from the upper ring. The buck-



HAVEN'S AUTOMATIC WIRE ROPE RAILWAY

et, now full, begins its downward course, and, acted on by gravity, travels down to the end of the rope.

Before proceeding further, it will be well to notice the arrangements for supporting the wire lines in order to keep them from sagging along their length. This is accomplished by clips, Fig. 3, one of which for each rope is attached to a midway post. The lower end of this device is turned up and shod with a metal plate. The line fits, as shown, in an inside groove, and is there secured by a key, D, driven firmly in. This means of support clearly offers no obstruction to the passage of the bucket rollers, and still holds the line up firmly in position. The usual nuts, screw, and washers, serve to attach the clip to its post.

We left the filled bucket near the end of the upper line; and supposing it to have arrived over the coal heaps, it is ready to discharge its contents. Referring once more to Fig. 2, pivoted to the side of the bale is a slotted piece, E, which slips over an upwardly projecting stud, thus holding the bucket in the position shown. Attached to piece, E, is a rod, F. The construction of the bucket is such that the rear or bottom curved portion is the heavier, so that, when empty, its tendency would be to invert to the left of the engraving; but this is prevented by a lug, G, which takes against the bale, so that the receptacle naturally assumes a level position. When, however, it is full, the delivery side overbalances the other; and to prevent its turning over and thus discharging, the catch, E, is used. If, therefore, the filled bucket be started down the rope, it will hang square until the rod, F, strikes some obstacle and, thus pushed back, swings up the catch. Discharge immediately takes place, as shown in the large engraving, and then the bucket reassumes its level position, the piece or catch, E, falling naturally back again over the projection on the side.

The empty receptacle will now have arrived at the end of the upper rope and is ready to start on its return along the lower line. In Figs. 4 and 5 vertical and plan views, the switch mechanism is represented. H is the upper wire rope, and I the lower one. J is a peculiarly shaped metal arrangement, to which both of the above mentioned ropes are secured, as represented by the dotted lines. Pivoted to J is a tongue, K, directly in line with the rope, H; and this tongue is counterbalanced by a weighted lever which ordinarily holds it in the position indicated by the dotted lines. When the bucket comes rolling from the left along the rope, H, its wheels strike this tongue; and pushing it down so that its further end rests against the opposite side of the piece, J, they run over it and up and along the line which forms a continuation of the rope, I. That is, the bucket runs up hill until its motion is arrested, when of course it takes up a return movement. As soon, however, as the bucket clears the tongue, the weight on the latter pulls it up again; so that, when the returning bucket reaches the piece, J, the tongue no longer forms a bridge between the opposite ends. The bucket is therefore compelled to continue straight on down the rope, I, which, as shown at K, in both Figs. 4 and 5, forms a downward path leading off at an acute angle.

If the reader will refer again to the large illustration, he will see the empty bucket on its returning course near the middle post. The lower rope is firmly secured at its end to a hanger on the pole, which forms the starting point of the apparatus, but is continued by another line, B, which leads out along an arm, passes over a pulley, and ends in a weight which keeps it taut. On this line the bucket runs and necessarily drags it down, its weight counterbalancing that on the rope, so that it is gradually eased down into the hold of the vessel. Here the fillers remove it from the line, and then, by suitable means, allow the latter to become gradually once more taut.

In Figs. 6 and 7 are shown the plan and elevation of the turntable device, by means of which a bucket may be transported to any desired point in the yard. L is a curved metal arm connected to a support, at M, to two pivots, transverse and vertical, so that it has free movement in both of these directions. At its opposite end is affixed a standard, N, Fig. 7, on top of which is arranged a small roller, O. Fastened to the solid framework of the device is a metal band or track, P, which has a curve conformable to a circumference, described with the arm, L, as a radius, as shown in Fig. 6, and also, besides, a downward bend, as shown in Fig. 7. On this band, the roller, O, rests, and thereby supports the arm, L, hanging beneath. At the upper part of standard, N, and near the roller is secured a cord which, passing over a pulley, at Q, terminates in a weight, R. The object of this arrangement is to draw the arm, L, up automatically to the highest point of the curved band, P, or in the position of Fig. 6. When thus placed, the end of the upper wire rope, H, directly meets the end of the arm, L. Consequently a bucket sliding along rope, H, will run up on the arm until its motion is stopped by the ascent and then start down again. Meanwhile the under rope, I, has been connected so as to coincide with the bar, if the latter were carried over (its upper roller running on P) to the position marked by the dotted lines. The bucket, however, it is evident, running back over the arm, L, would fall from the end, unless prevented, while the arm was being shifted. This difficulty is obviated by arranging boards inside the track, P, against which the receptacle takes and is stopped. At exactly the point, however, where the dotted arm and rope, I, coincide, an opening is made out of which, of course, the bucket escapes and travels away down rope, I, to the desired point. The boards inside the track may be made movable so that, rope, I, being attached at any place, a suitable opening can be easily made.

It is hardly necessary to explain the advantages of this very ingenious apparatus, since, we think, they are obvious from the details of the description. The fact may be noted, however, that this device differs from many others of its class, in that the road itself does not move, endless belt fashion, but merely the buckets. Hence a single line may be put up, supported at intervals as we have described, for almost any length; and then the buckets can be dragged over it by connecting a light endless cord or equivalent arrangement.

The absence of cumbrous trestle work or staging, and of elevated or underground tracks, is a point of merit, as is also that of gravity being the sole agent for performing the work. As to its employment the inventor considers the arrangement especially adapted to retail coal yards, on account of its portability and economy. An attachment, he states, may be applied to weigh and register the weight of each bucket passed over the rope, so the only power required is that needed to hoist it to the necessary elevation.

The device is covered by several patents, and is the invention of Mr. A. F. Havens, a well known engineer of this city. Further information regarding right to use, etc., may be obtained of the proprietors, the American Gas Works Construction and Supply Company, room 33, 61 Broadway, New York city.

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Contents.

(Illustrated articles are marked with an asterisk.)

American progress in stock breeding..... 201
Answers to correspondents..... 203
Arctic expedition, tidings of the missing..... 193
Balloon to Europe, failure of the 193
Brake, railroad hand*..... 198
Budding fruit trees..... 200
Burrs from heating, to prevent... 198
Business and personal..... 203
Butter and cheese exchange, a.... 199
Chemical sugar..... 192
Clutch drill, improved*..... 199
Department of Parks, New York city, the..... 192
Devil fish, the..... 196
Down Hall, Harlow, England*..... 199
Earwigs*..... 195
Electric light, the..... 199
Fires on board ship, preventing... 200
Gas as fuel..... 193
Gas from crude petroleum, making..... 192
Incrustation of water pipes..... 198
Inventions patented in England by Americans..... 201
Locomotives without fire, steam. 200
Magic lantern as a means of demonstration, the*..... 200
Multiplex telegraph, the..... 197
New books and publications..... 201
Notes and queries..... 203
Patents, official list of..... 204
Patents, recent American and foreign..... 201
Patents, value of foreign..... 199
Phosphorus thought / is..... 195
Poison, a remarkable..... 194
Poisonous undershirts..... 201
Potato disease, a chemical remedy for the..... 198
Prizes for electrical inventions... 201
Railway dead weights..... 200
Rigi railway, the*..... 194
Scientific and practical information..... 198
Slate roofing paint..... 194
Spade and fork, combined*..... 198
Spontaneous generation..... 196
Steam motor, new*..... 194
Vienna exposition, the—Letter from Professor Thurston..... 197
Vienna patent congress once more, the..... 192
Vienna premiums and the sewing machines..... 201
Water and pressure gage, combined*..... 198
Wire rope railway, automatic*.... 191

THE VIENNA PATENT CONGRESS ONCE MORE.

It will be remembered that this body, after long discussions, adopted a series of resolutions affirmatory of the duty of all nations to encourage the arts and sciences by the grant of patents to inventors, in reward for useful discoveries, specifying also the various legal provisions by which inventive rights ought to be secured. But the Congress then proceeded to destroy the practical value of its labors by adopting as its final resolution the absurd proposition that inventors ought not to be allowed to sell their patent rights except at such rates as government officers might dictate.

The most singular circumstance connected with the passage of this silly proposition is, that it was supported and its adoption secured by American votes. Mr. R. W. Raymond, of the *Engineering and Mining Journal*, who was a delegate, is our authority for this statement. He says that the American party was strong enough in numbers and in logic to defeat the obnoxious resolution, and would have succeeded in doing so had not two of their number, Hamilton Hill of Boston and Mr. Hall, changed their minds during the night, and voted next morning with the opposition. These gentlemen palavered at a great rate during the five days' discussions in favor of granting liberal rights to inventors, and then, at the last, they changed front and voted against the essential thing for which they had been arguing. It is to be hoped that American inventors may never again be misrepresented by such a pair of incompetents.

MANUFACTURE OF ILLUMINATING GAS FROM CRUDE PETROLEUM.

The Pittsburgh *Commercial* states that the method discovered by Mr. Charles Gearing, of that city, has been put into successful practical operation at Sharpsburg, Pa., and the borough is now admirably lighted by gas made from crude petroleum oil, 8,000 feet of gas being produced from one barrel of the oil.

As the subject is one of great importance, not only to the inhabitants of our towns and cities, who need good light at a cheap price, but also to gas companies and oil producers, we will give a few details of the Gearing process, from which practical gas men may, in some degree, judge of its actual merits. To us it looks like a good improvement, worthy of the careful investigation of all who are interested in the extensive branch of industry to which it pertains.

In the simpler form of the Gearing apparatus, some seven retorts are employed in connection with one furnace. These retorts have double chambers, made by enclosing small cylinders within other cylinders of large diameter. The inner cylinders are filled with pebbles, the object of which is to provide very extensive heating surfaces. A jet of steam and air is, by means of an injector, introduced at one end of the first of the series of retorts, and then passes on through the pebbles, successively into and through three other retorts, until the steam and air are thoroughly dried and heated; thence the jet goes into contact with the crude petroleum in another retort and takes up therefrom a supply of the oil vapor, thence on successively through three other retorts contained in the furnace, where the final heating takes place, thence into the gas holder. The operation is simple and continuous. The peculiar construction of the retorts is alleged to prevent loss of oil by conversion and deposit into solid carbon, the only resulting deposits in the retorts being the sand usually found in crude oil, with some other foreign matters.

A company has been formed, we understand, to put this process in operation in Titusville, Pa. We shall look with much interest for the practical results. The success of this or any other method of employing crude oil for permanent gas illumination would create an immense demand for the article and give relief from the depressing effects of over production under which the oil market now suffers.

THE DEPARTMENT OF PARKS, NEW YORK CITY.

Mr. S. H. Wales, formerly of the SCIENTIFIC AMERICAN, has recently been chosen President of the Department of Parks in this city, with a salary of $10,000 a year. This is a post of much responsibility, the duties of the office are onerous and varied, and their discharge with satisfaction to the public requires the exercise of marked ability on the part of the incumbent. Happily for Mr. Wales, he retired some time ago from active business life, and is therefore enabled to devote his whole time, if need be, to the important functions that now devolve upon him, and which, we are glad to say, are especially congenial to his tastes. In æsthetics Mr. Wales is a gentleman of the highest cultivation, a lover of science, an extensive traveller, a careful observer and an indefatigable worker. He possesses, moreover, an intuitive appreciation of the wants of the people; he is an approachable man, and a gentleman of the noblest integrity. His administration is, therefore, likely to prove not only popular but most useful. His unanimous election as President reflects the highest credit upon his associate commissioners.

The general scope of the powers and labors of our Department of Parks is not generally understood, and is far more extensive than is commonly supposed. It embraces the custody of twenty-four parks, covering an area of more than 1,000 acres, of which the Central Park has cost nearly $12,000,000. The work also includes the surveying and laying out of all streets and avenues north of 59th street, the hydrographical surveys of the Harlem river, the care of bridges across the river, the building of tunnels and suspension bridges, and the establishing of bulkhead lines. It also takes in the surveying and laying out of streets and avenues in the adjoining towns of Kingsbridge, West Farms and Morrisania, and upon the annexation of those towns, the regulation and grading of streets and avenues, drainage, etc., will belong to the Department. It has charge of the construction of the Museums of Natural History (the two structures now in progress costing $500,000 each), also the care of these museums and of an observatory. All these require the constant service of a large force of architects, engineers and laborers (some 1,500 in all.) A distinct police force is also maintained by the department. It also runs a menagerie, and an exotic and plant-propagating department, which requires many skilled gardeners. In addition to these the Department employs blacksmiths, tailors, carpenters, painters, plumbers, stonecutters, masons, etc.

The ordinary expense of maintaining the parks is about $500,000 per annum; and for construction of works, $1,000,000 was appropriated for the year 1873. The Commissioners are now laying out and constructing two new parks (Riverside and Morning Side); and in short the details are very numerous.

From the foregoing, which is only an outline of its labors, it will be seen that the Department of Parks is one of the most important institutions in our midst. The effective management of its extensive concerns involves more real labor, watchfulness and ability, on the part of its executive, than almost any other department of municipal or state government.

CHEMICAL SUGAR.

Dealers and manufacturers of the important article of sugar have lately experienced a disturbance of the even tenor of their ways by the announcement of a new chemical discovery, by which saccharine commodities may be produced as by magic, without the troublesome and expensive methods of cane growing and grinding. The new discovery is credited to M. Jouglet, a French engineer, and his process is alleged to involve the mere bringing together of certain common and cheap articles, from which the best qualities of sugar are rapidly and economically produced. The process is claimed to be the subject of a patent, which is at present in the hands of a large company.

We imagine that the stock of the company will be for sale on the market a long time in advance of the sugar, and we advise sugar manufacturers not to shut up their existing establishments just at present.

There is undoubtedly room for improvement in the manufacture of sugar, and many diligent students are engaged

upon the subject. Every year adds to our knowledge and facilities for conducting this great industry, which is so extensive and involves so much capital, that the smallest economical advance, in any of its processes, is a matter of importance to the world. But we should about as soon expect to see the steam engine superceded by the hot air machine, as to find the present sugar processes set aside by the novelty now announced.

The production of sugar by chemical means from various materials, is by no means a new thing, having long been practiced. Thus starch, treated with warm diluted sulphuric acid, is converted into sugar. It is cheaply produced, and an extensive manufacture is carried on. This product is known as grape sugar, or glucose, and the only drawback to its substitution for cane sugar is the fact that grape sugar has only half the sweetening power of the cane. Starch sugar is employed to adulterate honey and cane sugar, and is used in lieu of the latter in various saccharine preparations.

The cheap and common materials suggested by this French engineer may refer to rags or other refuse containing woody fiber, such as cotton wool, paper, etc. Exhaustive attempts have heretofore been made by chemists to induce people to eat their linen rags, after a cooking which converts them into sugar. This consists in treatment with sulphuric acid, by which means a fine crystaline article of sugar may be produced from old collars and shirt tails. But rag sugar, like that from starch, lacks sweetness, and the stuff is unsuited for the popular taste.

TIDINGS FROM THE MISSING ARCTIC EXPLORERS.

The United States steamer Juniata has arrived at Newfoundland, bringing news that the steamer Tigress, the vessel which was sent by our Government in search of the survivors of Captain Hall's expedition, had found and visited their last winter encampment, near Littleton Island, Greenland, in latitude 78° 23'.

It will be remarked that the statement of the persons belonging to the Hall expedition, who were rescued from the ice this spring, after floating southward for several months, was to the effect that, when they last saw their vessel, the Polaris, she was at anchor near the shore, with sails furled, and they were astonished that she did not come to their rescue.

It now appears from the statement of the natives that the Polaris was so badly injured as to be incapable of movement, and Captain Buddington and party took to the shore. Here they wintered in good health; and this spring they built a pair of whale boats, and on the 1st of July launched out southward, intending to find their way home by intercepting some of the whaling vessels that visit Baffin's Bay. These are the latest tidings of the missing men, who are supposed to be safe on board some one of the whalers, now cruising in that vicinity and soon to return home. The Tigress has gone from Disco on a new search among the whalers, to find the Buddington party if possible. The natives say that when Captain Buddington left he presented the wreck of the Polaris to them; but in about a month afterwards, during a gale, the ship was carried off shore and sunk.

FAILURE OF THE BALLOON TO EUROPE.

The departure of Professors Wise and Donaldson on their proposed aerial flight to Europe was brought to an adjournment, *sine die*, on the 12th instant, by the sudden collapse of their balloon, which unfortunately proved to be deficient in strength. The day above mentioned was most beautiful and auspicious for a balloon ascent. The air was clear, the wind gentle, the preparations complete. Early in the day it was announced by the Messrs. Goodsell, the projectors, proprietors of the *Graphic*, that the inflation had begun and that the balloon would start in the afternoon, from the Capitoline grounds, Brooklyn. Yielding to the urgent written petition of many of our prominent but verdant citizens, the Messrs. G., reluctantly, of course, consented to admit a few select thousands of spectators to the grounds, at 50 cents per head and 50 cents extra for reserved seats, to witness the ascension.

We regret to say that the veteran aeronaut, Professor Wise, who in the early stages of the enterprise expressed his unlimited confidence in the use of the gigantic balloon, who was in fact the consulting engineer for the apparatus from the very beginning, and who, in several public letters, announced the brave intention of going up in the machine, came to the conclusion, towards the last, that the apparatus was unsafe, and declined to risk his life in the car. He left the grounds before the final catastrophe occurred. Professor Donaldson, however, who is afraid of nothing, stuck to his post, determined to go up if such a thing were possible. So the inflation proceeded, and the gigantic bag, over 100 feet in diameter, swelled majestically in the air, impatient of restraint, and tugged with tremendous force upon the retaining ropes. The gas kept pouring in, the balloon grew larger and larger, the inflation was all but complete, Professor Donaldson made his final arrangements to leave the earth, and the thronging multitude stood gazing at the great air ship with breathless interest, when suddenly a ripping of the cloth was heard, and several rents in the top appeared, through which the gas took instant flight; and the enormous envelope fell flat to the earth, a mass of shapeless rags. The result fully justified the fears of Professor Wise.

Professor Donaldson states that the *Graphic* people have agreed to furnish a new balloon, of smaller size, to be made of silk, and that it will be ready in October, when he will again essay the voyage to Europe. Professor Wise complains of bad faith on the part of the *Graphic* people, who, he says, did not furnish the strong materials agreed upon, but made everything as showy, as cheap and flimsy as possible. The result appears to sustain these charges. On the part of the *Graphic* people, the whole thing was designed as a pure advertising dodge for their newspaper, and in this respect has proved an undoubted success. Let no one, therefore, suppose that the great transatlantic balloon did not accomplish what its projectors originally contemplated.

GAS AS FUEL.

Two of the three prime necessaries of civilized housekeeping, water and light, are now provided in our city homes without carriage. The third, fuel, is still subject to many troublesome and expensive handlings. Consider the cost of a poor man's fire, after the coal is paid for at the retail coal yard. The retailer's profit and the cartman's pay for delivering the coal in small lots being included in the purchase price, we will leave them out of the account—though the cost of distributing a year's supply of coal throughout a city like this is something enormous—and take up our dirty fuel from the pavement at the consumer's door. If there is a hole in the side walk through which the coal can be pitched to its place in the cellar, its conveyance thither is a matter of small moment; but the chances are that there is no such convenience. In this more common case, the coal must be shoveled into pails, buckets or baskets, and toilsomely carried to its receiving bin, perhaps through a preliminary alley way of considerable length. This cannot be done without an expenditure of time and strength, having a measurable money value, which increases by so much the original cost of the coal. The fire is wanted on the third, fourth or fifth floor. Some one must descend to the cellar, shovel up the coal, and bear it by hand up the intervening flights of stairs, putting forth, it may be more human effort than was required to lift the coal from its native bed in the mine. At the mine, coal lifts and carries coal; in our houses, the work is done by human muscles. In the process of feeding the fire the coal is handled again: a small matter when we think only of one bucketful: but multiply it by the number of bucketsful handled every day in the city, and the product is an amount of labor not at all to be despised. While burning, the fire calls for constant attention; it must be watched, regulated and renewed, each step costing still more time and labor, the grand aggregate of which, for all the coal consumed, is very great. Then the ashes must be taken up, sifted and carried away, involving yet more cost of time and strength; and coals and ashes soil the hands, clothes and furniture, which must be made clean agian by additional labor. The burden of all this labor falls heaviest on the poor, for by them the coal is most frequently handled; but the rich are far from exempt. Could we sum up the cost of service employed in caring for our household grates and furnaces, the aggregate would swell immensely our yearly bills for fuel.

Further, the burning of coal in small quantities, as in cooking stoves and small heaters, is wasteful in the extreme. The combustion is imperfect; but a fraction of the possible heat is cooled; and much of that is wasted in cavernous chimneys. Then a large percentage of the coal is consumed when no heat is required, when it is objectionable even, to keep the fire in readiness for the time of need. In short, there are a thousand ways in which the original cost of coal is augmented and its efficiency diminished in the common crude and unscientific use of it for household purposes: ways never suspected by those who have never used a fuel which has none of the drawbacks of coal: which burns cleanly, quickly, perfectly and requires no carriage, namely, gas. It is more than probable that our children will live to look back upon our wasteful, troublesome, and expensive fires as we do upon old time tallow dips and the fetching of water in buckets from the town pump. Already the use of gas as fuel, especially for cooking, has been proved to be not merely convenient but economical; and economical in spite of the fact that the gas used has been expensively and, for fuel, needlessly refined, and paid for at an exorbitant rate even for illuminating gas. A cruder product would answer just as well. "Don't never prophesy unless you know" is the sound advice of one of our humorists. In the face of the caution, however, one may safely predict that the fuel of the future will carry itself, and will leave no soot or ashes. Further, the combustion will be perfect, and under perfect control; and however small the quantity burned in any case, its full heating power will be developed.

For several months a friend of ours has been testing the availability of gas for these purposes. He has used a range having two separate burners for boiling or frying, and a third burner heating at once a roasting chamber (on the principle of a Dutch oven) and an ordinary closed oven for baking. Broiling is done in the roasting chamber under a sheet of flame which covers uniformly the top of the chamber. The range has ample capacity for a family of six or eight persons, though in the present case the cooking was rarely for more than two, living modestly yet fully up to the average of people in moderate circumstances, and having two meals always, generally three meals, a day. Biscuits were baked occasionally but not bread, which, however, was almost always toasted in the roasting chamber under a full sheet of flame. During the three months just past the gas consumed —measured by a standard meter officially sealed—amounted to a trifle short of one thousand feet, costing, even at the high rate charged by our metropolitan gas companies, two dollars and a half, and averaging not more than one cent a meal. Had coal been used for the same cooking, it would have cost more to hire a boy to fetch it from the cellar and carry away the ashes.

The secret of the economical cooking can be told in few words. There was no fuel wasted. Its full heating power was scientifically developed, where it was wanted, and just so much as was wanted and no more. There was no waiting half an hour for the fire to kindle and heat up the stove; there was no high degree of heat maintained when a lower degree would suffice; and the instant any portion of the heat was no longer required, that moment, generally speaking, the flow of gas was stopped. Was a certain temperature required at a given point for ten minutes, half an hour or any other interval, the gage could be set to maintain it uniformly and trustily. It was certain the fire would not get too hot, or go out, or vary in the least. This divested the cooking of half its trouble and nine tenths of its anxiety; and there was no food spoiled by accidental causes. It is true that such economical cooking involves more than ordinary care, intelligence, foresight and conscientiousness on the part of the cook, still it is not more than the majority of women are capable of; and when cooking is thus made light, cleanly, and free from uncertainty and worry, there will be less repugnance on the part of well-to-do wives to this most important domestic duty.

If costly illuminating gas can be used economically for fuel, there can be no question of the feasibility of warming our rooms and cooking our food with gas less highly refined and consequently much cheaper.

SCIENTIFIC AND PRACTICAL INFORMATION.

FACTOR OF SAFETY FOR STEAM BOILERS.

A committee, appointed by the Franklin Institute of Philadelphia to determine a factor of safety for the iron of steam boilers, assume the ultimate strength of a single riveted sheet to be 34,000 pounds per square inch, and recommend that 6,000 pounds per square inch be adopted for the working strain. This allows a factor of safety of $34{,}000 \div 6{,}000 = 5{\cdot}67$, if we consider the ultimate strength of the material, or an average value for the factor of $(34{,}000 \div 2) \div 6{,}000 = 2{\cdot}83$, with reference to the elastic strength of the iron. When we remember that many boilers are subjected to shocks and pulsations, and that allowance must be made for deterioration and for uneven quality of the iron, this large value for the working loads seems open to grave objections.

CONVERTING BONES INTO FERTILIZERS.

How to dissolve bones conveniently on one's farm or country place, for fertilizing purposes, without resort to sulphuric acid, is an inquiry frequently asked, and has been more than once answered in the SCIENTIFIC AMERICAN. Place the bones in wood ashes, the pile being moistened with water, is the reply that has been given.

A method, said to be in use in Russia, is as follows: A trench, three or four feet deep and of any desired length, is dug in the earth, and filled with alternate layers of ashes and whole bones, each layer being about six inches thick. The lowest as well as the top layers are of ashes, and each layer of ashes is thoroughly saturated with water. At distances of three feet, poles are rammed down to the bottom of the ditch, and every eight or ten days they are taken out and enough water poured in the holes to saturate the ashes. At the end of two months the whole heap is thoroughly stirred up with a fork so as to mix the ashes and softened bones, which are then left to ferment again, water being added as often as necessary. In about three months more, the heap being worked over twice or three times more, the decomposition of the bones will be so complete that only a few of the largest bones remain, and these are taken out and put in another heap.

CRANK PINS FOR STEAM ENGINES.

A paper on this subject by Theron Skeel, C. E., was lately published in the *Iron Age*. As the conclusions therein established are of interest and importance to those designing engines, we give below a brief summary of the paper:

A crank pin has a tendency to become hot, because the work absorbed by the friction of the bearing is changed into heat. By reducing the friction, we reduce the tendency of the journal to heat. The friction can be reduced by making the rubbing surfaces smooth, and using a good lubricant. At high pressures, the lubricant is forced out from between the surfaces. The pressure at which this occurs is supposed to be somewhat above 2,000 pounds per square inch of bearing surface, as millstones can be run, without excessive heating, with a pressure of nearly 2,100 pounds per square inch on the spindle. The tendency of a crank pin to heat is independent of its diameter, it being only necessary to provide sufficient area to dissipate the heat stored up by the friction. The bearing upon a crank pin is less than the projected area of the pin, and the length (of the pin) that bears should always be used in making calculations.

Let l = length of the pin in inches; S = stroke of engine in inches; I = indicated horse power of the engine. Then the formula deduced by Mr Skeel is as follows: $l = I \div (s \times k)$, or the proper length for a crank pin of an engine is equal to the indicated horse power of the engine, divided by the stroke, multiplied by a coefficient which is determined by experiment. An examination of the best modern practice shows that this coefficient is between 1·3 and 1·5; and that if a crank pin gives a larger coefficient than this, it is liable to heat.

EXAMPLE: What length should be given to the crank pin of a steam engine having a stroke of 30 inches, and developing 250 indicated horse power? l = from $250 \div (1{\cdot}3 \times 30)$ to $250 \div (1{\cdot}5 \times 30)$ = from 6·41 to 5·56 inches, the latter being the least length of pin advisable.

THE liability of safety valves to stick, in consequence of corrosion, is obviated by nickel plating both the valve and the seat.

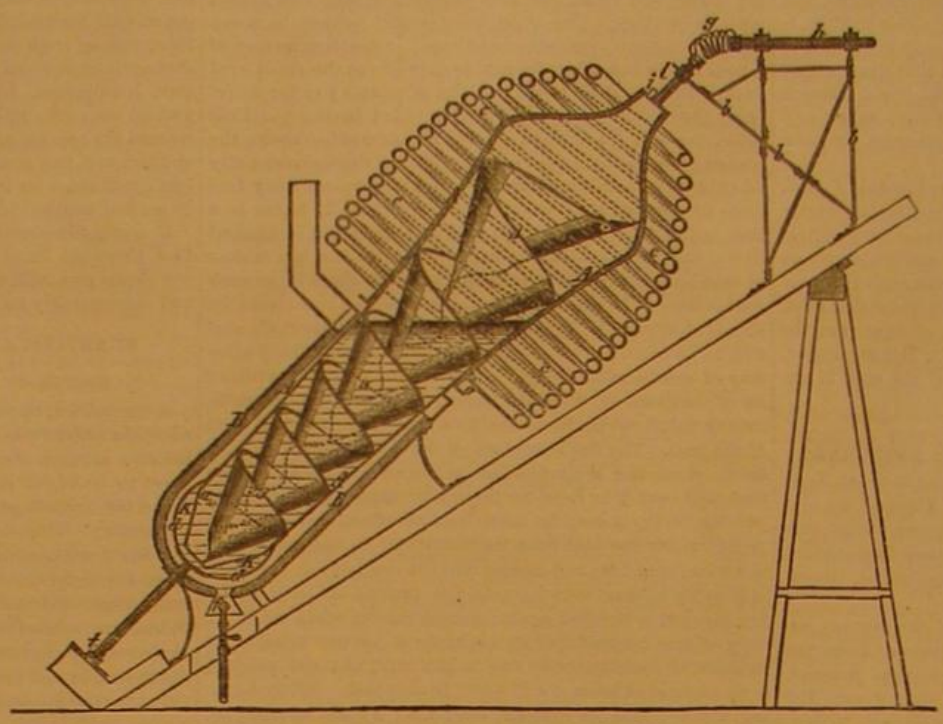
NEW STEAM MOTOR.

Among the novelties at the World's Fair, Vienna, is the steam motor of Friedrich Siemens, of Dresden, Saxony, which is worked without the use of pumps, valves, or special moving parts, but operates through the rotation of the steam generator itself. The exertion of power begins instantly with the development of steam, and is continued by the expansion of the steam until close to the vacuum, so that the greatest possible amount of power is developed from the steam pressure and made useful.

Our engraving, from the *Deutsche Industrie Zeitung*, represents such a motor, one tenth the natural size. The machine consists essentially of a rotating boiler placed in an inclined position. A is the boiler or shell, inside of which there is a worm or screw, *s*, made out of plates cut funnel shape, and attached to A. At the lower end the boiler, A, is provided with a double bottom, *d*, while the upper end is surrounded by a spiral tube, *c*, its spirals being in reverse of those of the interior worm or screw, *s*. The double bottom of the boiler forms a water space, K, which communicates through circular holes, *a*, with the inner space of the shell, A. The machine is mounted on a sloping axle tree, which is stepped at *t*, and supported above on the shaft, *l*, and bar, *b*. The motion of shaft, *l*, is transmitted to the horizontal shaft, *h*, by means of the flexible connection. The lower part of the shell, A, is surrounded by a furnace of clay, B; and fire is applied through an opening at *f*. In this example a gas flame is employed. The products of combustion rise from *f* and surround the shell, A, finally escaping through the upright pipe, at the upper end of B. The boiler, A, is filled with water at *i*, and here a fusible plug is used, which melts when the temperature of the steam rises above that of a given pressure, and permits the escape of steam into the atmosphere, thus ensuring the safety of the apparatus. When the fire is kindled at *f*, the steam which developes rises through the water and acts on the spirals, *s*, causing the turning of the whole machine. The steam continues to rise until it reaches and enters the spiral condensing pipe, *c*, which surrounds the upper exterior portion of the shell, A. In passing through the pipe, *c*, the steam is condensed, and the water of condensation is screwed back by the rotation of the pipe, *c*, down below the water level in the boiler, A, near *o*, where the water enters the boiler, and is again converted into steam. In starting the machine the steam must first be allowed to escape at *o*, out of the spiral condenser, in order to drive out all the air; then the opening, *o*, is closed, and the steam, then rising into the cooling pipes, *c*, is condensed as before described.

The machine, if once filled and made completely tight, continues to work without requiring any other attention, except to keep the fire going. No pumps to supply water, on valves or other devices are required; but a constant use of the same water over and again takes place; the water being first converted into vapor, which is then condensed, then again evaporated, and so on.

In lieu of water other liquids may be employed, and it has been suggested that quicksilver might be advantageously used.



NEW STEAM MOTOR.

A Remarkable Poison.

This poison is obtained by pressure from the seeds of *strophanthus hispidus*, an apocynaceous plant, found in Africa; and from experiments made with samples of it, taken from arrows upon which the natives place it, it appears that it acts more powerfully than digitaline or antiarine, and quickly paralyzes the heart. The $\frac{1}{11000}$ of a grain will kill a frog, a sparrow, or a dog, though the resistance of certain animals varies. A snail, for instance, requires $\frac{1}{10000}$ of a grain; a mouse has withstood $\frac{1}{11000}$ of the extract (obtained by macerating the seeds in alcohol), while the latter dose kills a dog nearly a thousand times heavier than the mouse. The heart comes to a complete standstill after a few irregular efforts.

THE RIGI RAILWAY.

The construction of railroads over mountains has made wonderful progress in the last year or two, and some of the greatest achievements of modern engineering science have been made in developing the plans for such schemes. The railway up the Rigi (in Switzerland, on the borders of Lake Lucerne) is the work of three German engineers, Herren Riggenbach, Naeff, and Zschokke, the first named gentleman having proposed the construction, an idea which was suggested to him by a visit to the Mount Washington railroad, in this country. We present an illustration which shows the general character of the work.

The Rigi line starts from Vitznau, on the borders of the lake, and rises up the mountain side to a station at Staffelhöhe, which is above the hotel and bath establishment, called Rigi Kaltbad and well known to most travelers in Switzerland. The length of the line is 5,760 yards (about 3¼ miles), and the hight of the upper terminus above the lower is 3,937 feet, being an average ascending gradient of about 1 in 4½. After leaving Vitznau, the grades vary from 1 in 5·56 to 1 in 4. Among the instances of bold and difficult construction exhibited by this work are a bridge of three spans over a defile in the mountain, the track going into the side of a rock and through a tunnel. The bridge and tunnel together are 525 feet long, the grade being 1 in 4 and the direction a very sharp curve. The track is very solid and well built, and the engines have vertical boilers placed in the middle of their length. The boilers maintain their perpendicularity even in ascending grades of 1 in 5½.

It is proposed to continue the line to the Rigi Kulm, the summit of the mountain, and perhaps down the other side to Certh, at the eastern foot. The line at present existing was opened for public traffic on May 23, 1873.

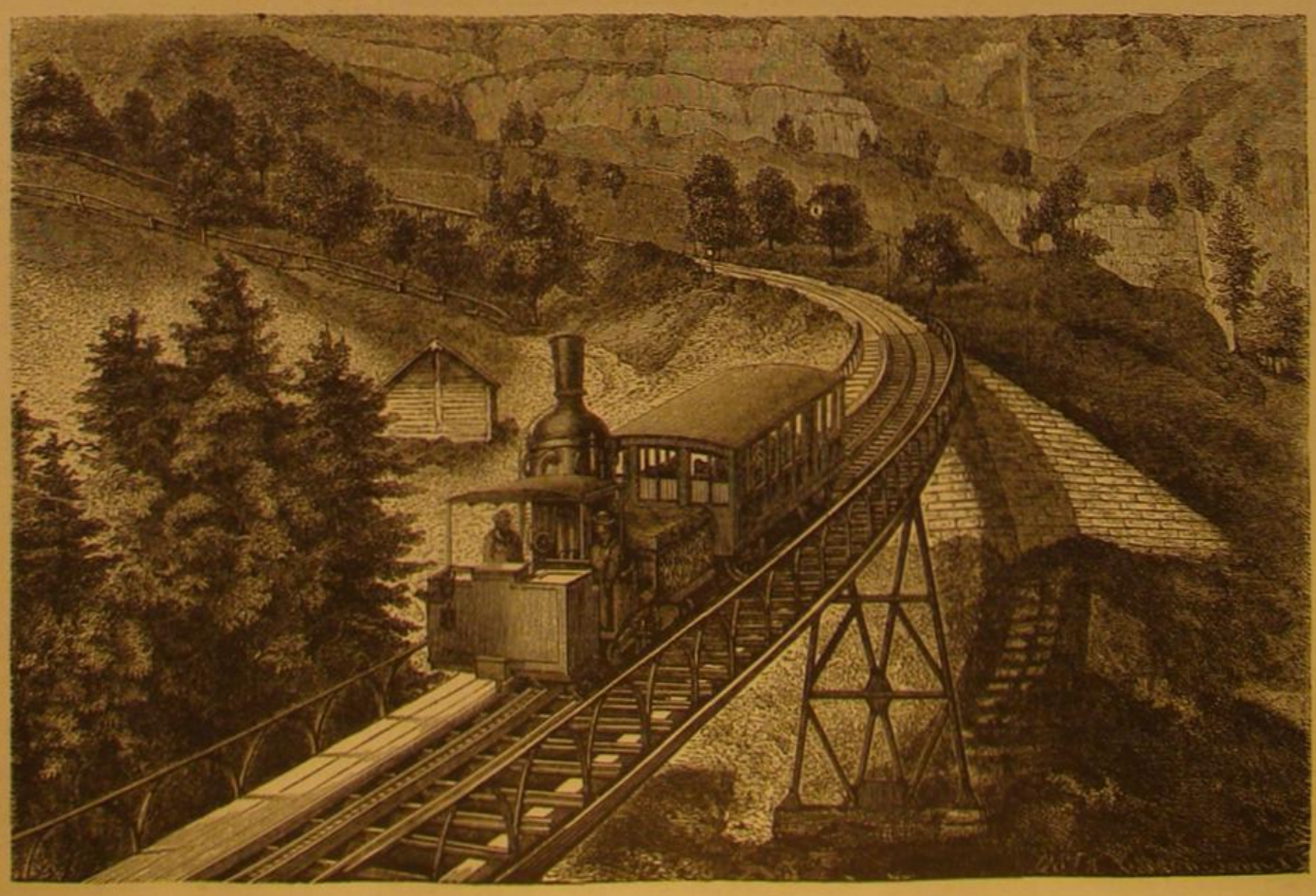
Slate Roofing Paint.

Our attention has been called to the superiority of a new paint compound, advertised on another page of this issue, which consists largely of pulverized slate. We have not tried the article, but we have the evidence of acquaintances who have used it, and speak of its merit in the strongest terms. It is equally adapted for new and old shingle roofs, rendering them impregnable to sparks; and it preserves the shingles equal to any other paint.

WE have received a letter from "Some of Your Readers" who are shocked at our incredulity respecting the miracles at Lourdes, France. They call our attention to the fact that a French gentleman has offered a reward of 10,000 francs ($2,000) to any one who can explain away the facts stated in a published book which gives an account of the miraculous cures, etc. This is a liberal and courageous offer, and it proves nothing but the public spirit and implicit faith of the gentleman who makes it.

THE annual exhibition of the American Institute in this city is now open; but some days will elapse before the machinery department will be in full blast.

G. A. P. writes to say that he has a preserved specimen of the devil fish measuring 4 feet from tip to tip of the arms



RAILWAY ON THE RIGI MOUNTAIN, SWITZERLAND

THE PLANET MARS—IS IT INHABITED?

Can it be possible that in all the vast universe but a single planet, and that the merest infinitesimal portion of the grand whole, can be the abode of living creatures such as ourselves? Does Science teach that other worlds are unpeopled deserts, serving no other purpose than to traverse their orbits obedient to the Divine will? Such are the questions which astronomers have been forced to meet and answer, unaided except by the testimony afforded by analogy and by deductions from theory, based perhaps on evidence mainly presumptive.

Leaving out of their consideration the possibility of organisms existing under conditions unknown upon the earth, the searchers of the heavens have examined the brilliant orbs which circle round the sun, first crudely and imperfectly, but as their knowledge and means increased with the progress of science, with augmented accuracy and power, adding discovery to discovery; until, link after link, the chain of proof has been forged, leading to but never reaching a universally accepted conclusion. As to all the planets, but two, the answer is certainly negative; the condition of all other worlds is such as to render human existence upon them absolutely impossible. Of the excepted pair, on one, Venus, life may exist, but every probability is to the contrary; regarding the other, Mars, divided opinion is encountered; and while it is asserted on one hand that, with reasonable certainty, the planet may be assumed as the abode of living beings, on the other the presumption is as specifically denied. Deferring the consideration of Venus to some other opportunity, it will be of interest to examine the present state of our knowledge regarding the Planet of War, and, at the same time to glance briefly over the arguments, *pro* and *con*, which have been advanced to prove or disprove its habitability.

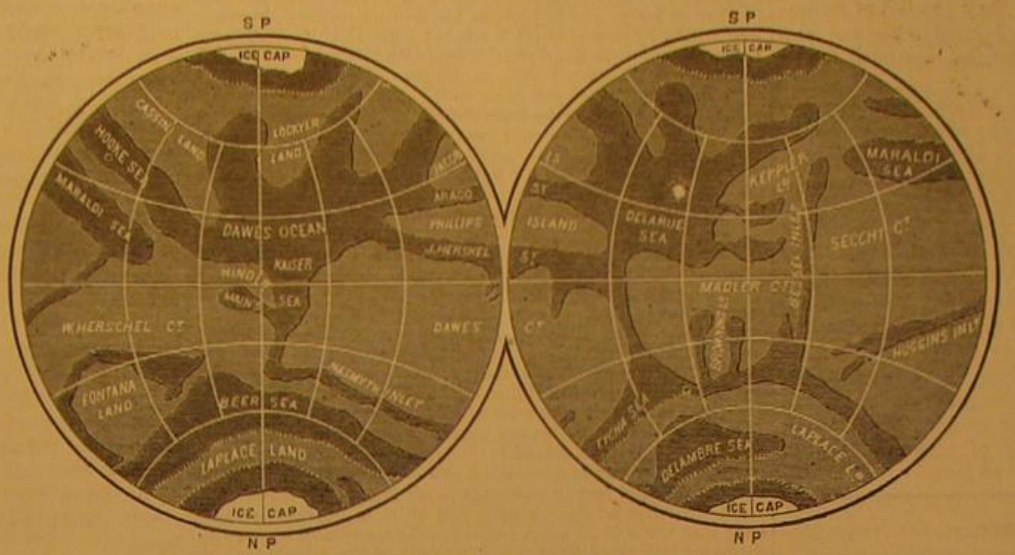
Just at the present time, Mars is plainly visible in the evening heavens, a ruddy star in or near the constellation *Virgo*. Forty millions of miles, at least, divides us from the bright globe of light which modern revelation tells us is the miniature of our own earth; 5,000 miles is its diameter, bearing a proportion to the similar terrestrial dimension of 5 to 8; consequently the relative surfaces are as 25 to 64, or more plainly, our world is two and a half times the larger of the two. Comparing the relative densities, Mars' is about three fourths that of the earth, hence the force of gravity at its surface is much less than the corresponding terrestrial attraction. If, therefore, the inhabitants of that planet are proportioned similarly to ourselves, their strength must be far greater in reference to their dead weight than is the case with us. In fact, if that organization, known as the Fat Men's Club, could be transported to Mars, its members, here barely able to support their mountainous protuberances and walk, would easily skip lightly over six-foot fences or bound along the ground in a way that would leave the best of our runners far in the rear. The nature of the inhabitants of Mars, we shall allude to, however, in detail further on.

The orbit of Mars is very eccentric. Its center is 13,000,000 miles from the sun, so that the light and heat received on the surface of the planet must vary considerably. It is less than ours in the proportion of 4 to 9. The Martial year lasts for 687 of our days, and the Martial day is 40 minutes longer than ours. The inclination of the equator to the plane of its orbit is 27½°, or very little more than is the case with the earth, which is 23½°. The changes of the seasons, so far as depending upon this cause, differ little from our own.

These general points being fixed, let us now turn to the planet's geography, or *areography* more properly, as we say *selenography* in referring to the moon. Comparatively speaking, our knowledge of the surface divisions of Mars is next in extent to our information regarding the earth. We know more, in fact, about the hemisphere of the moon than we do of our own globe; for while the vast lunar deserts have been measured to nearly an acre, and the mountains and craters to within thirty or forty feet, there are on the earth 11,400,000 square miles unexplored and unknown.

Jupiter and Saturn are almost constantly obscured by their closed envelopes, so that their true surface is rarely if ever beheld. Uranus and Neptune are mere points of light. Mercury is almost always eclipsed by the rays of the sun. Venus, nearly twice as large as Mars in diameter, is nearer to the earth, and comes within 30,000,000 of miles of us, but travels between the earth and the sun, so that her bright face is turned to that luminary and her dark hemisphere toward us. Hence Mars is the best fitted for examination.

In regarding the planet through a powerful telescope, it is at once observable that the poles are marked by brilliantly white zones which, it is believed, are caused by deposits of snow and ice. These arctic regions appear to extend during the Martial winter to parallel 45° of latitude, or as if the ice of North America, in our winter, should reach down as far as the northern part of New York State. We have said that Mars is ruddy, and the fact is easily discernible by the naked eye. Aided by the telescope, however, the surface appears to be far from uniformly red. The color is confined to particular spots or regions, the intermediate parts being of a greenish hue. Observations extending over long periods have demonstrated that the relative position of these divisions has never changed, hence they are not accidental phenomena. Thus, being considered as physical peculiarities, they have been made the subject of close study by almost all eminent astronomers.



THE HEMISPHERES OF MARS.

For reasons which we shall explain hereafter, the red portions of the planet have been considered as land and the green regions as water, and their appearance has been carefully mapped.

We give herewith a map, constructed by Mr. R. A. Proctor from a number of drawings, in which the various seas and continents are marked with the names of noted astronomers, by which they are distinguished. It will be observed that the seas seen are all land-locked—true mediterraneans—and communicate with each other only by narrow straits. The most remarkable features are the great equatorial zone of continents—of which there are four, namely, Herschel, Dawes, Madler, and Secchi—and the peculiar forms of the bell-shaped seas in the first of these grand divisions.

The waters, or rather the spots which we assume to be fluid, are of the same color as terrestrial seas, grayish green; but the land is a uniform ocherous red. To explain this latter peculiar tint, various theories have been propounded. It was at first supposed to be due to the atmosphere; but this view was soon abandoned; and at the present time it is generally believed to be the prevailing tint not only of the soil but of the vegetation. So that instead of verdant expanse of prairie or green forests, the eye is met by crimson trees or scarlet grass, and the dull lurid shades peculiar to such hues.

But it may be well urged that we are assuming too much in jumping to the conclusion that the red spots on Mars are land, the green ones water, and the white ones ice and snow. What proof have we that land, water, and ice exist on the planet at all? Mars has *clouds*. The invariable appearance of the moon, even under the strongest telescopes, does not exhibit the slightest trace of floating vapor on its surface, nor do the occultations of the stars indicate the existence of an atmosphere. With the planet we are considering the contrary is the case. Its spots change in brightness, and it seems at times as if a vail blurred the configurations of its surface for hours and days at a time. We can tell by the position of the Martial equator what season is in progress in either hemisphere at any time: and it has been found that when it is winter in one hemisphere and summer in the other, the former portion is always obscured. Just as upon the earth, the wintery sky is rarely clear. Aeronauts tell us that, at high altitudes, the clouds below them sometimes entirely obscure the surface of the earth, or, at times, breaking away, admit but small portions of its dark surface to the view. Hence, when Mars is thus covered in parts, it is as if such portions were blotted out, while the shape of the true surface below is changed. Careful observations, therefore, indicate, with every appearance of probability, that the misty vail is formed of clouds, vapor, or fog; so that, in fact, unless it be a fine day on Mars, we cannot see his surface.

[To be continued.]

Is Phosphorus Thought?

There appears still to be much difference of opinion among chemists about the changes which occur in the secretion of the kidneys after waste of nerve tissue. For example, Dr. L. Hodges Wood, as the result of his observations published in 1869, denied the correctness of the generally received statement that the amount of phosphates in the urine is increased by fatiguing mental exercise. He found that, while the alkaline phosphates were slightly increased, the earthy phosphates were notably diminished after mental work, and that, when the mind was not much employed, the excretion of earthy phosphates was increased instead of diminished. He accounts for this on the hypothesis that, when the brain was worked it, withdrew more phosphorus from the circulating fluid.—*Medical and Surgical Reporter.*

EARWIGS.



EARWIGS.

The insects popularly termed earwigs are known scientifically as *forficulæ*, a name derived from the Latin, and meaning "small scissors." The French appellation is *perce oreille*, or ear piercer, and is given on account of a pair of claws or nippers extending from the posterior extremity of the body, which resembles the instrument sometimes used by jewelers for boring the ear to admit earrings. The vulgar name, earwig, is owing to the supposed predilection of the insect to enter the human ear; an erroneous impression, doubtless based on the instinct of the animal which teaches it to take refuge in dark cavities. Even if it did enter the organ of hearing, it could do no harm, as it could not penetrate any further than the drum, and might be easily dislodged from the passage by a drop or two of oil.

The color of the insect is from brown to dusky yellow. The body is elongated and flattened; and the head is slightly movable and heart shaped, having filiform *antennæ* of from twelve to forty articulations; on the sides of the head are small eyes. A breastplate, rectangular in shape, follows; and, in the segments in rear of the thorax, two pairs of differently constructed wings. The first pair are shorter than the abdomen, cut squarely in rear, united to the frame in the center, and not crossed upon each other like the similar appendages of grasshoppers and crickets. The wings proper would hardly be supposed to exist, as exteriorly they appear as a horny shell which, when folded close to the body, become a means of protection. The rest of the member is formed of a diaphanous, rainbow-tinted membrane, which folds up like a fan and is completely covered by the exterior scale. The abdomen is covered with scales, similar to those on the tail of the crawfish, from which the sex of the animal may be told, the male having nine above and eight below, and the female, seven above and six in the ventral region. The male insect has also much stronger nippers, and the last segment of the back is larger than in the female. The claws attached below the thorax are six in number, short, and only suitable for running. They terminate in tarses of three articulations.

The young, on leaving the egg, and after the first change of skin, have no vestige of wings except a slight elevation on the posterior sides of the second and third segments of the thorax. After the second change, short wings appear, more or less united in a thin envelope or sheath; and it is not until the third sloughing that the insect has all the members entire.

Earwigs dislike light and live entirely in obscure places, concealing themselves under stones, in cracks of trees, and sometimes in deep flowers. They are social, and numbers are found together. They are voracious eaters, feeding on flowers and boring into ripe fruit, or, if they cannot get vegetable diet, contenting themselves with carrion or manure. If kept without nourishment, they devour each other. Their only utility to man is the war which they wage on several insects destructive to wheat and other grain, particularly

those varieties the larvæ of which bury themselves in the kernels of the plants.

The females have a remarkable and curious fondness for their young. The eggs are developed in little cavities in the earth and always in damp places. The mother watches them carefully, transporting them from the place if the moisture dries, or gathering them if they become scattered. The larvæ at first are white, and appear to swell after emerging from the egg, but become dark and hard in a few hours. The female still guards them, and, it is said, gathers them under her, as a hen does her chickens. Earwigs are destitute of feelings of gratitude or filial affection; for just as soon as they attain sufficient size, they proceed to devour their mother, if she happen to get injured or die, and also such of their relatives as fall under the inevitable law of natural selection.

The engraving, extracted from *La Nature*, given herewith represents the three varieties of the earwig common in Europe. The insects marked 1 are the ordinary garden species or true earwig. No. 2 is called the "giant Labidour" and is the largest of the different kinds. The *antennæ* have a large number of articulations, the *elytræ* are elongated and rectangular, and strongly protected by a shell-like covering. The nippers are nearly straight, have a tooth in the middle, and appear dark at the extremities. The male insect represented grows, nippers and all, to about an inch in length, and the female to about two thirds that size. In Fig. 3 is shown the "apterous Chelidour," a variety confined to the Pyrenees mountains; a similar and smaller species is also found in the Alps and other ranges. The head is somewhat triangular, and the body, of a chestnut brown. The insect attains the length of half an inch.

Correspondence.

Spontaneous Generation.

To the Editor of the Scientific American:

In your issue of August 23 is an editorial on "Spontaneous Generation," containing some interesting facts and statements on that important subject. Knowing that your desire, as a friend and votary of science, is to give your readers "the truth, the whole truth, and nothing but the truth," and knowing also that very many of your readers are most deeply interested in the results of the investigations referred to, I venture to ask space for some additional facts and statements.

Your article opens with the statement that "All experiments thus far made with infusions of different substances, for the purpose of producing infusorial animalculæ, appeared to prove that the access of air was necessary for their formation." The truth of this was admirably shown by Professor Huxley, in his great address, as President of the British Association, in September, 1870. After pointing out the fact that the theory of spontaneous generation (the doctrine of *abiogenesis*) was the accepted theory of the world, on the origin of life, until two hundred years ago, he proceeds in a most masterly and exhaustive manner to trace the history of the opposing theory, that all life originates from some antecedent germ (the doctrine of *biogenesis*), from its first enunciation by the philosopher Harvey to the date of that address before the Association.

Professor Huxley's conclusion, which is very guardedly and yet very strongly stated, and which was reached by passing through all the experiments up to that date, is as follows: "But though I cannot express this conviction of mine too strongly, I must carefully guard myself against the supposition that I intend to suggest that no such thing as abiogenesis ever has taken place in the past or ever will take place in the future. With organic chemistry, molecular physics, and physiology yet in their infancy and every day making prodigious strides, I think it would be the hight of presumption for any man to say that the conditions under which matter assumes the properties we call 'vital' may not, some day, be artificially brought together. All I feel justified in affirming is that I see no reason for believing that the feat has been performed yet."

Perhaps no one will deny that Professor Huxley is as wel fitted as any man living to reach a just conclusion on this subject. Notwithstanding his strong desire to believe the theory of abiogenesis true—a desire, the strength of which is shown by the unwarranted admission concerning the possible power of organic chemistry, etc., thrown in by the way—he feels himself compelled to declare that he sees "no reason for believing" that the feat of producing life by spontaneous generation has yet been performed.

That at the time of making his address, Professor Huxley was familiar with Professor Bastian's loudly trumpeted experiments, that after sufficiently investigating them he determined to ignore them in that address as being unworthy of scientific consideration, and that he had the very best reasons for doing so, appear from an eminently spicy and trenchant letter which appeared in *Nature*, October 13, 1870. That letter furnishes data from which any ordinary reader, who makes no pretensions to science, can reach a judgment for himself upon the value of Professor Bastian's experiments and the caliber of Professor Bastian. It is as follows:

"Dr. Bastian and Spontaneous Generation.—I find that the address which it was my duty to deliver at Liverpool fills thirteen columns of *Nature*. The reply with which Dr. Bastian has favored you occupies fifteen columns, and yet professes to deal with only the first portion of the address. Between us, therefore, I should imagine that both you and your readers must have had enough of the subject; and, so far as my own feeling is concerned, I should be disposed to leave both Dr. Bastian and his reply to the benign and lethean influences of time.

But I am credibly informed that there are persons, upon whom Dr. Bastian's really wonderful effluence of words weighs as much as if it were charged with solid statements and accurate reasonings; and I am further told that it is my duty to the public to state why such distinguished special pleading makes not the least impression on my mind. With your permission, therefore, I will do so in the briefest possible manner. The first half of Dr. Bastian's reply occupies seven columns of your number for the 22d of September. In all this wilderness of words there is but one paragraph which appears to me to be worth serious notice. It is this:—

"In the first place, he does not attempt to deny: he does not even allude to the fact [that living things may and do arise as minutest visible specks in solutions in which, but a few hours before, no such specks were to be seen.] And this is in itself a very remarkable omission. The statement must be true or false; and if true, as I and others affirm, the question which Professor Huxley has set himself to discuss is no longer one of such a simple nature as he represents it to be. It is henceforth settled that, as far as visible germs are concerned, living beings can come into being without them."

If I did not allude to the assertion of Dr. Bastian, put between the brackets, it is because it bears absurdity written upon its face to any one who has seriously considered the conditions of microscopic observation. I have tried over and over again to obtain a drop of a solution which should be optically pure, or absolutely free from distinguishable solid particles, when viewed under a power of 1,200 diameters in the ordinary way. I have never succeeded; and, considering the conditions of observation, I never expect to succeed. And though I hesitate to speak with the air of confident authority which sits so well on Dr. Bastian, I venture to doubt whether he ever has prepared, or ever will prepare, a solution in a drop of which no "minutest visible specks" are to be seen by a careful searcher. Suppose that the drop, reduced to a thin film by the cover glass, occupies an area one third of an inch in diameter; to search this area with a microscope in such a way as to make sure that it does not contain a germ one forty-thousandth of an inch in diameter, is comparable to the endeavor to ascertain with the unassisted eye whether the water of a pond a hundred feet in diameter is or is not absolutely free from a particle of duckweed. But if it is impossible to be sure that there is no germ one forty-thousandth of an inch in diameter in a given fluid, what becomes of the proposition, so valuable to Dr. Bastian that he has made your printer waste special type on it?

I now pass to the second part of the reply, which, though longer than the first, is really more condensed, inasmuch as it contains two important statements instead of only one. The first is, that Dr. Bastian has found *bacterium* and *leptothrix* in some specimens of preserved meats. I should have been very much surprised if he had not. If Dr. Bastian will boil some hay for an hour or so, and then examine the decoction, he will find it to be full of bacteria in active motion. But the motion is a modification of the well known Brownian movement, and has not the slightest resemblance to the very rapid motion of translation of active living bacteria. The bacteria are just as dead as those Dr. Bastian has seen in the preserved meats and vegetables; and which were, I doubt not, as much put in with the meats as they are with the hay, in the experiment to which I invite his attention.

The second important statement, in the second part of the reply, is: "Professor Huxley is inclined to believe that there has been some error about the experiments recorded by myself and some others." In this I cordially concur. But I do not know why Dr. Bastian should have expressed this my conviction so tenderly and gently as regards his own experiments, inasmuch as I thought it my duty to let him know, both orally and by letter, in the plainest terms, six months ago, not only that I conceived him to be altogether in the wrong, but why I thought so.

Any time these six months, Dr. Bastian has known perfectly well that I believe that the organisms which he has got out of his tubes are exactly those which he has put into them; that I believe that he has used impure materials, and that what he imagines to have been the gradual development of life and organization in his solutions is the very simple result of the settling together of the solid impurities, which he was not sufficiently careful to see, in their scattered conditions, when the solutions were made. Any time these six months, Dr. Bastian has known why I hold this opinion. He will recollect that he wrote to me asking permission to bring for my examination certain preparations of organic structures, which he declared he had clear and positive evidence to prove to have been developed in his closed and digested tubes. Dr. Bastian will remember that, when the first of these wonderful specimens was put under my microscope, I told him that it was nothing but a fragment of the leaf of the common bog moss (*sphagnum*); he will recollect that I had to fetch Schacht's book "Die Pflanzenzelle," and show him a figure which fitted very well what we had under the microscope, before I could get him to listen to my suggestions; and that only actual comparison with *sphagnum*, after he had left my house, forced him to admit the astounding blunder which he had made.

To any person of critical mind, versed in the preliminary studies necessary for dealing with the difficult problem which Dr. Bastian has rashly approached, the appearance of a scarlet geranium, or of a snuff box, would have appeared to be hardly more startling than this fragment of a leaf, which no one even moderately instructed in vegetable histology could possibly have mistaken for anything but what it was; but to Dr. Bastian, agape with speculative expectation, this miracle was no wonder whatever. Nor does Dr. Bastian's chemical criticality seem to be of a more susceptible kind. He sees no difficulty in the appearance of living things in potash-alum until Dr. Sharpey puts the not unimportant question: Whence did they get their nitrogen? And then it occurs to him to have the alum analyzed, and he finds ammonia in it.*

And as to elementary principles of physics: In his last communication to you, Dr. Bastian shows that he is of opinion that water in a vessel with a hole in it, from which the steam freely issues, may be kept at a temperature of "230° to 235° Fahrenheit for more than an hour and a half."† I hope that Professor Tyndall, whom Dr. Bastian scolds as authoritatively and unsparingly as he does me, will take note of this revolutionary thermotic discovery in the next edition of his work on heat.

It is no fault of mine if I am compelled to write thus of Dr. Bastian's labors. I have been blamed by some of my friends for remaining silent as long as I have done concerning them. But when, because I have preserved a silence which was the best kindness I could show to Dr. Bastian, he presumes to accuse me publicly of unfairness, and to tell your readers that my address "is calculated to mislead" them, I have no alternative left but to give them the means of judging of the competency of my assailant.

Jermyn Street, October 10. T. H. HUXLEY.

*See *Nature*, No. 56, p. 198. †*Ibid*, No. 48, p. 433.

After such a damaging exposition of Dr. Bastian's claims by so great and so competent a man, you will doubtless agree with me that no scientific man would be inclined to expect anything of any real scientific value from such an experimentor, should he even devote his time for a century to come to his experiments. The opinion of Mr. Wallace, and all his school of prejudiced and purely imaginative philosophers, will have no weight with the true scientist when arrayed against the careful research and clear logic of Professor Huxley's address and the damning facts of Professor Huxley's letter.

The truth is Professor Bastian has attempted to prove what can not be proved even if it be true. Such is the deliberate conclusion of my esteemed friend and teacher, Dr. Arnold Guyot. Said this great man, in conversation a few days since: "The conditions of the problem—in the material and instruments used and in the limitations of the eye and the microscope—are such that, even if life should be spontaneously generated, in the manner claimed by Professor Bastian, it could never be proved." It can never be known that there is no life germ as a minutest visible speck present in any flask of liquid. To ascertain with a microscopic power of 1,200 diameters that there is no germ one forty thousandth of an inch in diameter in a flask that exposes to view a lateral surface of three square inches, would be just as easy as to ascertain with the naked eye that not a single flea is living on the side of a pyramid of 600 feet base and 900 feet ascent, or on any one side of Cheops itself. This, however, provided the miniature ocean currents in the flask should be not more active than the living inhabitant of the Cheops. But the germ of one forty-thousandth of an inch in diameter is too large; reduce it to one one-hundred-thousandth of an inch and then make the calculation. A microscope which would make such a germ, when brought into its range, clearly visible would lift up a man to the hight of the Himalayas.

I trust that these facts and statements will not be uninteresting to your numerous and intelligent readers.

Princeton, N. J. D. S. GREGORY,
Professor in University of Wooster, Ohio.

The Devil Fish.

To the Editor of the Scientific American:

I notice in your last issue an illustration representing the devil fish. Until I saw it, and your announcement of two living specimens, I was not aware of the existence of any living specimens in the world. My attention was particularly attracted to the matter because I have a most perfect fellow (in alcohol), and have earnestly endeavored to find out how many there were either in Europe or America. Thus far I have not been able to find any in America, except my own. If the one in the Hamburgh aquarium is but two feet from tip to tip, mine is more than as large again, being four feet three inches. The smaller one has, however, the advantage of being alive.

The strength which these creatures possess is almost beyond comprehension, as is evidenced by what took place when my pet (!) was captured. He had seized hold of a submarine diver, at work in the wreck of a sunken steamer off the coast of Florida. The man was a powerful Irishman, who claimed to weigh three hundred pounds. His size and build fully verified his statement, and, to use his own language, "the baste landed on top of my shoulders and pinned my arms tight. I felt my armor and myself being cracked into a jelly." It seems that he was just about being brought to the surface, else the monster would have killed him, for he was suffering so from the terrible embrace that he could move no part of himself. When dragged on to the raft from which he had descended, and finally released, he had fainted. The men on the raft seized the fish by one of its wriggling arms, and tried to pull it off, but could not break the power of a single one of the suckers. The fish was only removed by being dealt a heavy blow across the sack containing the stomach. This sack stood stiffly up above the eyes, while the eyes stood out like lobster's eyes and gleamed like fire. The monster is, all in all, one of the most frightful apparitions it could be the fate of a man to meet. It fulfils in every particular the horrible features attributed to it in Victor Hugo's "Toilers of the Sea." Notwithstanding the severity with which the able Frenchman has been criticized for "creating a nondescript with his weird imagination," the truth must be granted that his "nondescript" has an actual existence, as is evidenced by the specimens in Brighton and Hamburgh, as well as my own. The likeness of the picture to mine is perfect in every particular.

CHARLES B. BRAINARD.

Winthrop House, Boston, Mass.

J. H. says: "I am building a planing mill inside the fire limits, and have concluded to use perpetual motion in place of steam power. I do not care about a highly finished machine, but it must be all right in its working parts, have a capacity of about 80 horse power, and be easily controled. Whom do you consider to be the most reliable maker of perpetual motion engines?" [Inventors of perpetual motion engines would do well to advertise their devices in the SCIENTIFIC AMERICAN.—EDS.]

BURNT AND BROKEN GRATE BARS.—R. F. writes that he recently visited Cape Breton, N. S., and there saw, in a boiler furnace, a system of protecting the bars from the burning to which they are subject, and from the violent raking which is necessary when they are choked with clinker. The means employed consist of a layer of flat pieces of freestone, placed underneath the coal. The clinker adheres to the stones, and the bars are protected from burning, warping, and choking.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 11.

VIENNA, August, 1873.

While there is not very much that appears new or specially interesting among the metal or the

WOOD-WORKING TOOLS

of the exhibition, there is occasionally one which attracts the attention of the American mechanic by its novelty; such, for instance, is the combination of wood-working tools referred to in the preceding letter and known among English builders, as well as at home, by the name of the "universal joiner," and the planer also there referred to. Among them may perhaps be also included the dovetailing machines of Hall in the United States section, and of Armstrong in the British section. The former, by the ingenious application of boring tools, cuts a peculiar and very pretty form of dovetail, and the latter, by an equally ingenious use of circular saws having parts of their edges turned over to form portions of cylindrical saws, cuts the usual form of dovetail in a very neat and rapid manner. Both of these machines are most creditable in design, workmanship, and performance.

A considerable amount of

SAW MILL MACHINERY

is exhibited in other sections than in that of the United States. We have none at all on show. The British exhibit is by far the most extensive, and is the best in all respects. Some German firms present good exhibits, however, and, in the Austrian section, one or two of the most creditable of all their exhibited machines are of this class.

The general design of these machines presents no important novelties. For log sawing, the use of the circular saw seems quite unusual. The best machines are what the builders call the portable or, more usually, the semi-portable log frame. In these machines the frames are made stiffer and stronger than we are accustomed to make them in America; the saw frame is carefully counterbalanced; the balance weights are placed at the side and quite out of the way, below the level of the floor, and the machine as a whole is strong and compact, and its performance seems most satisfactory. These frames are constructed to take logs of two and a half feet in diameter, and they find a market in all parts of the wood-producing States of Europe and the British colonies. They require comparatively light foundations; and as they may therefore be readily removed from one locality to another, they are very well entitled to the name which has been given them. One of these machines, which seems, if possible, a better specimen of the type than its neighbors, takes a log sixteen inches in diameter and is said to weigh four tuns. The Armstrong dovetailing machine and several of the tools made by Ransome & Co., including the band saw and their mortising machine, are recognized at once as American designs; and in every part of the exhibit of wood-working machinery, we find familiar types, usually strengthened and made somewhat more substantially than at home, by continental as well as by British builders. The fact is simply another illustration of the extent to which our people and our institutions have benefitted those older countries from which our population has been derived.

The visit to the Exposition of a large

PARTY OF ENGLISH WORKMEN

has excited some interest, just now, among all classes. A society of mechanics and of those interested in the "promotion of scientific industry" has sent to Vienna thirty-five delegates from among its working members. The London *Engineering*, in an article referring to this delegation, remarks, very justly, of the English mechanic, that while he may have no superior as a workman, "he is behind the average continental mechanic in mental and scientific training," and that "England is no longer without rivals in industrial production," and further that the British are "heavily weighted with the evils of discord between capital and labor." Still, while laboring under the disadvantage of a lack of opportunity for obtaining the superior education of the German, and while having no such inducement to exercise that native inventive talent which he undoubtedly possesses in a hardly less degree than the American, and while involved in those sad quarrels which are a natural consequence of a misapprehension, by both masters and men, of those laws of political economy which control the relations between capital and labor, the English mechanic holds a position here which commands the highest respect; and it may well be a cause of pride that we who are most closely competing with him are his nearest relatives. Other nations have, like the United States and Great Britain, sent corps of observation to Vienna, in which are included some of their most skilled artisans; and it may be fully expected that this enlightened policy will produce most valuable results. No nation, however, has as many representatives from among the class of "practical artisans" as the United States. Large numbers of our most intelligent and most experienced mechanics have visited Vienna to see for themselves what the world on this side of the Atlantic is producing that is worthy of imitation. All are, probably, in some degree disappointed in their expectation of finding a large proportion of novelties here, yet probably none will go home feeling that the time and the money expended has been lost. From

THE GERMANS

they learn the value of a practical mental and scientific training, and see what it has done for a nation that cannot be termed a nation of mechanics. They learn also how splendidly the Teutonic nations have developed this kind of education, and how much we, and still more the British, have been left behind in that great field of culture. They learn from

THE FRENCH

that we do not excel in the combination of the useful with the ornamental, or in the exhibition of good taste in general work, or in the manufacture of those delicate kinds of apparatus and those marvellously perfect constructions which have become the ordinary tools of scientific work. From

THE BRITISH

they learn to admire that simplicity of form and that substantial construction which distinguish the mechanical works of that nation to a degree that we may well hope at some future time to imitate, though perhaps hardly to excel. They learn, finally, that, while we may feel proud of the position already attained, we have still ample opportunity to improve in many ways.

The exhibition of machinery for

MAKING CLOTHS AND FOR WORKING TEXTILE MATERIALS

is exceptionally large, and includes a most interesting variety. In this department, the United States exhibits almost nothing, but every other manufacturing nation is quite well and, in some cases, magnificently represented.

The Avery continuous wool spinner deservedly attracts much attention. It is the machine which excited so much interest in the Fair of the American Institute of 1872, with one or two small but valuable improvements in details. The machine spins continuously and rapidly, and does its work well. It is compact and forms a remarkable contrast with its only competitors, which, however, are now placarded "*Hors Concours.*" This machine is claimed to be specially adapted to working short wools, and, on trial, to have worked a very large percentage of shoddy. Wool-preparing machines are largely exhibited. Cards are present in some variety, and at least one example of a comber is exhibited in the British section. Platt Brothers, of Oldham, exhibit a fine collection of cards and the comber referred to. These machines are well known in the United States, and no very remarkable novelties are found here. They are all well and neatly made, and are capable of doing the best of work. The whole exhibit of textile machinery is far more remarkable for its magnitude than for novelty. In the exhibit of Bede & Co., the use of friction gearing is an innovation which, if as successful as it is claimed to be, will be largely imitated.

The exhibition here, of one of our best card setting machines, of our harness making machines of some of our well known inventions, and of our standard machinery in this important department, would have added immensely to the interest of the United States section of the exhibition contained in the machinery hall. The manufacture of

SILKS

is with us a comparatively youthful branch of industry, although the Cheneys and a few other manufacturers have, in isolated cases, been long engaged in it. Naturally, it has no representation in the United States section. France and Switzerland have very interesting exhibits of silk-working machinery, and it is easy to trace the whole process of silk manufacture, from the winding of the fiber from the cocoon to its final appearance in the woven goods.

In one of the annexes may also be seen illustrated the whole previous history of this invaluable textile material. Beautiful specimens of many varieties of the moth are shown; the eggs, the grub, the cocoon, are all exhibited, and the whole process of treatment, not only of the cocoon but of the butterfly and its eggs, is fully exhibited. With the baking of the cocoon, for the purpose of killing the unfortunate insect within it, the process of silk culture ceases and that of manufacture begins. The thread is wound from the cocoon by means of winding or reeling machines, which are, in some examples seen here, so contrived as to slightly twist the fiber while winding it.

The process of spinning is remarkably well and largely illustrated in the Swiss section. It is quite different from cotton or wool spinning, and consists merely in twisting together the requisite number of fibers to produce the desired size of thread. The "drawing" which is so important a part of the process of spinning textile materials of short fiber is not necessary or possible here. Among the silk looms are several very fine specimens, which are at work weaving silks of various widths and patterns.

Switzerland exhibits some examples of waste silk working machinery. As the fiber is, in this case, much broken up, and resembles more nearly those more familiar textiles, cotton and wool, the process of working is intermediate between that by which new silk is worked and the ordinary method of working long wools.

If we may judge by what is shown here, the silk manufacture of Switzerland must be a large and an exceedingly important branch of that nation's industry.

SEWING MACHINES

can hardly be classified with the textile machinery, but they are hardly second to them in importance, and they appear in every section of the machinery hall in wonderful variety and in great numbers. As a matter of course, the more important and most effective of these machines, wherever exhibited, are of American make or are copies, made with great accuracy frequently, of American machines. The manufacturers of Great Britain and on the continent have imitated our methods of manufacturing, and sometimes produce exceedingly creditable work. The exhibit of sewing machines in the United States section is very extensive, and all of our standard machines are well represented. This is one of the most attractive departments of the whole *Welt-Ausstellung*, and interests all classes of visitors. Examining carefully the construction of these machines and comparing those of foreign make, it is soon discovered that, where defects occur in the latter, they are generally the result of a lack of knowledge of the proper distribution of material. The machines are made of standard forms and their parts are always made to gage and are interchangeable; but still the fits are sometimes a little loose, and the neat adaptation of the special qualities of steel and of iron, or of case-hardened iron, which invariably distinguishes the American productions, is sometimes not seen in the foreign copies.

The large number of ingenious and convenient attachments, which accompany the American machines is also one of the distinguishing characteristics. The foreign manufacturers do not invent them, and they are somewhat slow in adopting those invented in the United States. It is not at all remarkable that, notwithstanding the fact that so many sewing machines are now built in Europe, hundreds of thousands are still annually exported from America. Even the humble cottagers of Bohemia and the semi-civilized people of Russia and of Turkey are now becoming purchasers of these universally useful little "labor savers." An old subscriber to the SCIENTIFIC AMERICAN, who resides in Sweden, states that the poor peasants of that country also are succeeding frequently in satisfying the ambition, which is common to all, of possessing an American sewing machine. The sewing machine has thus become one of the most important aids in the advancement of civilization. Increase of production and the decrease of prices are therefore matters of great moral, as well as commercial, importance. The expiration of the last of the important patents upon essential details will now soon take place, and these very desirable consequences must soon follow.

R. H. T.

The Multiplex Telegraph.

On page 64 of our current volume, we called attention to an article in a contemporary, describing a French invention by which four operators can, it is asserted, each work a telegraphic communication over a single wire in one direction simultaneously; and not only this, but four others can operate at the same time in the other direction. A correspondent, J. T., writes to inform us that the honor of this invention belongs to the United States, and that the original and only inventor of the system by which more than two telegraphic instruments can be worked at the same time over one wire is Mr. Merritt Gally, of Rochester, N. Y., the inventor of the "Universal" printing machine. Mr. Gally's telegraph improvement has been patented in the United States and in some European countries.

Our correspondent states as follows: "By the use of Mr. Gally's invention a large number of operators at different stations along a single wire can be simultaneously employed sending different messages in either or both directions without conflict, each accomplishing as much or more work than would be possible for him to do by the use of the Morse key. Mr. Gally has adapted his system to each and every kind of receiver or register. The operator can receive his letter in print or by sound, or both simultaneously; or by the embossing, marking, or the electro-chemical recorder; and his instruments are so simple and accurate in their manipulation that it seems impossible that a mistake could occur in their operations. No time whatever is wasted in adjusting the instruments. They are always in readiness, and the first stroke of the operator sends the first letter of his message. Each touch of the key board represents a letter or other signal complete. The operator may be sending a message to a distant station, be receiving another from an intermediate or more distant station, and through a third part of his instrument be in active communication with every office on the line, receiving or sending calls or explanations; while on the same wire numerous other operators, all along the line, may be similarly employed. By using the electro-chemical recorder, on Mr. Gally's system, at least sixty operators may be simultaneously employed upon a single wire sending messages to any destination along the line; thus entirely doing away with the necessity of previously preparing the messages in punched slips of paper, as is done for the automatic machine."

The writer makes other claims as to Mr. Gally's invention; but the above will suffice to show the nature and great importance of the discovery. We hope soon to publish full particulars and illustrations of this last addition to and improvement in our telegraphic apparatus, the capabilities of which multiply with astounding rapidity.

IMPROVED RAILROAD HAND BRAKE.

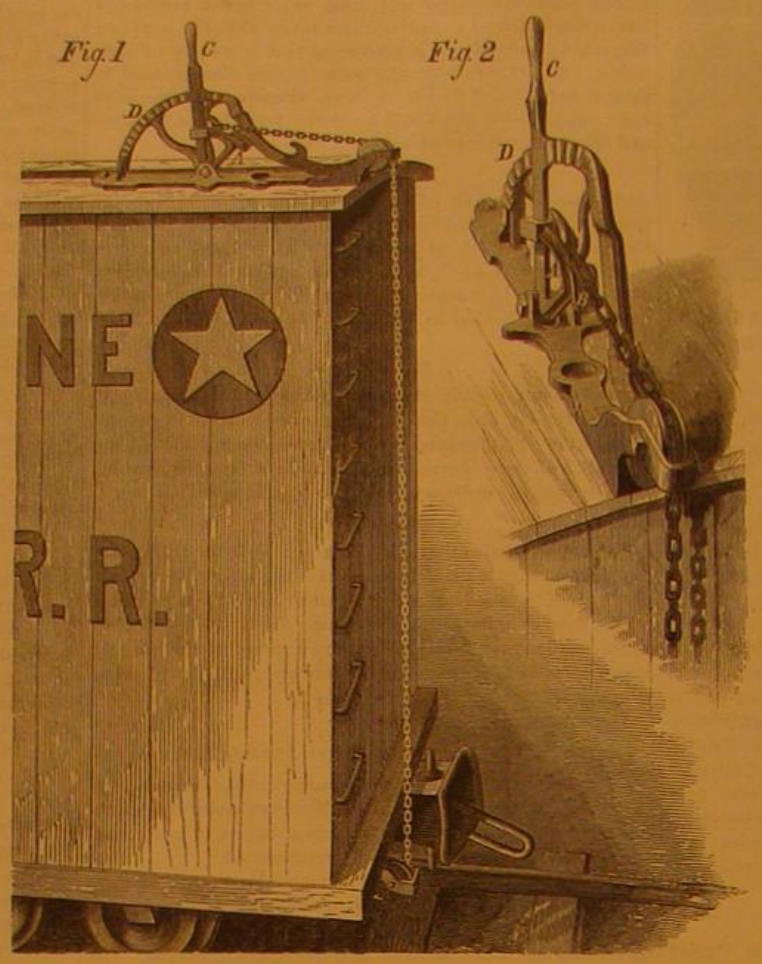
We illustrate herewith an improved form of railway hand brake, which, it is claimed, saves fully two thirds in distance run and time occupied while setting brakes. It is also stated to be much safer in use than the ordinary "twist up" arrangement, as it is placed from three and a half to four feet from the end of the car roof, so that, in case of accident, there is less danger of the brakeman being thrown between the train.

The device is quite simple, and consists of a bed plate, to which is pivoted, in lugs, a segment, A. On the latter is formed a hook, to which the brake chain is attached, and also a fork, B, for guiding the same. C is a wrought iron lever, connected with the segment and provided with a steel lip to engage in the teeth of the rack, D. The brake chain passes from the hook on the segment over a pulley, journaled in suitable bearings cast with the bed plate, and thence down under another pulley, secured as shown under the car, and so to the brakes. The arrangement on the roof of the car is, secured by but two bolts; and having merely a single motion, can necessarily be quickly operated.

The inventor informs us that on the occasion of a competitive trial between his device and the ordinary brake, which took place on the Little Miami railroad, while the latter stopped four cars and an engine in 1,130 feet, actual measurement, his invention performed the same operation within 425 feet, thus gaining 705 feet; and this although the cars in both cases were of the same weight and running as nearly as possible at the same speed.

From our engraving, giving two perspective views of the apparatus, and also showing how it is applied, a clear idea of its construction will be obtained. It appears strong and durable, and, according to the inventor, is not expensive.

Patented by Mr. W. S. Foster, of Foster's Crossings, Warren county, Ohio, who may be addressed for further particulars.



FOSTER'S RAILROAD HAND BRAKE.

To Prevent Burrs from Heating.

Says a correspondent in *Leffel's Mechanical News*, writing on the above subject: Dress from center to circumference, leaving no bosom. Draw a line across the center, each way, dividing a four feet burr into 16 squares or divisions, and other sizes more or less, in the same proportion, with all straight furrows. Let the draft be one half the diameter of the rock. Lay off the lands and furrows one quarter inch each, observing to dress smooth. Sink the furrow at the eye one quarter inch deep for corn, and run out to three sixteenths at the periphery; for wheat, three sixteenths at the eye and one eighth at the periphery. When thus finished, crack the lands in straight lines, square with the draft of cross lines, so as to make lines face in the runner and bed direct. This will never heat.

COMBINED SPADE AND FORK.

Our illustration represents an ingenious arrangement for adapting a fork for use as a spade in a speedy and convenient



manner. The fork may be of any ordinary pattern and the device, consisting of a sheath of corresponding form, is made to slip over the tines.

In our engravings, Fig. 1 shows the attachment partially in place. From the back is cut a triangular piece, A, which is hinged at its lower angle to the main portion. The same has a right-angled flange formed on its upper edge, which, when the fork is inserted, forms the top of the sheath. B is a projection on the triangular piece made semicircular so as to fit around the handle of the fork.

When the sheath is slipped entirely over the fork, a ring or sleeve, C, on the handle is brought down so as to surround the projection, B, and thus firmly hold the attachment in place. The sheath is made of sheet metal and, when affixed, forms the spade, as shown in Fig. 2. The plan is novel and economical, as the appliance can necessarily be obtained at a much less cost than an entire spade.

Patented July 15, 1873. For further particulars address the inventor, Mr. Heber Stone, Galveston, Texas, or care of W. S. Pierce & Co., 63 and 65 Stone street, New York city.

The Geographical Distribution of Mineral Oils.

M. J. Girard says, in *La Nature*, in relation to the above subject; that sources of bitumen have been known from antiquity. Those of the Euphrates, of Judea, the naphtha deposits of Bakou on the Caspian Sea, and the asphaltum of the Dead Sea, have existed from the earliest times. At Bakou, the inflammable gas or vapor of naphtha often produced remarkable phenomena, believed by the inhabitants to be supernatural and hence made an object of worship. A temple consecrated to fire was once erected there; but on its ruins, a paraffin factory now stands.

There is a certain relation between the mud volcanoes of Sicily and the Crimea and the sources of natural oil, as the emission of gas, surely indicating inflammable substances within is very common at times of eruption of the former.

Bituminous deposits are found in the mountains of the Caucasus, in South America, and especially in China, where the inhabitants utilize the gas flowing from the wells for domestic purposes. Before the discovery of the Pennsylvania petroleum, the sources of Burmah furnished the material in sufficient quantity to warrant exportation. There are important deposits of mineral oil at Pegon, and emissions of gas are observed at Chittagong and are locally known as the burning fountains of Bramah. In Assam, wells have been sunk for the extraction of oil, and recently petroliferous regions have been discovered in the south of India, in Australia and in Sumatra.

These mineral products are found all over the globe, though in the greatest quantities in the basins of large rivers, like the Indus, Euphrates, St. Lawrence, Mississippi, Colorado and many of the streams of California and Mexico; and also near lakes and inland seas. Pure and mixed oil has also been discovered in the islands of the Mediterranean, in the Grecian Archipelago, and in Ceylon.

Incrustation of Water Pipes.

The Boston fire insurance companies are now calling attention to the condition of the water pipes in that city. It seems that the water supply is greatly diminished by the incrustation formed on the inside of the iron pipes by the action of the water, so that a three inch pipe that has been laid ten years becomes reduced to two inches, those of four inches to three, and the six inch mains reduced to five and four inches. A pipe was recently taken up in Howard street through which one could not see, though water flowed slowly: and a pipe of three inch bore was taken up in Beacon street, filled up solid with rust. Here is a chance, says the Boston *Advertiser*, for an inventor to discover some coating to render iron pipes proof against the action of water. In the suburbs cement pipes are used, but it said that they are hardly strong enough to bear the pressure of the Cochituate water.—*New York Times.*

A Chemical Remedy for the Potato Disease.

Professor Alexander S. Wilson, in a communication to the *Chemical News*, states that he has made analyses of the tubers of diseased potatoes, and finds in the ashes a marked deficiency in the salts of magnesia and lime. In the ash of the healthy tuber from 5 to 10 per cent of magnesia salts are usually found, and over 5 per cent of lime. But in the ashes of diseased tubers, although the proper quantities of other minerals were found, the percentage of magnesia was only from 1 per cent up to 3·94 per cent, and of lime only 1·77 per cent.

With these considerations before us, I think, says Professor Wilson, that we are justified in appealing to chemical science—to solve the problem as to the prevention of the disease—to suggest not a substance that will destroy the enemy, for this is next to impossible, but to give the plant such nourishment that will enable it to resist the adverse circumstances in which it is placed, as well as the attacks of its own peculiar enemies.

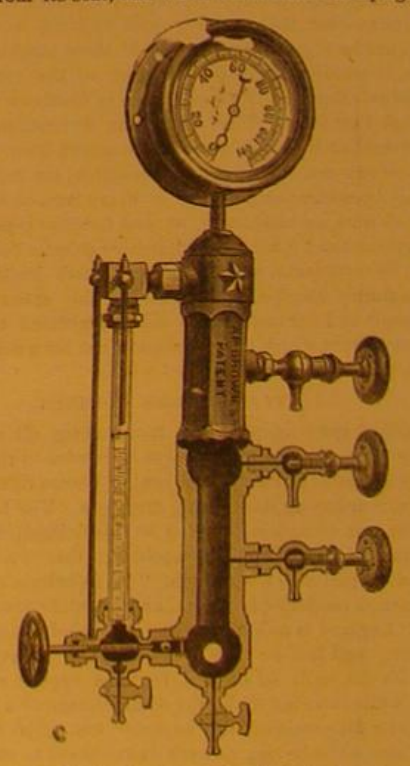
Some years ago, Professor Thorpe found, from the analyses of diseased and healthy orange trees, that, in the former, the amounts of lime and magnesia are deficient; the same thing, we have seen, is the case in the diseased potato plant.

It has lately been shown by Dr. Crace Calvert, that lime is one of the few substances which we know that are capable of altogether preventing the development of fungi in organic solutions. He does not give any experiments relating to the action of caustic magnesia on fungi, but doubtless its action will be found to be similar.

Here, then, is a curious and, at the same time, significant fact: Diseased potatoes are deficient in lime salts: lime prevents the development of fungi. May not the development of fungi in the vessels of plants be furthered by this deficiency? The circumstances are such as scarcely to leave room for doubt. So far, then, theory and practice agree; lime has been found by experience to be useful in preventing the disease, and I cannot doubt that magnesia, if tried, will be found to have a similar effect.

COMBINED WATER AND PRESSURE GAGE.

The inventor of the device of which we herewith give an illustration has combined the glass tube water gage, the try cocks, and the pressure gage in one neat and compact arrangement, which is claimed to be far cheaper than the separate articles: The boiler need be punctured in two places instead of six; the pressure gage is placed right before the eyes of the engineers, boiler tenders, or other workmen; and the gage glass is specially arranged to prevent, by a most ingenious contrivance, accidents from broken glass tubes. The three try cocks are opened by compression, and are self closing, being fitted with spiral springs. In each of the horizontal passages at the top and bottom of the glass tube is a valve, consisting of a ball of solid material. This is so placed that, if the tube be broken the pressures of water and steam in the tube no longer balancing each other, the ball is instantly driven into its seat, closing the orifice, preventing the escape of hot water and steam and the scalding of the bystanders, as well as the loss of power from the boiler. The engineer can then, without danger or waste of time, put in another glass; and by slightly pressing in the piston, on the bottom at the left, the ball is driven from its seat, and water rushes into the upright tube,



the pressure of which drives the ball in the upper par away, and equilibrium in the gage is restored.

By the valuable safety improvement, and by bringing together the various parts, frequently distributed about a boiler to the great inconvenience of the attendants, the inventor Mr. A. P. Brown, claims that he has effected an important improvement in boiler engineering. For further particulars address T. Holland, 8 Gold street, New York city.

IMPROVED CLUTCH DRILL.

Little explanation, in addition to our illustration, is needed to show the action of this invention. By communicating the motion of the lever to the drill spindle by means of a friction clutch, the strain is distributed all around the spindle, and the liability of the drill, when acted upon on one side only, to swerve from the perpendicular is prevented. The merest possible motion of the lever moves the drill; and it will be seen that the clutch can be slid lengthwise on the spindle, allowing the latter and the lever to work clear of obstructions. The inventor claims that, by using cast steel as a material, he has produced the best and cheapest drill stock now in market, and the only one which uses friction as a means of communicating the motion, and which has, consequently, the advantages above mentioned.

For further information, address Mr. George W. Gill, 405 Commerce street, Philadelphia, Pa.

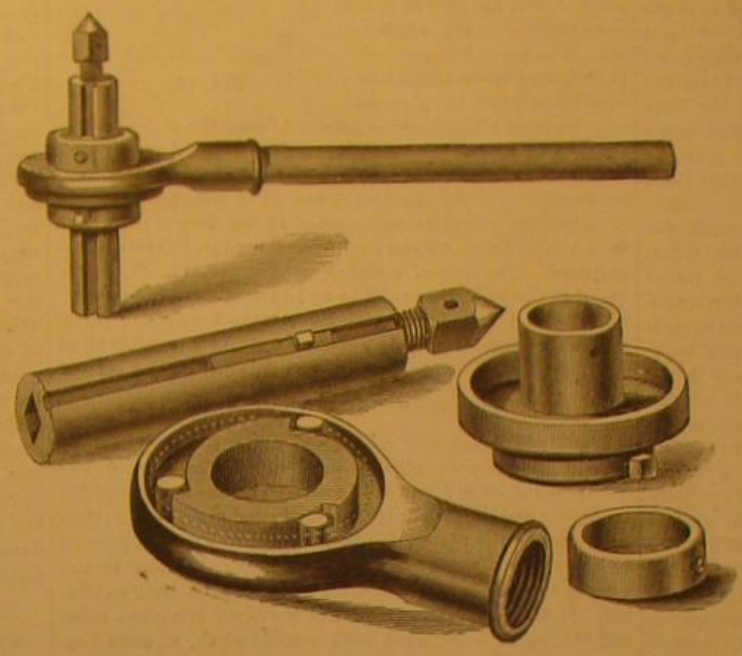
Value of Foreign Patents.

In Europe the American origin of an invention is looked upon as a sort of guarantee that it is a good one, and those inventors who have, in addition to their American patents, secured patents in Europe have generally realized a larger profit from them than from those obtained at home. The reason of this is obvious when we consider the large amount of capital invested in the manufacturing branches of industry in England, France, and other European countries, and the competition which is naturally created thereby. Under this state of affairs it will readily be seen that the monopoly or control of any special branch of industry will, in a measure, free the manufacturer from the incubus of competition, and enable him to make a larger per cent upon his invested capital.

Cheap manufactures beget cheap labor and competition begets cheap manufactures. Therefore it is policy for the manufacturer to secure a monopoly of some branch of industry which he can manage and control, independent of his neighbor and competitor. In the United States, our manufacturing business has not yet resolved itself entirely into the hands of large manufacturers, but is divided up among a large number of small manufacturers who are not able to control more than a limited patronage. It would not, therefore, always justify them to invest in patent rights; and being small manufacturers, there is no inducement to get up such a close competition in business as would reduce their profits. The inventor depends mostly upon supplying the wants of the manufacturers, and it therefore behoves him to secure his inventions where the largest manufactures and the closest competition is found, and it is there he will realize the largest profit from his invention.—*Mining and Scientific Press.*

DOWN HALL, NEAR HARLOW, ESSEX, ENGLAND.

This mansion, the seat of Sir H. Selwin Ibbetson, Bart., M. P., occupies the site of the former house, once the residence of Prior, the poet, of which, however, nothing remained of the smallest architectural interest. Building materials of a good character being wanting in the neighborhood, and the site being upon an excellent gravel, it was determined to build the whole of the walls in concrete. The quoins, cornices, and columns, dressings of openings, etc., are in stone, and it has been especially sought to avoid giving the forms of stone work to any of the concrete. The plain surfaces, which alone are treated as concrete, are divided into panels, the stiles being plain Portland cement and the panels rough cast with fine sea shingle. The decorative panels and two horizontal friezes are executed in sgraffito. The internal arrangements offer no special features except the entrance hall, which, being of very large area and only of the same hight as the reception rooms, and therefore requiring to be broken up, is treated as a Pompeian atrium, the columns offering great facilities in the construction of the upper floor. Mr. F. P. Cockerell was the architect of the house, which is important not only as a fine specimen of construction in concrete, but as a most elaborate and handsome dwelling of the best modern type.



GILL'S CLUTCH DRILL.

A Butter and Cheese Exchange.

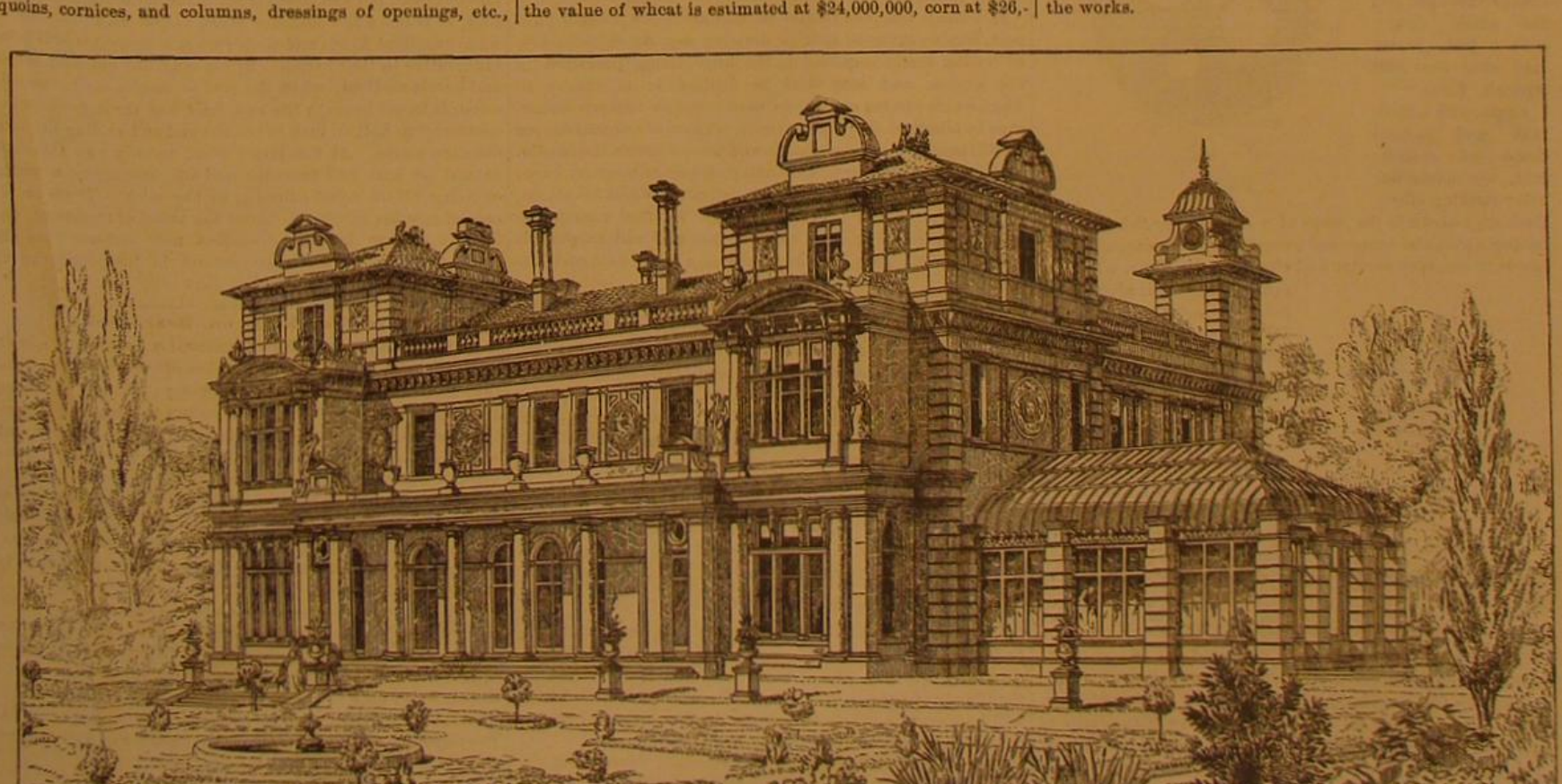
A new exchange for the butter and cheese dealers of this city was formally opened, on the 10th instant, in the large building at the corner of Reade and Greenwich streets, owned and occupied (as a sugar refinery) for many years by Messrs. R. L. and A. Stuart. The location being near the North River, by which most of these products arrive, and the building having been refitted to accommodate the business, the promoters of the enterprise look forward to advantageous results to the trade generally. From facts gleaned at the opening ceremonies, we are able to present some statistics of the dairy and provision products, which, by their extent, surprised us, and will be new to many of our readers.

It is estimated, from the present average of receipts from the 1st of May last, that there will arrive at the piers of the Hudson, during the current year, 3,500,000 packages of butter and cheese, of the aggregate value of $50,000,000, while the value of wheat is estimated at $24,000,000, corn at $26,000,000, *flour* at $30,000,000, cut meats at $12,000,000. It will thus be seen that dairy products and provisions represent by far the largest amount of business in the produce trade.

The Electric Light.

Up to the present time, as is well known, the electric light has been used only for lighthouses, as an electric sun illumination for signals, or on the stage, where a strong light may be required without regard to cost; but thus far it has been quite impossible to employ it for lighting streets or houses. By the old method the electric spark was passed between two points of charcoal, each attached to a copper wire connected with an electro-magnetic machine. The disadvantages attending this mode consisted in the facts that for each light a separate machine was required, and that the light so obtained, although very powerful, was impossible to be regulated, besides being non-continuous, owing to the rapid consumption of the charcoal points from exposure to the air. All these difficulties Mr. A. Ladiguin, of St. Petersburg, Russia, has tried, and apparently overcome most successfully. By his newly invented method, only one piece of charcoal or other bad conductor is required, which, being attached to a wire connected with an electro-magnetic machine, is placed in a glass tube, from which the air is exhausted, and replaced by a gas which will not at a high temperature combine chemically with the charcoal. This tube is then hermetically sealed, and the machine being set in motion by means of a small steam engine, the charcoal becomes gradually and equally heated, and emits a soft, steady, and continuous light, which, by a most simple contrivance, can be strengthened or weakened at the option of those employing it, its duration being dependent solely on the electric current, which of course will last as long as the machine is kept in motion. Taking into consideration the fact that one machine, worked by a small three horse power engine, is capable of lighting many hundreds of lanterns, it is evident that an enormous advantage and profit could be gained by the illumination of streets, private houses, public buildings, and mines, with the new electric light. In the latter, it must prove invaluable as no explosion need ever be feared from it, and these lanterns will burn equally as well under water as in a room. Without mentioning the many advantages this mode of illumination has over gas, which by its unpleasant odor and evaporation is slowly poisoning thousands of human beings, and from which explosions are frequent, we can state that, by calculations made, this electric light can be produced at a fifth of the cost of coal gas. We hope shortly to place before the public more complete particulars, as well as reports of further experiments which are proposed to take place in Vienna, Paris, and London.—*Gales, and Journal of Society of Arts.*

THE London Underground Railway is now in process of extension from Moorgate street to Aldgate. The new line passes under Finsbury Circus, under Bloomfield street, under Finsbury Chapel and the Moorfields Roman Catholic Chapel. But it is stated that these buildings will not be disturbed by the works.



DOWN HALL, NEAR HARLOW. ESSEX, ENGLAND

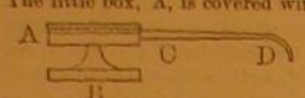
THE MAGIC LANTERN AS A MEANS OF DEMONSTRATION.

BY HENRY MORTON, PH. D.

PART 3.

EXPERIMENTS WITH THE VERTICAL LANTERN.

1st. Propagation and reflection of waves. For this we either use the water condenser or a shallow tank made by cementing a ring of glass five inches in diameter and about one inch deep upon a piece of plate glass. To produce the waves an admirable contrivance has been made by Mr. George Wale, of Hoboken, N. J., which is constructed as follows: The little box, A, is covered with a sheet of elastic rubber, and has attached to it the bent tube, C D. A light tap upon the elastic cover drives a puff of air out from the end of the tube and produces a single, well defined wave in the water over which it is held. The reflection of this wave from the sides of the tank can be well observed, and admirably illustrates the law of reflection from a concave circular surface. By placing an elliptical ring of thin brass in the tank, the peculiar properties of that curve in connection with reflection can be admirably illustrated. Thus, when the waves are produced at one of the foci, they are seen to develope a reflected center at the other, while in other positions curious patterns are evolved from the crossing and interfering lines.



2d. Cohesion figures. With the same tanks used in the foregoing experiment and some specimens of oils, we can exhibit, in a very perfect manner, those characteristic differences, in the behavior of films of the latter on the surface of water, first studied by Tomlinson (*Philosophical Magazine*, October, 1861, and March, 1862). Thus, some perfectly clean water being poured into a tank which has been washed with a solution of caustic potash, well rinsed and drained (not wiped) dry, a single drop of oil of coriander is allowed to fall upon its surface. It will instantly spread into a large circular sheet which, in another instant, will break into a moss-like pattern, such as is represented in Fig. 13, and this, in a moment more, will fall apart into a multitude of minute globules.

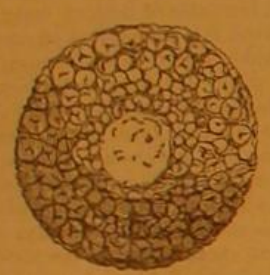


FIG. 13.

Taking a fresh tank, and dropping upon it some oil of cinnamon, we have, as before, an instantaneous flash into a large circle (see Fig. 14); but this slowly developes a series of beads around its edge, and then, one by one, circular openings break out in the interior, each of which acquires its string of beads and gradually expands until one of them, reaching the margin, breaks through, and the whole figure, with a jerk, passes into some new and irregular form.

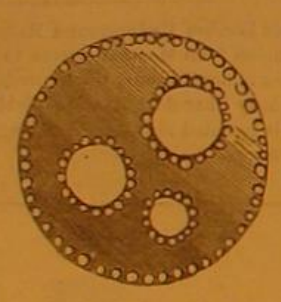


FIG. 14.

Again, with a fresh tank and several drops of carbolic acid, we obtain another striking effect. Each drop assumes the shape of a sort of jelly fish (Fig. 15), having a globular center and irregular fringed margin, which last is in constant motion and changes its outline, while the entire object sails about from point to point of the tank. Ether, likewise, makes a very beautiful though transient figure; and indeed, by changing the substance, an indefinite variety may be given to the experiment.



FIG. 15.

The most scrupulous cleanliness is essential with the tanks and water. The former, after use, should be washed with a little solution of caustic potash, be thoroughly rinsed, and then allowed to dry by draining.

MOTIONS OF CAMPHOR ON WATER.

This phenomenon, which has exercised the ingenuity of scientific men for nearly a century and has finally, we think, received its full elucidation at the hands of Professor Tomlinson (*Philosophical Magazine*, Vol. 34, page 409), admits of striking and amusing exhibition with the same arrangement as we have above described, an absolutely clean tank being, however, essential. Into this a few grains of gum camphor are thrown (contact with the hands being avoided as much as possible); and at once they will set up a rotary motion and one of translation, like so many waltzers in a ball room. The accidental shapes of individual pieces or groups of fragments clinging together, with their motions, sometimes produce effects ludicrous in the extreme.

WATER WAVES ON A CHLADNI PLATE.

This experiment (Fig. 16), devised by the present writer, is arranged as follows: By means of a clamp which fits the front part of the vertical lantern, a plate of glass, a foot square, is so held by its middle that one corner covers the condenser. This corner has cemented to it a thin ring of soft rubber of about five inches in diameter, and in this is poured water to the depth of one tenth of an inch. In the figure, C D being the clamp and A B the glass plate, E F is the ring or rubber exactly over the condenser. The parts being so adjusted, we draw a violin bow over the edge of the plate so as to produce a low musical note. At once the water within the ring of rubber is thrown into a system of large waves, which are seen on the screen in a shaded network of singular beauty. On so drawing the bow as to produce a higher note, smaller waves take the place of the larger ones, and with a mixed note we can even get two or more systems, superposed. The sound emitted by the plate is distinctly heard at the same time; and as an illustration of the connection between sound and vibration, wave length and pitch, this experiment certainly answers well, to say nothing of the beauty of the wave patterns as exhibited on the screen.

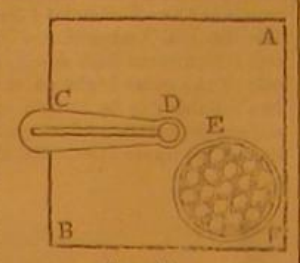


FIG. 16.

DUST FIGURES BENEATH A CHLADNI PLATE.

If a little impalpable silica, such as may be obtained by passing fluoride of silicon into water and drying the gelatinous silica so formed, is scattered on the surface of the condenser and the Chladni plate is adjusted close over it: then on sounding the plates, the figures, which Faraday showed to result from the vortical air currents developed by the various motions in the vibrating plate, can be well exhibited. If the same light powder is scattered in a glass tube, and the latter is sounded with a moist cloth, so as to produce the figures of Kundt, these can likewise be readily exhibited in the lantern. A more convenient method is to sound the tube with a whistle, and the tube itself may be made square, of plate glass. These arrangements, as also the method of exhibiting the dust figures, are due to Mr. Wm. E. Geyer, Instructor in the Stevens Institute of Technology.

EXPERIMENTS IN ELECTRICITY.

If a piece of thick platinum or tin wire is bent into a hoop circling the interior of one of the glass tanks above mentioned, and the tank itself is filled with a strong solution of bichloride of tin: then, on inserting another wire at the center of the solution and connecting with a series of two or three Grove's elements, so as to make the center wire the negative and the hoop the positive pole, a beautiful growth of metallic crystals will shoot out from the center and spread over the entire surface of the field. A similar experiment may, of course, be performed with a vertical tank, but the unsupported weight of the metallic blades then soon breaks them down. In this arrangement, however, they are supported perfectly, resting, in fact, on the bottom of the tank, as the solution should not be more than an eighth of an inch deep.

If a small compass needle be mounted on a pointed support, like an inverted tack or drawing pin, its motions are, of course, vastly amplified in the huge image projected on the screen, and may thus be utilized in a number of ways which are too evident to need mention and too numerous to admit of it. If, moreover, a piece of covered copper wire is bent into a flat rectangle and placed beside the needle, with its ends, of course, in binding screws or mercury cups, it will form a galvanometer quite delicate enough for all ordinary use. It will indeed show the induced current developed by introducing a magnet into and withdrawing it from a helix. This, of course, opens a wide field of illustration.

A more complete apparatus for use as a lantern galvanometer has been described and used by Professor A. M. Mayer, of the Stevens Institute of Technology, with great success, but as it involves several modifications in the constructive detail of the instrument, we must refer the reader to the Professor's original description. (See *American Journal of Science*, 1872, Vol. 3, page 414; *Journal of the Franklin Institute*, 1872, Vol. 63, page 421; and "The Earth a Great Magnet." Chatfield & Co.

Another arrangement, superior to this for many purposes and not requiring a vertical lantern, has since been devised by Professor Mayer, and will be found described in *American Journal of Science and Arts*, 1873, Vol. 5, page 270.

MAGNETIC EXPERIMENTS.

If a powerful steel magnet, about an inch and a half long, be laid upon the horizontal condenser, and a plate of glass, on which fine iron filings have been previously sifted, be then brought close over it and gently tapped, the iron filings will be seen to arrange themselves in that beautiful system of curves known as the magnetic spectrum.

A great variety of similar experiments, illustrating the laws of magnetic force, will suggest themselves to any one familiar with the subject, and a number will be found in the little book already named, "The Earth a Great Magnet," which is the substance of an illustrated lecture which was delivered by Professor Mayer at the Stevens Institute of Technology, as well as in the Academy of Music, in New York, and at New Haven.

Steam Locomotives without Fire.

The fireless locomotive, heretofore engraved and described in the SCIENTIFIC AMERICAN, has lately been tried in Chicago. The Chicago *Tribune* says:

"In front of the cars was the motive power, contained in a small, compact, and neat locomotive, manipulated by an engineer. This was the fireless locomotive. It consisted of a boiler, eight feet long by three feet in diameter, and the usual machinery on a small scale. There was no fuel, no fire, no fireman. The steam was supplied for the round trip of six miles before starting. At the depot was a supply boiler, sixteen feet by three feet, in which steam was generated until 200 pounds pressure was indicated by the steam gage. The locomotive boiler was three fourths full of cold water. Instead of boiling this by means of a fire and raising the pressure to a required hight, the heat was introduced from the supply boiler through an iron tube. The iron tube was connected with the locomotive boiler, the latter running under the water along the bottom of the boiler and letting out the superheated steam, as it was freed from the supply boiler, into the locomotive boiler. This steam, rising through the cold water, permeated it, and quickly raised its temperature to 170 degrees. With this supply of steam the locomotive started, drawing a heavy four horse car over the three miles, to 35th street in ten minutes. The amount of steam consumed was 80 pounds, the locomotive starting back with 90 pounds remaining. When the starting point was reached, there was 57 pounds of steam in the boiler, the pressure being reduced only 33 pounds in the return trip, which was down a grade. It must be borne in mind that there was a large car, heavily laden, making eighteen miles an hour. The experiment proved conclusively that, as a substitute for dummy engines, the fireless locomotive is, beyond question, a success. There is no fire or fireman required, very little steam escapes, and the locomotive, not being one half the size of the clumsy dummy engine, does not frighten horses and endanger the public safety."

Railway Dead Weights.

We think it may be safely be said, remarks the *National Car Builder*, that, as a rule, every piece of inferior wood or metal used in the construction of a car adds unnecessarily to its weight; and on the other hand, the better the stock from which castings or other iron work are made, and the greater the care in selecting, seasoning, and applying to their special uses the various kinds of timber, the more the aggregate weight can be reduced without impairing the requisite strength. The modern buggy and other vehicles built at our carriage shops, are illustrations of this. Their strength, lightness, and slender proportions, as compared with their predecessors of former days, are almost a marvel, and are due to the quality of the material and the skill with which it is utilized. Let the same principle be applied, as far as practicable, in car construction, and a vast quantity of dead weight may be got rid of.

Budding Fruit Trees.

This is the proper season for budding most trees. Peaches especially are growing luxuriantly, and a bud or two inserted at this time will in two or three years give a bounteous return. It is very easy to go to a nursery and purchase a few young trees in spring, but it is not quite so easy to procure large ones of a bearing age. Therefore when there are any old pear, or even peach trees, standing around our dwellings, it is but a few minutes' work to put in a few buds of some excellent kind, and thus insure a crop that will be remunerative in time to come. By the way, the quickest, easiest and surest method, when the bark separates easily from the scion, is to cut beneath the bud, half way through the stock, commencing half an inch below the bud and ending the same distance above. At the latter point merely run the knife around the bark and twist the bud off, leaving as a matter of course all the wood adhering to the stick. These in the case of peaches rarely fail under the worst of treatment, and in fact so sure has the operation now become that the large propagators use this method in preference to all others.—*Correspondent of New York Tribune.*

Preventing Fires on Board Ship.

Dr. M. Schuppert, of New Orleans, La., writes to call attention to the frequent destruction of vessels by fire, and the consequent loss of life and property; and he points out the special liability of cargoes of cotton to spontaneous ignition, as bales are often put in places where they may absorb oil. He proposes to have, in the holds of such vessels, boxes filled with marble dust, into which pipes are to be led to convey dilute sulphuric acid. The carbonic acid gas disengaged by the contact of the sulphuric acid will undoubtedly extinguish fire; and Dr. Schuppert points out that the gas, being heavier than atmospheric air, can easily be confined to the hold of the vessel.

SQUARING THE CIRCLE.—A correspondent sends us a paper by an author who wisely conceals his name. It proposes to square the circle by the following irresistible logic: $\frac{11}{14}$ of the diameter $= \frac{1}{4}$ of the circumference. Therefore a quadrilateral figure 14×11 = a circle whose diameter is 14. The objection to it is that $\frac{11}{14}$ of the diameter of a circle does not equal $\frac{1}{4}$ of the circumference.

C. M., of Reading, Eng., says: "You cannot think how eagerly your admirable publication is sought after in these parts, and what interest is taken in it. The knowledge I have gained in my little way has proved not only beneficial, but of great and lasting advantage to others; and I wish my scribble would bring you 5,000 more subscribers."

American Progress in Stock Breeding.

In nearly all matters relating to industrial and material progress, the United States are making unquestionable advance, the basis of which is individual effort. Here every man aspires to better his condition, and tries to attain improvement in whatever his hand may find to do. If a mechanician, he is not satisfied until his devices are made superior to the old fashioned styles. If a horse breeder, his mind is given to the raising of a stock that shall beat the world. This pervading spirit of enterprise, this constant study for improvement, ramifies into almost every pursuit, and the general result is an elevation of the quality of American productions which makes them specially sought for in foreign lands.

An exemplification of this is seen in the circumstances connected with a recent cattle sale at New York Mills, N. Y., near Utica, at the farm of Mr. Samuel Campbell. The animals sold were chiefly of the short horn variety, imported twenty years ago from England, and since that time subjected constantly to American study and improvement. The result is now seen in the production of cattle of such great superiority that bidders for them have come from distant lands to pay down probably the highest prices ever before given for animals of this variety.

The New York *Tribune* says that about 500 people were in attendance at the sale, among whom were: the Right Hon. Lord Skelmersdale, whose seat is near Liverpool; Mr. Halford, of Papillon, Market Harborough; Mr. Calthorpe; Mr. Richardson, who represents Sir Curtis Lampson, of Sussex: Mr. Berwick, agent for Lord Dunmore, but who buys for Earl Bective, recently Lord Kenlis, of Underley Hall, Lancashire, and Mr. Kello, agent for Mr. R. Pavin Davis, of Horton, Gloucestershire.

A three year old bull brought $12,000. A cow, $30,600. A yearling heifer, $19,000. Another cow, $35,000, bought by Lord Bective. The culmination of the intense interest, however, was reached in the bidding for the Eighth Duchess of Geneva, which was sold to Mr. R. Pavin Davis, of Gloucestershire, Eng., for the unprecedented sum of $40,600. After this 11 cows of the Duchess family sold for $238,800, an average of over $21,700. Of these six went to England at a cost of $147,100, and five remain here at a cost of $91,700.

After the Duchess family came the Oxfords, then the other families, the bulls being brought in after all the cows were sold. There were in all 111 animals presented. The sum realized was $380,890.

Poisonous Undershirts.

Well authenticated instances of poisoning, resulting from wearing fabrics colored by some of the dyes in common use are by no means unusual. A highly intelligent gentleman, B.P., Esq., of Byfield, Mass., called a few weeks ago to consult us regarding his own case, which was of so serious a nature as to cause much alarm, not only to himself but to his family.

He had a few days previous purchased some new undershirts of cotton, colored with various tints, among which aniline red predominated. In a short time after putting on the garment, a peculiar eruption of an irritating nature appeared on the portion of the body covered by the cloth. The effects were not merely local, but to a considerable extent constitutional, pain and uneasiness being experienced in the back and lower extremities. In proof that the eruption was caused by the dye colors, it may be stated that a portion of the garment about the upper part of the chest was lined with linen on the under side; and wherever this came in contact with the skin, no eruption or redness appeared. The gentleman had worn cotton stockings, upon the upper portion of which there was woven in the fabric a narrow line of red. Beneath this band of red, around the leg, appeared a corresponding band of irritated skin after wearing the hose one day. The poisonous influence of the dye colors in this case cannot be disputed. It is not probable that the number of persons is large who possess such idiosyncrasies of constitution as to be easily poisoned by dye colors, but that three are some does not admit of a doubt.—*Boston Journal of Chemistry.*

Prizes for Electrical Inventions.

Among the general subjects for which prizes of gold and silver medals are offered by the Society of Arts, London, are the following:

A galvanic element which shall combine the constancy fo the Daniell's cell with the low resistance and high electromotive force of a Grove's cell.

An electric condenser which shall combine high capacity with small bulk and small residual charge.

A sensitive pocket galvanometer. The size should not exceed that of a watch.

To which may be added, as of use in telegraphy:

A varnish or coating which can be applied to iron wires so as to protect them against rust, and which shall not be liable to chip off when the wire is bent or rubbed.

Electric weaving. To the manufacturer who first practically applies electricity to the production commercially of figured fabrics in the loom.

Telegraphs. For an economic and permanent means of telegraphing through uninsulated wires, between places not less than 1,000 miles apart.

All communications and articles intended for competition must be delivered addressed to the Secretary, at the Society's House, free of expense, either on or before the 31st December, 1873 or 1874, except where otherwise stated. In the first case they will be considered during the session 1873-74; in the second case during the session 1874-75. Any communication rewarded by the Society, or any paper read at an ordinary meeting, will be considered as the property of the Society.

VIENNA PREMIUMS AGAIN AND THE AMERICAN SEWING MACHINES.

By reference to the "General Regulations of the Vienna Universal Exhibition," published by Archduke Regnier, President of the Imperial Commission, we find medals were to be awarded, in the mechanical department, in two classes—one for merit, and one for progress. The medal for merit was for the article possessing the greatest merit of its kind and class; and the medal for progress, for the article or thing which had made the greatest progression toward perfection. (In this country, the award of progress would be called a second premium.) Hence we conclude that, as the Wilson Sewing Machine was the only sewing machine that received the Grand Medal of Merit, when the awards were made at the Vienna Exposition, it must have been the best sewing machine on exhibition; although other sewing machines that received medals for progress should not be considered very inferior machines. At the great American Centennial Exposition of 1876, they may have so improved as to equal the world renowned Wilson Shuttle Sewing Machine.—*New York Tribune*, Sept. 8, 1873.

THE number of complete patents granted in England, in 1872, was 2,734.

NEW BOOKS AND PUBLICATIONS.

A TREATISE ON CIVIL ENGINEERING. By the late D. H. Mahan, LL.D., Professor of Civil Engineering at West Point, N. Y. Revised and Edited by De Volson Wood, Professor of Mathematics and Mechanics in the Stevens Institute of Technology. New York: John Wiley & Son, 15 Astor Place.

Dr. Mahan's "Civil Engineering" is one of the standard American text books; and we have here a new edition, containing the methods and formulæ of the present day. The work is too well known to need commendation in this place; but we are happy to give unqualified praise to the manner in which this new issue has been improved and edited.

SOUND AND MUSIC: a Non-Mathematical Treatise on the Physical Constitution of Musical Sounds and Harmony, including the chief Acoustical Discoveries of Professor Helmholtz. By Sedley Taylor, M. A., Fellow of Trinity College, Cambridge, England. Price $3. New York and London: Macmillan & Co.

This book is an acceptable supplement to Dr. Tyndall's "Lectures on Sound," and applies the masterly reasoning of that work to the explanation of the theory of musical intervals and harmonics. We cordially commend it to students of acoustics, and to musicians desirous of investigating the science of their art.

PROGRESSION: Devoted to the Railroad Interests of the West and South. Volume I., No. 1. Subscription, $2 a year. St. Louis, Mo.: Lee and Josselyn.

This is an excellent specimen of contemporary journalism; and the field it proposes to occupy is large enough even for Western energy and pluck.

THE PRACTICAL MAGAZINE: a Monthly Illustrated Cyclopædia of Industrial News, Inventions, and Improvements. Price $1. London, England; and J. R. Osgood & Co., Boston, Mass.

The eighth issue of this very handsome publication has just come to hand from the well known publishing house of J. R. Osgood & Co. There is no falling off either in the literature or illustrations of this first class magazine, which includes in its present issue, among other engravings, an admirably life-like portrait of Robert Crawshay, of Merthyr Tydvil, one of the iron kings of South Wales.

THE AMERICAN TEXTILE MANUFACTURER: a Journal devoted to Textile Manufactures, Market Reports, Practical Information and Scientific Subjects.

This neatly printed sheet is issued by the Textile Publishing Company, 234 and 235 Broadway, New York. It contains a considerable amount of trade information, and some articles, original and selected, relating to the industries on which it relies for support. We are glad to see that our efforts in the cause of industrial progress are appreciated by the editors of this new publication.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 25 to August 28, 1873, inclusive.

BATTERY GUN.—J. P. Taylor, Elizabethton, Tenn.
BRUSH MAKING.—Florence Manufacturing Company, Mass.
BUFFER AND COUPLING.—W. H. Skidmore, Philadelphia, Pa.
COMPOUND FAUCET.—W. S. Bate, Philadelphia, Pa.
GAS MAKING.—H. H. Wainwright, Philadelphia, Pa., *et al.*
GAS MAKING.—O. C. Hoffman, New York city.
HACKLING MACHINE.—J. C. Todd, New York city.
INTERNAL SCREWING.—J. L. Pope, Cleveland, Ohio.
LOCK AND KEY.—D. K. Millor *et al.*, Philadelphia, Pa.
LOOM HARNESS.—F. Condit, Providence, R. I.
SHAFT COUPLING, ETC.—J. Charlton, Philadelphia, Pa.
SHUTTLE GUARD.—E. M. Stevens *et al.*, Boston, Mass.
TRIMMING PAPER, ETC.—M. H. Semple, Lowell, Mass.
WATCH REGULATOR.—C. Teske, Saratoga Springs, N. Y.

Recent American and Foreign Patents.

Improved Sawing Machine.

Allen Xander, Slatington, Pa.—This invention consists in the improvement of sawing machines. The table is provided with one or more boards arranged to slide in and out of supports in the under side of it, to hold the work directly in front of the saw when it may be required to do so for cutting slots or notches in the end of the work. This tool may also be used for making long grooves in the work by running it over the cutter on the table.

Improved Hoisting Jack.

John Churchill, Cross River, N. Y.—The object of this invention is to construct a hoisting jack which is easily operated, effective in action, and readily adjusted to different hights. The invention consists of a bell crank lever with treadle, which acts by means of an intermediate connecting rod and weighted link on a sliding rack, guided between a strong frame.

Improved Automatic Gate.

John S. Folt, Kenton, O.—This invention has for its object to furnish an improved gate, which shall be so constructed that it may be readily opened and closed by simply moving the end of the lever in one and another direction. The invention is an improvement in the class of gates having appliances for swinging them at a distance; and consists in the arrangement of a set of parallel levers and their connecting rods with a pivoted plate, upon which the gate itself is pivoted and partly supported. By this arrangement, by operating either of the levers, the gate is swung open and latches upon the post, and by moving either lever in the opposite direction the gate will be swung shut.

Improved Land Marker.

George W. Betts, Shadeville, O.—This invention relates to an arrangement of a sliding bar and pivoted lever with the pivoted frame to which the markers are connected. The plows or markers have a free vertical, but no lateral movement. The rear ends of levers pass through keepers attached to a bar, so that the plows or markers may all be raised and lowered at the same time, by raising and lowering the said bar. The bar is attached to the rear ends of two levers which are pivoted to short studs, attached to the rear bar of the frame. The forward ends of the levers are connected by a board for the driver to rest his feet upon, so that he can, with his feet raise the plows from the ground, to pass an obstruction or for convenience in turning around. To a hand lever is pivoted the forward end of a bar which slides in the slot of an upright, attached to the rear bar of the frame. The bar projects rearwardly, so that, by adjusting it by means of the lever, it can be made to support the plows when raised from the ground; or it can be adjusted to act as a lever for forcing the plows farther into the ground. The slotted upright has several holes formed through it to receive pins, between which the bar slides, so that by adjusting the said pins the bar may be adjusted to support the plows at any desired distance from the ground.

Improved Machine for Making Taper Tubes.

Thomas J. Jones and John T. Jones, Sharon, Pa.—This invention consists of a taper mandrel, with a clamp for holding the plate of which the tube is to be formed at one edge, and a lever and bending plate, so contrived that the tapered plate is bent to the form of the mandrel by pressing said bending plate upon it by the lever, the mandrel being shifted around from time to time, and held stationary while the pressing is performed. The invention also consists of a mandrel and holding clamp, a welding roller, and a carriage, so combined and arranged that the bent plate, being reheated and arranged on the mandrel with the edges lapped and adjusted in the carriage, is quickly and thoroughly welded by the pressure of the welding roller, under which the lapped edges are caused to pass forward and backward until the joint is completed.

Improved Knob Latch.

August Heyse, Terre Haute, Ind.—The object of this invention is to furnish an improvement in the class of door locks having a sliding spindle with wedge-shaped pieces attached to it. The invention consists in the arrangement of guide pieces in connection with the bolt spindle. The latch bolt consists of three parts: Head, shank, and wedge extension. The head is considerably larger than the shank part, and is acted upon at its rear side by the end of a band spring. The wedge part extends sidewise in a right angle from shank, forming, with guide piece, a square aperture for the knob spindle. Two wedge projections are placed centrally, but in opposite directions, on spindle, and act from both sides on wedge extension. The latter is, therefore, pressed back whether the knob is pressed or pulled, opening thereby the door. A spring presses the bolt forward again as soon as the knob is released. The whole lock is let into the door, which is, as well as the side face plate, provided with slotted perforations.

Improved Circular Saw Guards.

Oscar A. Dean, Bethel, Vt.—The object of this invention is to provide means for protecting the operator in using circular saws: and consists in a guard consisting of two or more pieces. By raising and lowering the guard bar the two guards may be kept nearly in contact with the piece of lumber which is being sawn, and all danger from pieces, splinters, or loose knots being thrown toward the operator is prevented.

Improved Reversible Rotary Steam Engine.

Orwin Adams, Black Hawk, Col. Ter.—This invention has for its object to furnish an improved rotary steam engine. To the main shaft is keyed the drum, through slots in the face of which the pistons move in and out. The shaft works in cast steel bearings made adjustable. The pistons are bolted to yokes, which work upon the shaft. To the pistons and yokes, at or near their point of intersection, are secured slides, which move along the outer surface of a circular guide to force and hold the pistons out, and along the inner or concave surface of an elliptical guide to force and hold the pistons in. Steel circular rings, working against the metallic packing in edge of the drum, are let into the heads of the cylinder, and are adjusted by set screws. The part of the cylinder above the points of intersection of the guides is recessed to allow the exhaust steam to escape freely around the edge of the pistons, as soon as they have completed their stroke. The steam is prevented from passing directly from one port to the other by a packing held against the drum by springs. To the shaft, at one end of the cylinder, is secured a cam which moves a bar downward by striking against a pin and friction roller attached to the said bar. The bar is moved upward gradually, as allowed by the cam, by a spring, and is slotted to receive and slide upon a spindle and shafts, and to its upper part is attached a dog which, as the said bar moves upward gradually, through suitable mechanism opens the valve suddenly at the beginning of the stroke. As the valve opens the valve stem is caught and locked by a tappet. At the end of the stroke the valve will be instantly closed by the action of a stiff spring. To reverse the engine, the valve works are thrown out of gear, and the cut off is thrown open by a lever. The engine, when reversed, works at full stroke, and is regulated by the throttle valve. The cut off may also be made reversible by an extra cam, friction pulley, and lever arrangement.

Improved Crib.

Ward B. Carpenter, West Topsham, Vt.—The object of this invention is to provide an attachment to a crib, by means of which the same can be readily changed from the rocking position into a stationary one without being perceptible to the child sleeping therein, and permitting the quick and easy removal of the crib from one place to another. The invention consists of a slide attachment pivoted centrally to the rockers, made of two halves, having casters at their outer ends, by which the rocking crib can be changed directly into a crib moving on casters.

Improved Grain Sieve.

Lorin D. Carpenter, Buffalo Grove, Iowa.—This invention relates to the construction of sieves for cleaning and separating grain, designed for all kinds of separating machines; and consists in a series of perforated angle plates so as to overlap each other, and bent up at their lower edges so as to form long narrow troughs, into which the grain is received, and whence it is discharged.

Improved Device for Preventing Horses from Cribbing.

Alexander Stilwell, Dwaar's Kill, N. Y.—This invention consists in a device or machine for causing pain when the horse attempts to crib. In fastening the device to the horse it is brought in contact with the throat. It consists of a metal frame with levers, guards, etc., suitably arranged. When the horse attempts to crib, the cribbing action distends the larynx and presses upon a cross, which causes points to rise and punish him. When he is quietly eating his feed this action does not take place, and he is fully protected.

Improved Foot Power Apparatus.

Ebenezer Harding and Henry Harding, Delavan, Minn.—This invention consists of a fly wheel, foot treadle, and crank for obtaining motion, and a lever and connecting rod for transmitting and converting the motion to work vertical saws, mortising machines, and the like, arranged in a simple and efficient way, calculated to provide driving mechanism for small shops, by which sawing, mortising, and the like can be done to better advantage than with the ordinary hand power machines.

Improved Lamp.

John Kirby, Jr., Adrian, Mich.—This invention is an improvement in the class of hanging or chandelier lamps provided with a detachable feeding reservoir; and the improvement relates to the construction of the suspending devices of the detachable reservoir, and the means for drawing off the settlings of the permanent reservoir.

Improved Ferry Bridge.

Carroll J. Atkins, Louisiana, Mo.—This invention consists of a bridge or platform for ferry boats arranged to swing down, without obstruction, as low as needed to be level with the boat deck at low water; and an incline in the bow of the boat to run under the projecting end of the bridge and raise it to the level of the boat deck, whether the water be high or low. The invention also consists of large V-shaped notches in the edge of the platform or bridge, and corresponding projections on the boat to enter them, and thus bring the boat and bridge into alignment. This part is more particularly designed for railroad ferry boats and bridges, to insure the alignment of the tracks for running the cars from one to the other.

Improved Boot Heel Screw.

William Ackerman, Flint, Mich.—The object of this invention is to fasten boot heels made partly of wood and leather to the upper part of the boot heels by means of screw bolts, so that by unscrewing them the heels may be easily taken off and put on again, or new ones substituted in their stead. The screws may also be provided with sharp points, to be used in winter and by persons employed in occupations which require a firm hold of the feet, as raftsmen and others.

Improved Packing for Hydrants.

John W. Murphy, Baltimore, Md.—This invention consists in a hydrant packing ring, cylindrical on the inside and tapering downwardly on the outside, whereby leaking and waste of water or other liquid is effectually prevented.

Improved Manufacture of Friction Matches.

Charles F. Bonhack, New York city.—The object of this invention is to furnish to manufacturers of matches an improved dipping machine, by which the matches may be dipped more quickly and conveniently than with the machines hitherto in use; and also a more even and complete head of the matches be produced, and the workmen to a great extent protected against the deleterious influence of the phosphoric vapors. The invention consists of the combination of the receptacle for the phosphorus paste and surrounding water bath with stirrers and transferring rollers, together with regulating and guiding appliances.

Improved Weighing Attachment for Wagons.

Jacob W. Hill, Jefferson, Iowa.—This invention is intended to furnish an improved weighing attachment for wagons, to enable the load to be conveniently weighed without the necessity of driving to a platform scale, and which shall be so constructed that the knife edges will not be liable to wear while transporting the load. The bolsters are made in two parts, one attached to the axle, while the other or false part supports, and is movable with, the wagon box. The levers for lifting the box are pivoted to the fixed part of the bolster, and the weighing levers—which have for their fulcrums bars that are pivoted to the lifting levers—pass through slots in the fixed bolster, and converge and connect with the graduated arm of the beam or weighing lever, which has a fixed fulcrum beneath the box, and projects laterally through a slotted keeper.

Improved Pessary.

Edmund P. Banning, Sr., New York city, assignor to Banning Truss and Brace Company, of same place.—The object of this invention is to so improve the arrangement and connection of uterine repositors with their pendent shaft that any desired repositor suitable to the special position of the uterus may be applied, relieving thereby any undue pressure on the same and protecting against irritation and ulceration. The invention consists in the improvement of pessaries by providing the adjustable stem with a ring jointed to the support at one point only.

Improved Fence Post.

Hosea O. Elmer, Sand Bank, N. Y.—This invention consists of a fence post having its upper part of iron, its lower of iron, wood, and cement or artificial stone, and provided with an intermediate cap. By means of the iron clasps the entire strength of the wooden rail is secured, while splinting by ordinary use is rendered impossible.

Improved Tassel for Canes and Umbrellas.

William Harnach, New York city.—This invention is a cane or umbrella tassel made of a slitted strip of paper colored like the color of leather and varnished with a waterproof varnish. The appearance is better, because the surface is smoother, the substance more compact, and the color brighter. It is claimed to be equally if not more durable than leather, and is considerably cheaper than leather.

Improved Window Sash Ventilator.

John C. Bates, Cold Spring, N. Y.—This invention has for its object to furnish an improved device for ventilating rooms, cars, etc., through the sashes of the window. In the bottom of a window sash is formed a longitudinal slot, which is covered upon the inner side by a plate. The upper part of the sash bar is cut away adjacent to the plate so as to form an upward opening into the room, which opening may be surrounded by a box attached to the plate. A metallic plate is hinged at its upper edge to the sash bar or to a light metallic frame attached to said sash bar and surrounding the opening through it. The ends of the hinged plate are flanged or bent inward, and the said plate is made of such a size as to shut and fit closely into the opening through said sash bar. To the middle part of the inner side of the hinged plate is pivoted a long nut into which screws a screw, swiveled to the plate and having a knob formed upon its end for convenience in operating it. A fine wire gauze placed in the opening of the ventilator prevents the dust from entering the room, while allowing the air to pass in freely.

Improved Current Wheel.

Christoph Weeke, St. Charles, Mo.—This invention consists of a pair of boats arranged at some distance apart, connected by frame work and supporting a couple of revolving drums between them, whereon endless chains with a series of buckets work, one of the drums being provided with tackle for swinging it up and down, and having deflectors connected with it to vary the influence of the water on the buckets according to the power required. The other drum, which is in stationary bearings, gears with a vertical drum which is to transmit the power by a belt, and is as long as the extreme distance between high and low water, to allow the boats to rise and fall and yet work the driving belt properly.

Improved Hub Boring Machine.

James Duncan and William H. Arnold, Buchanan, Mich.—The wheel for centering and holding the wagon wheel, the hub of which is to be bored, is mounted so as to revolve in a vertical plane, and has a large central hole for the hub, also radial arms to which the rim is to be clipped by holders, so as to hold the hub in the hole. The small end of the hub projects through the wheel to the right and extends between sliding centering jaws, which are drawn up against its sides by a right and left screw, so as to line the hub with the boring mandrel before it is fastened to the arms by the clips. Two opposite sides of the wheel are first adjusted and fastened, then the wheel is turned a quarter of a revolution, and the intermediate two points are adjusted and fastened. The jaws are mounted on frame and may be adjusted to hubs of different lengths. The boring mandrel is mounted on a carriage, which slides toward and from the wheel on ways, being moved by a hand crank shaft. It is revolved by a belt worked by a long drum on the driving shaft, which allows the belt to run along with the mandrel as it moves forward and backward. The cutters are alternately reversed, as shown, to cut on opposite sides of the mandrel, to divide and balance the pressure.

Improved Cooking Stove.

William W. Karshner, Aubrey, Kansas.—This invention is an improved cooking stove, which is so constructed that all the heat may be thrown to the top of the stove and directed to one or more of the boiler holes, as desired, to enable cooking to be done without heating the lower part of the stove; or all the heat may be made to pass around the oven, to enable the baking to be done without heating the upper part of the stove; or the heat may be made to circulate through both the upper and lower parts of the stove before escaping into the chimney; or may be made to pass directly into the chimney without heating either the upper or lower part, thus enabling the fuel to be used with great economy, and the room to be kept comparatively cool when desired, it being necessary to use no more fuel than the special purpose may require.

Improved Compound for Destroying Insects, etc.

John B. Lunbeck, Leon, Iowa.—The object of this invention is to furnish a compound for the destruction of the "borer," and other worms, grubs and insects, which prey upon fruit and other trees; and it consists in a liquid or semi-liquid compound, composed of pine tar, soft soap, tobacco juice, and strong alkali. These ingredients are boiled together, and unslaked lime and strong dry ashes added. When all are stirred together, oil of tansy is put in. The compound is applied to the body of the tree, both above and below the surface of the ground, after excavating the earth and scraping the loose bark from the tree. A single coat of the compound applied with a common paint brush is sufficient to protect the tree for one year.

Improved Fly Trap.

Andrew J. Davis, Hartford, Mich.—The object of this invention is to furnish an effective and simple fly trap, by which the flies are caught rapidly and killed easily therein. The invention consists in the arrangement of an upper cage with cones for the entering of the flies, which cage is connected to a lower chamber with one cone leading into the upper cage, forming a double-acting trap. When the cage is filled with flies, the upper part is dipped into hot water, and the flies are then emptied out on taking off a cover. By detaching the cage from the lower chamber, the bait may easily be put into the lower chamber and through the top into the upper cones.

Improved Feed Water Heater and Purifier.

Samuel J. Sadler and Henry Volmar, Cleveland, Ohio.—This invention consists in separating the reservoir by a diagonal plate into two parts, of which one retains the water until the sediment is precipitated and then allows it to flow over the other from the surface.

Improved Flooring Clamp.

Sylvanus B. Wood, William S. Terry, Robert Y. H. Terry, and Alonzo W. Terry, Hamburgh, Ark.—This invention has for its object to furnish an improved clamp for forcing and holding jointed or matched work. In a lever about four or five feet long and of such a size as to give it the requisite strength is formed a slot to receive the tongue or tenon of a block, secured in place by a pin. The block is placed transversely upon the lever, and upon its forward side is formed a tongue to fit upon the edge of the boards. An iron bar bent twice nearly at right angles has a screw thread cut upon each end, and one extremity is passed through a hole in the lower end of the lever at right angles with the plane of the slot in the said lever, where it is secured in place. Upon the other end of the bar is screwed a nut having a flange formed upon each of its four sides, the first flange being flush with the inner surface of the said nut, and each successive flange being set back about half an inch farther than the next preceding one. Upon the rear side of the bar, at or near its lower end, is formed an arm projecting outward and upward. The outer end of the arm is made pointed, and to it is attached a brace the other end of which is connected with the bar. To the bar at the side of the lever is attached a flange which has a curved slot formed in its upper part to receive a pin attached to the lever, to limit the movement of the bar and prevent it from falling over back when being adjusted to the work. In using the clamp, the flanged nut is adjusted upon the end of the bar, according to the thickness of the joist, so that a flange of the said nut may rest against the outer side of said joist, and the point of the arm against its other side. The face of the block is then adjusted upon the edge of the board, and the lever is operated, forcing the board to its place, and holding it there until nailed.

Improved Street Lamp.

James S. Hagerty, Baltimore, Md.—This invention relates to means for securing the glass cover to lamps, and particularly street lamps, so that it may be comparatively inexpensive, securely held, and easily detached. It consists in a novel mode of locking the lamp seat to its holder; in peculiar means for preventing the seat from lurching forward; and finally, in a new device by which the cap may be slid up and down in the socket and held off or on the glass with equal facility.

Improved Water Regulator and Cut-Off.

Charles E. Seal, Winchester, Va., and Edwin F. Brooks, Baltimore, Md.—This invention consists in improving water cut-offs, by combining with the main valve, that operates the waste valve, a hand mechanism by which both may be simultaneously operated from any part of a building.

Improved Hay and Cotton Press.

David A. Nelson, Tyler, Texas.—This invention relates to presses for reducing the bulk of cotton and allowing it to be baled into convenient form for transportation. It consists in a novel mode of attaching the sides of the press box so that they can be speedily thrown down from the cotton after compression and allow its convenient manipulation. Also in a new mode of connecting the follower with its superposed lever so that it can readily turned up out of the way when the cotton is being filled into the press box. Also in a peculiar mode of combining levers to cause two followers to clamp and press the cotton between them as if in a vise.

Improved Fence.

George W. and James B. Durant, Bryan, Texas.—This invention consists in a peculiarly constructed metallic post support; in anchors thrown out on each side of the post support to steady the same and cause it to preserve its exact position; in a post formed of pieces that can be cheaply and quickly made from inexpensive timber; in a paling fence of a novel and economical construction; and in a peculiar method of preparing the lumber so that it can be conveniently packed for transportation, easily put together to form a fence, and withal so that great saving in the cost of a fence is attained.

Improved Lathe Chuck.

William Johnson, of Lambertville, N. J.—The shell is cast in a single piece, and to it are attached three worm wheels, which are made to revolve on their respective arbors at equal distance from the center of the chuck of the lathe and from each other. These wheels are confined to the shell by plates which revolve with them; and on each is an arm which projects out over the chuck, to which the holding jaws are attached. The jaws are grooved to fit the arm; but when they are turned round on the arm to a certain position, they can be removed from the holding pin at will. When the worm wheels are turned, the jaws, when thus attached to the arms, will be carried toward or from the axis of the lathe, as may be desired. These wheels are revolved by means of a worm screw which is made to engage with the worm wheels—two wheels upon one side of the screw and one upon the other. This screw is turned by means of a wrench.

Improved Cotton Seed Planter.

John L. Slocumb, Raymond, Miss.—The size of the discharge opening in the seed hopper is regulated to regulate the quantity of seed dropped by slides which work in guides attached to the bottom of the hopper, and are secured in place, when adjusted, by set screws. The conductor spout is made long and narrow, and is secured beneath the discharge opening. Sweeps overlap the upper part of the opener plow and are designed to push back the clods and top soil, leaving the furrow of a uniform depth. They can be adjusted higher or lower, to enable the seeds to be planted deeper or shallower in the ground, as may be desired. The face of the drive wheel has a deep and wide V shaped groove formed in it, so that it may press the side of the furrow inward to cover the seed without packing it upon said seed. With the wheel is connected gearing which moves the shaft within the hopper, to which are attached radial arms, which, as the said shaft is revolved, keep the cotton seeds stirred up so they cannot clog, and will pass readily to the discharge opening. Two flat arms, set at an angle with the axis of the said shaft, are inclined in such directions as to push the seed from the sides toward the center of the hopper, so that they may more readily pass out through the discharge opening. With the drive wheel is connected other gearing communicating with another shaft that passes through the conductor spout. To the shaft are attached two circles of radial arms, at such a distance apart that the arms rigidly attached to the front and rear edges of the spout may pass between them. By this device the seeds, as they pass through the spout, will be separated from their fibers, or said fibers will be torn apart, so that the seeds will be deposited in the furrow uniformly and not in clumps or clusters.

Improved Cotton Press.

James D. Pridgeon Marion Court House, S. C., assignor to J. P. Pridgeon & Co., of same place.—The follower which works upward in a vertical case has two arms jointed at one end to the lower side, one near each end, which, at the other end, have rollers to roll forward and backward on the bed frame. A rope is attached to the follower at one end, and is so led and arranged with suitable mechanism that a drum being turned one way will force the follower up into the press case by moving the arms toward each other, so as to cause them to rise up erect, or nearly so; and said drum being turned the other way will allow said arms to roll back at the lower ends, return to the horizontal line, or nearly, and let the follower down again.

Method of Forming Hollow Cores or Castings.

James Semple, Chicago, Ill.—This invention consists in combining, with a wax or other suitable mold, an elastic, inflatable and collapsible tube provided with connections by which it may be filled with air, emptied thereof, or closed airtight.

Improved Bridge Truss.

Frederick Schwatka, United States Army, now at North Platte, Neb.—The construction of this truss cannot be intelligibly described without the aid of a drawing. It allows, however, the braces and counterbraces to be made shorter, thus increasing their strength and decreasing the weight of the bridge. The centers are upon the longer lines, which gives points of support to these long lines whenever they are subject to compression, thus materially increasing their resisting power to deflecting strains and strains of torsion. The mass of the iron, also, is thrown toward the top beam, thus allowing a liberal use of wrought iron in place of cast iron

Improved Feeding Elevator for Corn Shellers.

Peter Kaufman, Hudson, Ill.—To dispense with a second hand or "feeder" for these machines is the object of this invention; and it consists in an elevating chain, constructed as described. The chain is composed of wire links and plate links connected together. A portion of the plate links are made elevating links, one end of the plate of which this link is formed being turned outward at right angles and divided and spread. Pulleys are attached, one to the machine and the other to the box, the former being revolved by the motion of the machine which carries the elevator. As the belt is revolved, the ears of corn will be picked up, one by one, and carried to the hopper of the machine.

Improved Tyre-Upsetting Machine.

Durbin L. Badley, Afton, Iowa.—The object of this invention is to furnish a tyre shrinker, which accomplishes, by its powerful action, the tightening or shrinking of tyres, with less time and labor than similar devices hitherto in use. The invention consists in the construction and arrangement of a sliding plate operated by an eccentric lever and a stationary plate carrying fixed blocks, and pivoted segmental blocks operated by a suitable mechanism. The turning of a disk to one side presses the segmental blocks against other blocks, so that the tyre can be firmly clamped between the rough uneven surfaces of these blocks. The reversing of the disk releases the tyre. When the tyre is firmly clamped, the forward or backward motion of the lever carries the sliding plate toward or away from the stationary plate, so that the shrinking or loosening of the tyre in a slow and powerful manner is obtained.

Improved Car Coupling.

Phillip Maughan Thompson, Toronto, Canada.—This invention consists in a peculiar construction of the inner chamber of the drawhead, whereby the link is not only guided but maintained in its true and nearly horizontal position; in a device by which the coupling plate may be lifted by the brakesman without leaving the car, or stooping over so as to endanger his safety and run the risk of being precipitated between the cars; in a simple novel and effective means for enabling the cars to remain uncoupled during the making up of a train; in making a car-coupling link in two parts which are pivoted so that one can turn upon the other and so that the two will separate as soon as a car has gone off the track; and finally, in the locking employed for connecting these two parts of coupling link detachably together

Improved Method of Casting Water Traps.

James Semple, Chicago, Ill.—This invention consists in the improvement of stench traps, by locating a reinforcement at and on the inside of the bend. This becomes absolutely necessary in their construction because of the common practice that prevails of thrusting sticks or metallic rods down the pipes to relieve them of any obstacle that has lodged therein.

Improved Wood Grinding Machine for Making Pulp.

Soren B. Zimmer, Elkhart, Ind.—This improved wood grinding machine consists of a large flat horizontal stone disk fixed stationary on the frame, with a bevel face inclining toward the axis above the stone, around which the wood is caused to revolve in boxes operated by arms projecting from a rotating shaft above the stone. The boxes contain springs, which press the wood on to the face of the stone. The arms are jointed to lower the boxes from time to time as the face of the stone wears away. The joints are clamped fast after adjusting them to make the arms rigid to hold the boxes off the stone. Water is discharged upon the face of the stone by tubes from a hollow penstock projecting up through the center, and connected by a pipe below with any suitable supply.

Improved Steering Apparatus.

Charles A. Seavey, Hodgdon's Mills, Me.—A casing is placed upon and attached to the deck, having a top. A bracket is rigidly attached to the top, the end of which supports the point of the wheel shaft. A bevel pinion on the wheel shaft meshes into the bevel wheel of the vertical shaft. The upper end of this shaft is supported by a bracket. Its lower end revolves in a box in the lower part of the casing. There is a spur pinion on the vertical shaft which engages with horizontal rack bars which receive an alternate horizontal motion as the pinion is turned in either direction. These rack bars slide in grooves in the casing and are confined by the top. A yoke is rigidly attached to the top of the rudder post, and in its top are slots or grooves. Swivel blocks on the ends of the rack bars rest in the grooves. The swivel pins allow the yoke to vibrate without binding, while the blocks have a slight movement in the slots. It will be seen that the movement of the steering wheel is instantly imparted to the rudder.

Improved Wagon Jack.

Nelson Crandall, Wooster, Ohio.—This invention relates to the construction of jacks for raising carriages and wagons. The stand consists of two plates separated by a longitudinal strip, a base block, and another block, all of which are about the thickness of the lifting bar and lever, but which allow the lifting bar and lever free play between the plates. The lifting bar is provided with a slot, in which slot is a stationary pin for limiting its vertical motion. The bar is confined between the plates. The lower end of the bar is cut on a circle, so that the end of the lever will always lift without binding it or causing undue friction. The lever is provided with a series of ratchet notches and a pawl. The pawl holds the lever and lifting bar in position when the latter is loaded. When the pawl is removed the long end of the lever will rise, and the lifting bar will drop by its own gravity. Friction rolls prevent friction against the edges of the lifting bar.

Improved Pole for Vehicles.

Henry Schmidt, Albany, N. Y.—The inner ends of the two parts of the bar are screwed into a short rod or double nut. Upon the outer ends of the parts are screwed ornamental knobs. Upon each of the parts of the rod is placed a sleeve, upon the upper side of which is formed a slot to receive a tongue formed upon the upper side of the parts, so that the sleeves may be free to slide longitudinally, but cannot turn. The outward movement of the sleeve is stopped by a knob, and its inward movement is limited by a collar. To the lower side of each of the sleeves is swiveled a bow, the ends of which are secured to the harness saddle by the screws that secure the saddle tree and pad to each other. To the upper side of the sleeves are attached short bars, to the ends of which are attached rings to receive the reins. To the center of the bars is attached an ornamental device which may be so formed as to receive and hold the check rein. In case it is desired to use the bar with a single horse, the part to be used is unscrewed from the double nut, and the knob from the outer end of the other part is screwed upon it, thus forming a neat single bar.

Improved Machine for Making Basket Splints.

John B. Poe, Worthington, Ind., assignor to himself and John F. Allison, of same place.—This invention consists in making basket or chair splints of bark, and also in certain means for making them either of the fiber or the bark. The forward end of the feed table, upon which the slab is placed to be sawn into bolts, is slotted to pass between the cutters so that the said cutters may come close to the feed roller. The journals of the feed roller revolve in curved slots in the plates, and the said roller is held down to its work by springs, so that the roller may accommodate itself to the varying thickness of the slabs. The cutters revolve in water in a trough placed upon the table, from which the water may be withdrawn, through a hole in its bottom, to remove the sawdust. This arrangement keeps the cutters from becoming covered with gum. To the end of the shaft which is geared to the feed roller is attached a crank wheel, which may be made large and heavy to adapt it to serve as a fly wheel. To the crank pin of the wheel is pivoted the end of the connecting rod, to the other end of which is pivoted the clasp that holds the end of the knife or saw. The cutter is made with teeth when hard wood is to be operated upon, and with a sharp edge when bark or soft wood is to be worked. Against the forward edge of the end parts of the cutter rest plates, upon one end of which are formed beveled toes to rest under the beveled edge of the edged cutter to prevent the cutter from springing down. When the toothed cutter is to be used, the plates are turned end for end. The cutter is held down to its place by bearing plates which can be adjusted as required. A plate is attached to the feed table to adjust the thickness of the splits cut from the bolts by the cutter.

Improved Fireplace.

William Lossie, Owensborough, Ky.—This invention consists in adjusting the hinged upper portion of the back of the grate by means of a screw rod and swiveled nut, and in the construction of the grate proper with a revolving bottom section in connection with two fixed side sections.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

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Cabinet Makers' Machinery. T. R. Bailey & Vail.

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Chemicals of all kinds for all trades made to order at our own Laboratory by addressing L. & J. W. Feuchtwanger, Chemists, 55 Cedar street, N. Y.

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Portable Hoisting and Pumping Engines—Ames Portable Engines—Saw Mills, Edgers, Burr Mills, Climax Turbine, Vertical and Horizontal Engines and Boilers; all with valuable improvements. Hampson, Whitehill & Co., Newburgh Steam Engine Works, Depot 26 Cortlandt Street, New York.

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Williamson's Road Steamer and Steam Plow, with rubber Tires. Address D. D. Williamson, 32 Broadway, New York, or Box 1809.

For Solid Emery Wheels and Machinery, nd to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

For best Presses, Dies and Fruit Can Tools liss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

Stave & Shingle Machinery. T. R. Bailey & Vail.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Gear, Boston, Mass., sells Machines and Supplies of all kinds.

Bookkeepers should try the Olmsted Patent Bill File and Letter Clip. They are admirable for all papers Save their cost in one day's business. Sold by all Stationers. J. H. White, Newark, N. J. Sole Manufacturer.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Bolt Makers, send for descriptive cuts of Abbe's Bolt Machine, to S. C. Forsaith & Co., Manchester, N. H.

Root's Wrought Iron Sectional Safety Boiler, 1,000 in use. Address Root Steam Engine Co. 3d Avenue and 28th Street, New York.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable W. D. Andrews & Bro. 414 Water st. N. Y.

The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.

Lightning Mill For Sale—A Walker Bros. Percussion Mill for pulverizing hard substances. Thos Waring & Bro., Colora, Cecil Co., Md.

Steam Fire Engines, R. J. Gould, Newark, N. J.

Peck's Patent Drop Press. For circulars, address Milo. Peck & Co., New Haven, Conn.

Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail, Lockport, N. Y.

Notes & Queries

E. M. McD. & Bro. ask: What will dry and harden black paint for use on a carriage?

G. G. asks: Can a pine tree be grafted, and if so, with what kinds of trees? Which is the most suitable time to transplant a locust tree, and to cut it down, for the preservation of the wood?

H. D. A. asks: What can I use to stain the unpolished part of tools? Japan will not answer.

T. M. Jr. asks: How can I preserve grapes in the bunch, fresh as when taken from the vine?

P. T. says: I hear that water used in steam boilers will not go as far in hot dry weather as in cold damp weather; in other words, that a boiler will use a great deal more water to make a given amount of steam in dry weather than in wet weather. Is it so? [This is a subject rather new to us, and we would be glad to hear from others of our readers on the matter.—EDS.]

F. G. asks: What effect has Portland cement upon coal tar and pitch? Would a dry mixture of 6 parts coarse sand and one part of Portland cement, stirred into boiling tar or pitch, make a better concrete than the sand and cement alone, when elasticity was an object? Is sand, highly impregnated with iron (so much so as to be discolored and lumpy) a good ingredient for cement concrete? Would it make the concrete harder and more enduring?

P. H. asks: What is the best thing to clean brass on fine toilet boxes?

S. S. asks: How can I mend a glass vase? It is cracked for the distance of 3 to 4 inches and lets in the dust.

Answers to Correspondents

L. K. can find Kepler's laws in any book on astronomy.—W. T. W. should read this journal regularly, and would not then ask a question which we have repeatedly answered in the last few weeks.—R. S. B.'s specimen of leather has the plain color given by the bark, and is not dyed at all.—T. G. A. can waterproof and fireproof wood by using the process described on p. 283, vol. 28.—S. P. P. had better try the method mentioned on p. 406, vol. 25, for preserving eggs.—O. B. and C. G. H. Jr. will find the cement for leather on p. 119, vol. 28.—E. F. B. can clean his zinc bath tub with soap, a scrubbing brush and elbow grease.—C. H. can attach rubber to brass by following the directions for flannel on iron, on p. 107, vol. 28.—E. B. can make printers' rollers by melting together glue and molasses to the proper consistency, and casting in a mold.—S. E. H. can cement wood to glass by using plaster of Paris. A cheap book on mechanical plan drawing is reviewed on p. 376, vol. 28.—J. S. H.'s query belongs properly to mensuration, and he had better read up that subject.—P. B. will find his query as to the effective weight of a safety valve lever answered in an article which will shortly be published.—J. A. H. will find recipes for colored fires on p. 165, vol. 24.

G. W. I. asks: How many cubic feet will a boiler of 1 horse power heat to 60°? Answer: About 140, if your question refers to air.

M. R. asks: Which describes the largest circle, the bow or the stem of a ship or boat when she is going ahead with the helm hard over? In other words, which end goes off endways the most? Answer: This will probably remain an open question until some careful experiments are made. It would seem likely that sailing vessels, side wheel steamers, and ships fitted with screw propellers, all turn on different points, and slight changes of rig or load may vary these points in any particular case.

H. K. says: Upon a shaft are keyed two wheels, namely, a belt pulley and a gear wheel, both of the same diameter. The gear wheel drives a breaker, and receives very heavy jars. Question is: How much lighter dare I make the arms of a pulley than those of the gear wheel? The pulley drives the shaft. 2. What are the proper proportions of arms for pulleys and gears? Haswell gives proportions for gear wheels, but does not take the width of face into consideration. Is not that an important omission? Answers: 1. Divide the whole strain received by the pulley among the number of arms, and proportion them accordingly. 2. The arms of a gear wheel ordinarily require to be about twice as strong as those of a pulley which transmits power by a belt, owing to the different ways in which the strain acts in the two cases.

J. H. F. asks: Can some one give me directions how to carburet pure hydrogen gas made by the action of sulphuric acid on zinc scraps? Answer: Pass the hydrogen gas through spirits of turpentine, benzine, or naphtha. The hydrogen in this case does not chemically combine with the carbon in the turpentine, etc., but carries off, mechanically suspended in it, a certain portion of the volatile hydrocarbon.

J. B. asks: What is the best and cheapest process of bronzing some small articles made of iron wire? Answer: Clean the wire perfectly, and then immerse it in a solution of sulphate of copper (blue vitriol) until covered with a coating of metallic copper. Then wash and immerse the articles in the following solution: Verdigris 2 ounces, sal ammoniac 1 ounce, vinegar 1 pint, diluted with water until it tastes only slightly metallic, then boiled for a few minutes and filtered. The articles of wire are steeped in this liquor at the boiling point, until the desired effect is produced; but do not keep them in too long. When taken out, wash carefully in hot water and dry.

J. T. D. asks: 1. What is the cause of the pieces of lumber clattering and inclining to raise up back of the saw when pushing hard against it? 2. What is the proper angle for saw teeth; or in other words, how much hook should a saw tooth have? Our saws vary from 8 inches to 19 inches diameter. 3. How fast should saws of these diameters run on one arbor? Answers: 1. We presume that you mean small circular saws from 8 to 20 inches in diameter, known as bench saws and sawing by a gage. The back half of the saw, having an upward motion, has a tendency to lift and raise the piece being sawn, especially when it springs and pinches on the saw or crowds between the saw and gage; while the cut at the front of the saw has the opposite tendency of holding that part of the piece down; this would cause the piece to tremble. 2. The hook or pitch of the tooth should be on a line to from one fourth to one fifth the diameter of the saw; a one fourth pitch is mostly used for hard and one fifth for softer timber. For very fine toothed saws designed for heavy work such as sawing shingles, etc., even from soft wood, one quarter pitch is best. 3. 9,000 feet per minute is the usual rule for the rim of a circular saw to travel; this speeds a 12 inch saw 3,000, a 24 inch 1,500, a 36 inch 1,000, a 60 inch 600, etc. Taper ground saws nicely balanced with collars attached to them, like shingle saws, may be run at higher speed with safety, say 12,000 feet per minute.—J. E. E., of Pa.

W. H. P. asks: How can I polish mineral specimens? Answer: The easiest way for you is to first grind the stones on the grindstone to the shape required, and then to smooth with emery, finishing by polishing with rottenstone.

F. L. R. asks: What will cement meerschaum? Answer: Make fine freshly calcined plaster of Paris into a cream with water, by sifting or dusting the plaster into the water, and apply as a cement to the broken parts. It sets in a few minutes, but takes a few days to become dry. It is fireproof.

J. I. asks: Is there a way to dissolve or disintegrate burnt clay, which, in hardness and cohesion, is about the same as a soft burnt brick? Hydrofluoric acid is too expensive; caustic potash or soda is too slow; heating and quenching in water is not effectual; sulphuric or other acid softens but does not dissolve or cause crumbling. Answer: If your clay were not burnt so hard, sulphuric acid would effectually dissolve it, as these are the materials used in the manufacture of what is known as aluminous cake. As chemical means have failed, however, we would suggest mechanical ones, in the shape of the pickaxe and hammer.

D. J. G. asks: How bones are treated before being ground into flour for fertilizing purposes? Answer: Expose the bones to the air and heat of the sun until hard and dry; then crush and grind.

W. C. D. asks: 1. Can you give me a receipt for making a hard white enamel? 2. Can you give me directions for putting the above enamel on a brass plate, making a good clear enamel? Answers: 1. Take tin 3 parts, lead 10 parts, mix; calcine in an iron pot at dull red heat, and scrape off the oxide as it forms, keeping it free from metal. Reduce this oxide to fine powder by grinding and elutriation. Take 1 part of this fine oxide, fine crystal glass 2 parts, manganese a few grains; powder, rinse, melt and pour fused mass into water, and repeat this process of powdering and melting, etc., 3 or 4 times. This powder is finally fused on the surface of the polished brass, either by the blowpipe or the heat of a small furnace.

R. C. G. says: I want to construct an engine for a boat 20 feet long by 4 feet beam, and to occupy as little room (with boiler and fuel) as possible. I propose to put in an oscillating engine 6 x 6 to make 200 revolutions per minute, geared to screw shaft, also to use a jet condenser, with a boiler of 20 square feet of heating surface. Please give me your opinion as to the practicability of the plan. Answer: The engine is probably larger than you need, and we think the boiler is too small for the proposed engine.

C. F. C. says: 1. I have a vertical engine of 5¼ inches diameter x 6 inches stroke, and a boat 25 feet long x 6 feet beam. I propose to use the engine to drive the boat with a three blade propeller of 20 inches diameter. Please tell me what are the proper dimensions of a vertical tubular boiler sufficient to drive it. Answer: You do not give sufficient data, but we can probably furnish you with figures by means of which you can answer the question for yourself. Calculate the power your engine is to develope, and allow about one square foot of grate surface, and from 15 to 20 square feet of heating surface, for each horse power.

S. asks: Can you give me a formula for a gall ink which will write black when first exposed and retain its fluidity after being exposed to the air? 2. What work on fermentation and its preventives should you recommend? 3. What practical work on chemistry as applied to the arts and sciences is the best? Answers: 1. You can make an ink which will write black at once by using white copperas instead of the ordinary kind, and by leaving the infusion of galls to itself some time before mixing. Here is a recipe: Galls, 125 parts, white copperas, 24 parts, gum arabic, 24 parts, water, 827 parts, in all 1,000. 2. Dussance on "Vinegar." 3. Bloxam's is very highly spoken of.

M. T. asks several questions as to water supply for a town. Answer: These are professional questions, the solution of which you should entrust to some reliable and competent engineer. A small outlay incurred for a thorough report will more than repay you.

E. E. P. asks: What will remove grease and dirt from parchment, and not disfigure the written or printed matter? Answer: We think you can restore the parchment to its former appearance by the use of concentrated benzine.

C. H. asks: 1. How much power can I realize from a steam pipe ¾ of an inch in diameter with a pressure of 10 pounds only? 2. How should such an engine be constructed? Answers: 1. Consult our article on the "Efflux of Steam," page 113, current volume. 2. You will find rules on this subject, in answer to former inquiries.

F. A. asks: 1. What amount of fall would a stream of water conducted by a one inch pipe require to produce one horse power by a suitable wheel? 2. Would a 2 inch pipe with one half the fall give the same power? 3. How can I harden copper and bronze? Answers: 1. A horse power would be produced by the fall of one pound of water for a distance of 33,000 feet in a minute, or by producing an effect of 33,000 foot pounds. 2. You can calculate the discharge of water from pipes of different diameters, by means of the formulas given in the article on "Friction of Water in Pipes" (page 48, present volume of the SCIENTIFIC AMERICAN), and thus ascertain the amount of fall required. 3. Copper and bronze can be hardened by heating them and allowing them to cool slowly.

G. P. A. says: 1. In raising and setting a pair of steamboat shafts, open on the bottom center and on the after half center, I contend that the shafts out boards must go back and be lowered to bring them right. Am I right? 2. What is the rule for raising shafts, how much to a foot, and what must be taken off for the length of the cranks? Answers: 1. The outboard ends of the shafts should be lowered, and should go back, if the cylinder is forward of the shaft. 2. To find how much the outboard end of the shaft must be lowered, measure the throw of the crank, the length of the shaft from face of crank to center of outboard bearing, and the amount the cranks have opened at the bottom center (or the difference of distances between cranks measured at center of shafts and center of crank pins), all in inches. Multiply the length of the shaft by half the opening of the cranks, and divide by the throw of the crank. The result will be the amount that the outboard shaft must be lowered.

A. R. S. asks: Is there any method, either with or without instruments, by which in a few moments I can measure land, in plots of from 50 to 640 acres, with tolerable accuracy? Answer: No.

A. B. says: What kind of a cable would be best, a chain, a wire rope, a common rope, or a tarred rope, to be used on a hoisting machine, exposed to the weather and in use every day, where the cable is required to raise a weight of 1,300 or 1,500 lbs. a distance of 20 feet and return every two minutes, running over two pulleys and winding up on a drum? What size should the rope be? Answer: If the drum is of good size, wire rope, five eighths of an inch in diameter, will probably give better satisfaction than a chain or hemp rope.

B. S. E. asks: 1. What should be the dimensions of the boiler of an engine 1½ inches bore x 2 inches stroke? Of what metal can it be most conveniently constructed? 2. What are the formulæ for the fly wheel and the safety valve? Answers: You will find answers to both these questions by consulting recent back numbers of our paper.

F. N. asks: 1. Why does the water in a boiler rise when the throttle is opened, and why does it rise more in one locomotive than in another? 2. When a locomotive is running at 16 miles an hour and is at once reversed, where is the pressure on the valves (top or bottom side) to cause the reverse lever to want to fly back to where it was before she was reversed? 3. Will an engine working pretty hard use as much water with 150 lbs. of steam as with 100 lbs.? Answers: 1. Because the pressure is relieved. If there is such difference as you state between the two boilers, it is probably on account of the different steam space in each. 2. If such action does occur, it may be due to the motion of the engine, which cannot be stopped at once; in which case the pressure will be under the valve. 3. Generally not.

O. G. says: 1. The supply pipe to a boiler and the waste water pipe from a heater are two inches in diameter, and were put in new two years ago; they are now nearly closed up with lime. Is it possible that I can take the lime out of them, or not? 2. Are all steamers in the United States subject to the Government inspection or not? I own a tow boat and do not go into any port of entry with her, either in this State or out of it. Answers: 1. Possibly you may be able to remove the incrustation by the use of some of the scale preventives in the market. 2. We think not.

J. H. asks: 1. Please give an illustration and description of an injector as used to supply boilers with water. 2. Suppose an engineer on board a steam boat is caught with low water, hot fire, feed pump out of order, steam rising, and it is desired of him to keep running, how can he get out of the difficulty without hauling the fire? Can he keep the machinery running? Answers: Write to the manufacturers and you can obtain a full description. 2. Engineers do sometimes try to keep the machinery in motion, under such cases, and almost invariably burn the iron of the boiler.

T. C. W. asks: Can a locomotive push a passenger train as well as it could pull it? Answer: Yes. But the engineer is unable to see the track or control the train very well when going backwards, and it is considered unsafe.

C. K. asks: Can you give directions for making what is known as the water blast, that is, a draft of air driven by a direct action of water? Answer: You will find a diagram and description of this device in Science Record for 1873, p. 235.

C. M. N. asks: How can sal ammoniac and nitrate of silver be precipitated? Answer: We know of no method of precipitating these soluble salts.

J. G. T. says: I have a pulley 8 inches diameter with groove cut for ¾ inch round belt; required the diameter of small pulley to make 4½ revolutions to one of the 8 inch pulley. Answer: Take for the radius of the pulley, the distance from center of pulley to center of belt when placed in groove, and make the calculations as before. Strictly speaking, even in the case of a flat belt, the working radius should be the same namely, distance from center of pulley to center of belt, so that diameter equals diameter of pulley plus thickness of belt. In practice, the thickness of belt, unless very great in comparison with the diameter of the pulley, may be neglected without much error.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Ships on Fire. By M. S.
On the Devil Fish. By G. A. P.
On Squaring the Circle. By ——.
On the Lourdes Miracles. By ——.
On the Million Dollar Telescope. By D. W. M. & Co.
On Blasting in a Coal Mine. By C. M.
On the Patent Right Question. By A. B. F.
On an Ocean Railway. By C. A. B.
On Church Clocks and Chimes. By W. M.
On Toads in Rocks. By W. A. A.
On Jumping from Railway Trains. By J. B. T.
On the Zodiacal Light. By A. D.
On Aeronautics. By M. B.

Also enquiries from the following:

J. B. A.—J. C. L.—W. C. B.—A. J. B.—J. M.—R. W.—T. C. S.—J. M. H.—D. M. G.—R. B. M.—R. L. & S. Co—O. S.—W. S.—E. M. D.—W. T.—A. B. W.—R.—H. G

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Correspondents in different parts of the country ask Where can machinery for boring wells be obtained? Who makes ore crushers? What is the cost of a brick compressing machine? Who makes egg beaters, and what is the wholesale price? Who makes drive wells? Who makes jig saws? Where can I get a cabinet maker's work bench? Who makes the best pick with a changeable point for miner's use? Where can I get a machine for cutting splints for lighting cigars, etc.? Where can I find a hand power drill that will do the work of 8 or 10 men? Which is the best brickmaking machine? Who has for sale a peat compressing patent? Where can I obtain a machine for splitting match wood? Where can diamonds suitable for dressing millstones be obtained? Who makes stave cutting machines? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

August 26, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Arithmetical frame, E. T. Curtis 142,151
Auger, earth, S. Emery 142,218
Awning frame, H. Stephens 142,291
Bale tie, cotton, A. J. Gohkg, (r) 5,553
Ball and socket joint, M. W. St. John 142,293
Ballot box, registering, J. S. Savage 142,134
Basket, fruit and berry, Swan & Finch 142,290
Bathing apparatus, steam, W. Wolff 142,185
Bedstead, sofa, E. Lovell 142,249
Bee hive, Rogers & Mason 142,281
Bee hive, A. T. Wright 142,318
Bell attachment, alarm, A. Sherwood 142,287
Belting, W. D. Powers 142,272
Billiard table, A. & F. Braun 142,202
Blocks in triple chains, fastening, P. Hendrick 142,110
Bobbin winding machine, W. Atkinson 142,198
Boiler, steam, T. W. Pratt 142,273
Boiler, steam, C. Stewart 142,180
Boiler for warming buildings, steam, G. W. Blake 142,196
Bolt, flour, Choat & Rich 142,083
Bolt and rivet machine, N. Beauregard 142,193
Boot and shoe heel, M. Bray 142,208
Boot, half, L. U. Williams 142,312
Boot lining, H. White 142,307
Boots and shoes, rubber sole for, D. E. Hayward .. 142,161
Boring machine, J. Strickler 142,296
Bottles, apparatus for corking, A. C. Jordan ..... 142,...40
Boxes, machine for making, G. W. Swan 142,297
Bracket, adjustable, J. B. Morrison 142,263
Brick, J. Deanen 142,087
Brick machine, McLean & Bennor 142,114
Brush handle, J. Ames, Jr 142,137
Buckle, J. M. Borchardt 142,076
Butter cutter and lifter, gaged, T. E. Colbrunn 142,207
Can opener and knife or fork, T. Kenderdine 142,109
Candlestick, S. D. Hill 142,162
Canvas stretcher, H. W. Holly 142,222
Car axle box, J. Hogan 142,104
Car axle box, S. Ustick 142,302
Car axle box, S. Ustick 142,303
Car coupling, L. D. Bennet 142,142
Car coupling, J. Crist 142,209
Car coupling, J. M. Enos 142,219
Car coupling, E. N. Gifford 142,226
Car coupling, J. Hiers 142,230
Car replacer, A. Whittemore 142,135
Car roof, J. B. Silchter 142,129
Card, playing, H. Billings 142,075
Carriage window, Hensgen & Kruger 142,229
Cartridge implement, W. M. Fowler 142,157
Case, packing or show, G. G. Bates 142,073
Cellars, etc., emptying, R. Boeklen 142,200
Chair, spring rocking, F. Chichester 142,145
Chandelier center, J. Kintz 142,165
Chandelier, extension, L. Hull 142,107
Check runner, J. Haggerty 142,160
Chimney top, revolving, C. L. Garfield 142,225
Chimneys, flue casing for forge, H. S. Wilcox 142,311
Chuck, E. Horton 142,163
Churn, reciprocating, H. Hatch 142,102
Cigar lighters, plane for cutting, W. H. Drips 142,216
Circuit closer for railway signals, H. W. Spang ... 142,131
Clothes line support, J. E. Roache 142,278
Clutch, friction, J. J. Grant 142,227
Coal, etc., apparatus for washing, M. Evrard 142,221
Cock, H. S. Boss 142,122
Coffee package, H. C. Lockwood 142,248
Column, metallic, S. Brandeis 142,201
Composition, wood and iron coating, E. F. Prentiss 142,117
Cooler, water, T. Smith 142,178
Corset clasp, J. B. Roby 142,279
Cotton seed, hulling, W. R. Fee, (r) 5,550
Croquet wicket driver, E. A. Barker 142,072
Cultivator, C. P. Norton, (r) 5,557
Ditching machine, J. W. Fauver 142,222
Drill extractor, D. Kunkel 142,244
Drill, rock, S. H. Yerden 142,319
Drilling machines, cutter head for, E. Weicks 142,183
Elevator, E. T. Hope, (r) 5,556
Engine governor, steam, A. Matson 142,167
Engine, steam, J. H. Strehli 142,295
Engine valve, steam, W. J. Stevens 142,292
Eye glass, M. Risley 142,277
Fabrics uninflammable, rendering, D. Nicoll 142,267
Fan, automatic, J. D. Bush 142,081
Faucet, beer, O. T. Earle 142,090
Faucet, self-closing, W. H. Bate 142,192
Fence, wire, G. & L. N. Lakins 142,246
Fender and ash lifter combined, W. C. Dobbins ... 142,214
File, paper, P. W. Derham 142,213
Filter, J. B. Ellis 142,217
Fire arm, revolving, W. H. Philips 142,175
Fire escape, P. W. Barnes 142,141
Fire place, W. M. Kepler 142,241
Fishing rod holder, F. Senleur 142,126
Fruit crate, D. Crane 142,148
Fruit dryer, I. B. Cottrell 142,147
Furnace, etc, rotary puddling, S. Danks 142,152
Furrowing machine, W. H. Rutledge 142,283
Gage, pressure, G. Sewell 142,128
Gas regulator, C. H. Edwards 142,155
Gas retorts, closing, G. A. McIlhenney 142,253
Gas, illuminating, A. P. Southwick 142,289
Glass, ornamenting, C. Schüssler 142,125
Grain binder, J. Waddington 142,304
Grain dryer, R. J. Williams 142,184
Grain steaming apparatus, J. C. Hunt 142,237
Grate bar, G. H. Clark 142,146
Griddle, S. Kennedy 142,164
Harness attachment, Croughwell *et al* 142,085
Harvester, P. F. Hodges 142,231
Harvester rake, J. K. Augsperger 142,139
Harvester rake, T. Murphy 142,171
Hay loader, Howland & Moore 142,234
Head band, D. McKinnon 142,169
Hinge, A. Wirth 142,315
Hinge, table, E. C. Brinser 142,077
Hinge, table, W. F. Daly 142,210
Hoe, J. H. Gould 142,159
Hoe, weeding, H. S. Crossland 142,149
Horse power, E. G. McMillan 142,115
Horse shoe, C. Goodenough 142,097
Horse shoe, Rowe & Brown 142,282
Hydrants, etc., packing for, J. W. Murphy 142,264
Indicator and alarm, low water, F. Strange 142,181
Journal, lubricating, G. A. Chapman 142,206
Journals, etc., packing for, C. Stevens (r) 5,551
Knitting machine, W. A. Tangeman (r) 5,552
Lamp, R. Hitchcock 142,103
Lamp bracket, L. Hull 142,106
Lamp chandelier, J. Aulback 142,189
Lamp wick trimmer, Naylor & Fairchild 142,265
Lantern, W. Westlake 142,184
Lantern, signal, R. B. Fernald 142,223
Lantern, signal, S. H. Miller 142,257
Lathe chucks, jaw for, M. C. Johnson 142,239
Lathe for turning spools, A. T. Wing 142,314
Lead, manufacturing white, E. A. Boehne 142,199
Locomotive head light, J. Briggs *et al* 142,204
Log canting machine, A. Rodgers 142,280
Martingale, F. G. Moody 142,261
Mill, fanning, L. M. Boardman 142,197
Mill pick, M. N. Young 142,321
Mill, rolling, A. Wood, Jr 142,316
Mill for ores, stamp, G. S. Olin 142,172
Millstone dressing machine, F. S. Davenport 142,153
Mitten, knit, O. F. Tripp 142,294
Moccasin, A. Margesson 142,255
Motor, hydraulic, W. Walter 142,183
Mowing machine, W. A. Kirby 142,111
Nut lock, H. W. Dopp 142,215
Ore, flux for smelting, S. D. Young 142,186
Ore, rotating sluice for washing, W. H. Patton 142,271
Pan, bake, W. B. Chamberlain 142,144
Pen and pencil case, J. H. Knapp 142,243
Pianoforte, W. W. Bennett 142,194
Picture hanger, F. W. Ely 142,156
Pipe tongs, J. R. Brown 142,143
Pipes, cock for two, J. & T. D. Richardson 142,120
Pipes, mold for earthen, P. McIntyre 142,168
Plow, J. F. Benton 142,074
Plow, E. Wiard 142,136
Plow colter, E. Wiard 142,310
Plow, gang, R. Coreth 142,084
Plow, rotary, C. T. Elliston 142,094
Plow scraper, H. Leach 142,113
Pot, coffee, Blaisdell & Estabrook 142,195
Press, R. Esmond 142,220
Presses, operating, Earle & Rider 142,093
Propeller, screw, N. A. Patterson 142,269
Pruning knife, A. C. Hulse 142,236
Pulley block, G. A. Ford 142,095
Pump, E. G. Russell 142,123
Pump bracket, Selden & Hanchett 142,286
Pump, direct-acting steam, O. T. Earle 142,091
Pumps, attachment for steam, O. T. Earle 142,092
Punching machine, W. Woicesk 142,317
Purifier, middlings, J. H. Dedrick 142,036
Railway rail, R. Steel 142,179
Railway rail, Wales & Cushman 142,182
Railway rail chair, W. Huffman 142,235
Railway water crane, Cubberley & Mann 142,150
Refrigerator, A. Bardell 142,191
Regulator, cotton opener feed, D. Harding 142,101
Rice cleaner, D. L. Geer 142,158
Roofing cement, fireproof, J. B. Silchter 142,130
Safe doors, bolt work for, H. B. Tripp 142,300
Safes, automatic fire escape for, I. Parks 142,174
Sash holder, J. Ware 142,305
Sauce for food, Agresta & Meucci 142,071
Saw tooth, W. P. Miller 142,258
Saw teeth, device for dressing, W. Rowe 142,176
Saws, machine for gumming, S. P. Olney 142,173
Saws, forming backs of, C. Majer 142,250
Sawing machine, J. Eachus 142,154
Sawing machine, J. M. Stowell 142,294
Sawing wood, machine for, I. G. Ringstad 142,121
Screw, wood, Ladd & Corning 142,112
Seed dropper, F. W. Young 142,320
Separator, seed, F. C. Miller 142,170
Sewer cleaner, J. H. Jenings 142,238
Sewing machine trimmer, W. A. Springer 142,290
Shaft coupling, W. J. Silver 142,288
Shafting, hanger for, J. Greenwood 142,100
Shingle machine, A. Anderson 142,138
Shirt front, T. M. Denham 142,212
Signal apparatus, pneumatic, W. Foster, Jr 142,224
Silk, reel for skeining, R. Simon 142,177
Spark arrester, J. White 142,308
Spark arrester for locomotives, M. B. Mason 142,251
Spike, G. N. Sanders, Jr 142,284
Spinning machine bobbin, P. Laflin 142,245
Stalk cutter, Ansley & Weaver 142,187
Stamp, hand, W. B. Gorham 142,099
Stamp, hand, H. Holt (r) 5,556
Steam whistle, O. Kromer 142,166
Stirrer, apple butter, G. W. Collins 142,208
Stocking supporter, E. K. Rand 142,118
Stool, milking, G. T. Lincoln 142,247
Stone channeling machine, A. S. Gear 142,096
Stone facing machine, cobble, L. Dutertre 142,089
Stove, cooking, R. M. Hermance (r) 5,554
Stove, heating, R. H. Brown 142,078
Stove, heating, R. H. Brown 142,079
Stove, heating, S. B. Patterson 142,270
Stove, laundry, J. H. Mitchell 142,259
Stove pipe coupling, H. A. Mears 142,254
Stove, reservoir cooking, R. H. Brown 142,080
Table, folding, C. H. Wheeler 142,306
Table leaf support, J. K. Moffett 142,260
Teeth plugger, T. L. Buckingham 142,205
Telegraph pole, J. L. Chapman 142,082
Thermoscope, Baker & Mayer 142,190
Thill coupling, G. R. Davis 142,211
Thill coupling, B. R. Rapp 142,274
Trap, steam, J. H. Blessing (r) 5,549
Turpentine filter, F. G. Richardson 142,276
Vehicle wheel, H. A. Gore 142,098
Vehicle wheel skein and box, N. L. Holmes 142,233
Vehicle stay spring, A. A. Horne 142,105
Vehicle rein guide, A. D. Smith 142,127
Velvet, etc., renovating, M. J. & J. T. Dewey 142,088
Ventilator, J. Ballou 142,140
Vessels, raising sunken, J. Rice 142,275
Vessels, removable ceiling for, W. F. Morgan 142,262
Wagon, hand, S. D. Scott 142,285
Washing machine, T. F. Kift 142,242
Washing machine, Marcar & Mehaffey 145,255
Washing machine, W. Parker 142,268
Washing machine, A. M. Wilson 142,313
Water wheel, E. Hackett 142,228
Weather threshold, J. P. Stark 142,132
Wheat, separating cockle from, G. H. Rich 142,119
Windmill, Bodwell & Atwood 142,198
Windmill, W. Jones 142,108
Windmill, W. C. Nelson 142,266
Wind wheel, G. Metcalf 142,256
Wood, bundling kindling, C. B. Whittemore 142,309
Wood, machine for splitting, R. Murray 142,116
Wood, softening and toughening, G. W. Swan 142,298

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,244.—MUSIC REGISTERING MACHINE.—H. F. Bond.

26,262.—JOURNAL BOX.—W. M. Ferry. Nov. 12.

26,327.—NURSING BOTTLE.—F. J. La Forme. Nov. 12.

26,410.—SEED PLANTER.—W. Blessing. Nov. 26.

EXTENSION GRANTED.

25,809.—NAIL MACHINE.—D. Dodge.

DESIGNS PATENTED.

6,825.—SAW FRAME.—T. S. & H. Disston, Philadelphia, Pa.
6,826.—MUFF.—M. Gross & B. B. Zippert, New York city.
6,827.—FUR COLLAR.—M. Gross & B. B. Zippert, N. Y. city.
6,828.—CHAIR.—S. Hayward, Boston, Mass.
6,829.—SKIRT MATERIAL.—J. Anderson, New York city.
6,830.—PAPER CLIP.—T. Orton, Chicago, Ill.
6,831.—STOVE.—W. D. Southard, New York city.

TRADE MARKS REGISTERED.

1,417.—KALEIDOSCOPE.—C. G. Bush & Co., Providence, R. I.
1,418.—SEEDS, ETC.—Chase Bros. & Co., Rochester, N. Y.
1,419.—SPICES, ETC.—E. R. Durkee & Co., New York city.
1,420.—CARPETS, ETC.—J. E. Hughes, Kidderminster, Eng.
1,421.—PEPSIN.—Lilly & Phelan, Evansville, Ind.
1,422.—LINIMENT.—W. H. Rainey, Brunswick, Ga.
1,423.—WINES, ETC.—O. Schloemer, New York city.
1,424.—CASTOR OIL PILLS.—W. Scruton, New York city.
1,425.—CELERY SAUCE.—Heinz & Co., Pittsburgh, Pa.
1,426.—HORSE RADISH.—Heinz & Co., Pittsburgh, Pa.
1,427.—RYE WHISKY.—T. L. Hume, Washington, D. C.
1,428.—ALPACA.—W. B. Lewis, New York city.
1,429.—GAS MACHINE.—F. W. Ofeldt & Co., N. Y. city.

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Practical Hints to Inventors.

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HOW TO OBTAIN *Patents*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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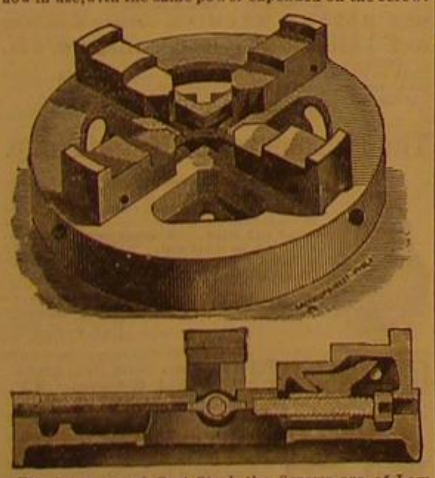
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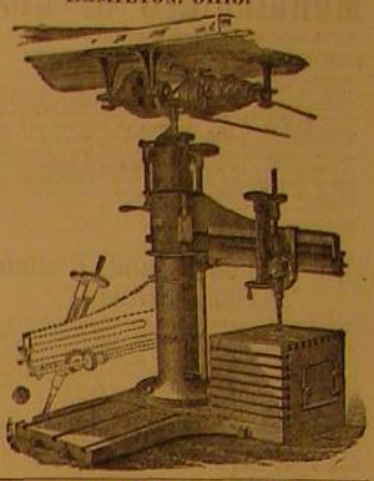
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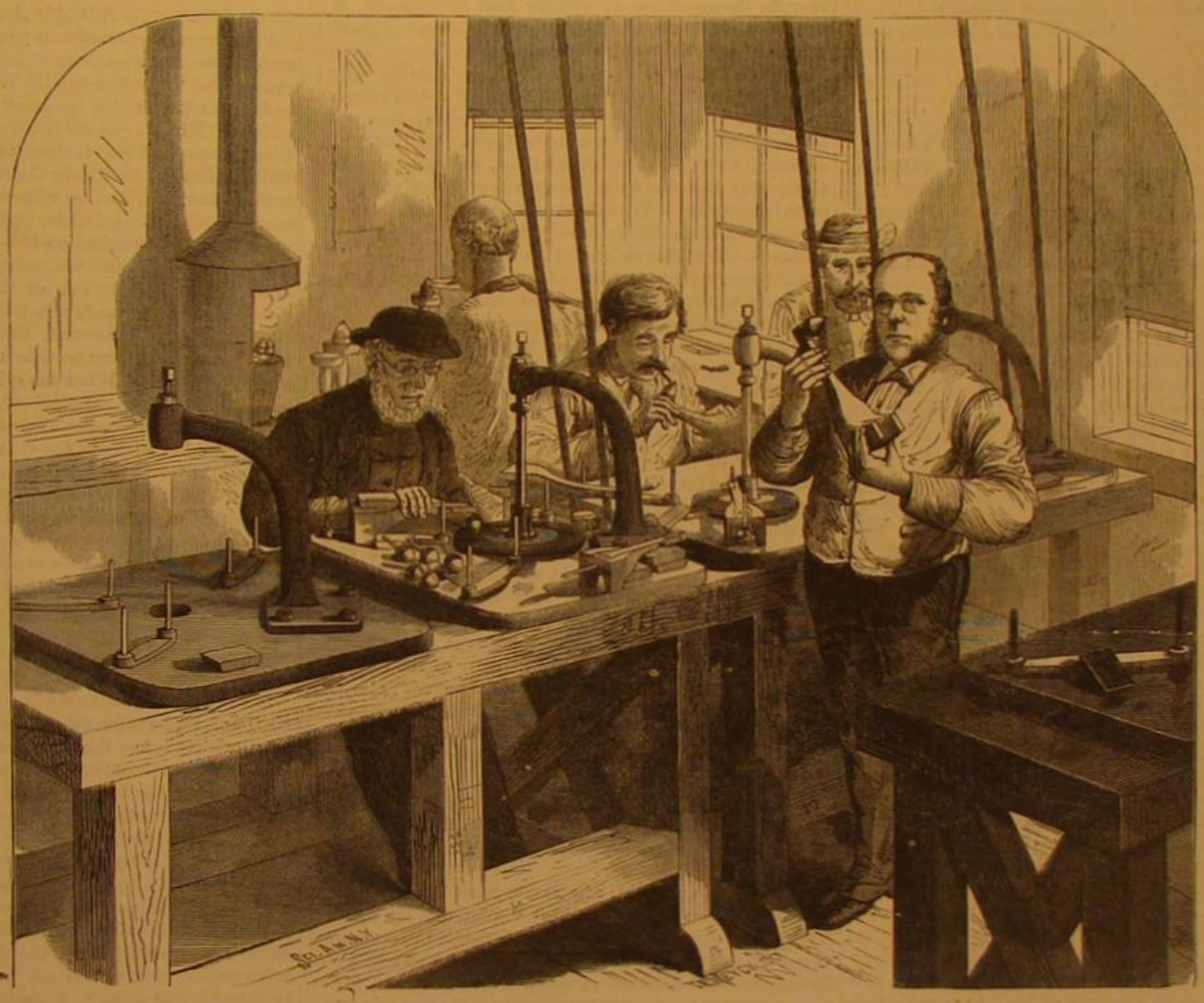
Vol. XXIX.—No. 14. [NEW SERIES.] NEW YORK OCTOBER 4, 1873. [$3 per Annum. IN ADVANCE

DIAMOND CUTTING—A NEW INDUSTRY IN NEW YORK.

Diamond cutting is an art, not merely an industry, requiring that certain degree of deftness of manipulation which, after a few years of apprenticeship, is readily attained in nearly every mechanical operation, but a fine art in the full sense of the term. It is labor which calls not only for an exquisite refinement of manual dexterity, but an unerring judgment, to be gained only by hard study and constant practice, extending perhaps over a lifetime.

HOW DIAMOND CUTTING WAS INTRODUCED IN THE UNITED STATES.

We purpose, in the following paper, to tell the reader how this pursuit, now for the first time in the world's history followed in the western hemisphere, came to be established in the the United States, and then to trace the various processes of diamond cutting as practiced in the city of New York. It is a matter of general information that the art, from time almost immemorial, has been confined to the celebrated lapidaries of Amsterdam, Holland, whither the rough gems were forwarded from all parts of the globe. At the time of the extensive discoveries in the diamond fields of South Africa, however, Mr. I. Hermann, a well known jeweler of this city and an expert in the art, became convinced that diamond cutting could be introduced in this country, both as a valuable accession to the national industries and as a means of attracting large amounts of foreign capital within our borders. To this end he undertook its establishment in the face of many serious obstacles. There was an import duty of ten per cent on the rough stones, the repeal of which had to be secured (a matter of no small difficulty, for the Government seemed unable to perceive the advantage of thus increasing the wealth within the country), large capital had to be obtained to start the enterprise, and, finally, workmen had to be persuaded to leave Holland and try their skill in a foreign land. When these men, in sufficient numbers, could not be induced to migrate, Mr. Hermann sought for other artists among the Dutch already in the United States; and he tells us that he found them pursuing all kinds of callings, in order to gain the support which the art they had studied all their lives was here unable to afford them. Then machinery was imported, only to be abandoned for entirely new inventions, also the work of the projector of the scheme; and thus at last staid old Amsterdam, to the dismay of her artisans, discovered that her long kept secrets were known across the ocean, and her hitherto undisputed supremacy rivaled in the metropolis of the West.



DIAMOND POLISHERS OR SLYPERS.

THE MANUFACTORY.

We have thus briefly touched upon the organization of the New York Diamond Company, as a part of the history of the art in the United States, from which others in future will trace its growth. Success, we are told, has been encountered, as jewelers and owners of gems necessarily prefer sending their diamonds to a locality where they may be repaired or re-cut without undergoing the perils of an ocean voyage. Twenty thousand dollars worth of the stones, we learn, are received regularly each fortnight, while millions of dollars worth are yearly handled. The largest diamonds ever brought within the country, one of which weighed 80 carats, have, through the same agency, been imported.

We recently were enabled to visit this establishment, situated in a small building in Fifteenth street, a few steps from Union Square, in this city, and there to follow the interesting operations which we are about to describe. As, in all descriptions, general explanations are first in order, we were at the outset informed that the business is divided into three entirely distinct branches—cleaving, cutting, and polishing. Also, that each class is a separate art, and that the workman finds the attainment of any one sufficient labor for the balance of his existence without troubling himself about the others. Hence, no one man can carry a stone through all the manipulations. A cutter cannot cleave, nor does a polisher know aught about cutting; and even further, a polisher or cutter of a brilliant cannot produce a rose diamond, and *vice versâ*; so that, in fact, each individual has his specialty, and there stops his knowledge.



SPLITTING THE DIAMOND.



CUTTING THE DIAMOND.

NATURE OF THE DIAMOND.

The diamond itself, as all are aware, is nothing but carbon, a combustible body. It is crystalized mostly in the shape of an octohedron (two four-sided pyramids united at their bases) or rhombic dodecahedron, the latter being the commonest. In its black form—as used for stone drilling or sawing—it is the hardest known substance, and in this state differs from the jewel, which has foliated passages parallel to the faces of figure, in which directions it may be split. In the accompanying engraving (Fig. 4) is represented an enlarged section of the rough gem, showing the grain, along which it may be as cleanly cleft as a piece of wood. The resemblance to the latter substance is increased by the fact that there are so called knots, which cause a conchoidal instead of a straight clean fracture.

THE CLEAVER.

This much imparted by way of preface, we were conducted to the apartment occupied by the cleaver, or *klover*, as he is called in Holland. This artist, we were informed, must possess a greater degree of skill than any other workman. So difficult is his labor that probably there do not exist twenty-five cleavers to every five hundred polishers and cutters in the world. The *klover* in Holland is taught from boyhood, and is usually the son of the owner of the establishment, outside parties being rarely instructed. On a small table in front of the workman was a little box divided into two compartments, the furthest containing a covered tray for the reception of stones. The other division was made deeper and had a false bottom, being finely perforated. Also on the table were a number of sticks like spindles, which, with a couple of knives (to which we shall presently allude), a metal rod for a hammer, a pair of scales, and a spirit lamp, constituted the entire kit.

Opening a number of little envelopes, each marked with a full description of its contents, the cleaver first put into our hands a quantity of rough stones. They seemed of irregular shape and varied in size, from that of a pin head to a large pea. Some pieces were quite flat and closely resembled mica. Selecting a diamond from the heap, the artist glanced at it a moment and then secured it in a knob of cement (brick dust and rosin) on the end of one of his spin-

Continued on page 215.

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Contents:

(Illustrated articles are marked with an asterisk.)

Amazon river, new exploration of the..... 209
American Institute, Fair of the... 209
Answers to correspondents..... 219
Apprentices, a word to..... 216
Axle, standard car*..... 211
Bisulphide engines, combined steam and..... 212
Business and personal..... 219
Calfskin tanning in Europe..... 211
Camphor..... 208
Cannon, new and remarkable..... 216
Cement for making concrete..... 213
Chuck, self-tightening drill*..... 211
Chuck, the Danbury drill*..... 214
Clocks and chimes, church..... 216
Cumberland Gap Cave..... 217
Diamond cutting in New York*.. 207, 215
Electricity, condoling by..... 211
Exposition awards..... 210
Gate and signal, automatic*..... 214
Hartford Steam Boiler Inspection and Insurance Company, the.. 212
Heat, specific..... 208
Inventions patented in England by Americans..... 217
Lightning, fatalities from..... 217
Mars, the planet—Is it inhabited?*210
New books and publications..... 217
Notes and queries..... 219
Patent right question, the..... 212
Patents, official list of..... 220
Patents, recent American and foreign..... 217
Petroleum for fuel and making gas 208
Plow attachment..... 214
Polaris, rescue of the remaining survivors of the..... 209
Secondary spectra..... 217
Smokometer, the..... 216
Straw-burning steam engine, the. 214
Thermal expansion of mercury, the..... 212
Three hundred miles of oil pipes. 216
Toad in the solid rock, a..... 212
Trap to catch lions, a..... 217
Tree protector, a simple*..... 210
Vienna exposition, the—Letter from Professor Thurston..... 215
Water as fuel..... 212

SPECIFIC HEAT.

When a substance is heated, it expands, and its temperature is increased. It is evident therefore, that heat is required both to raise the temperature and to increase the distance between the particles of the substance. The heat used in the latter case is converted into interior work, and is not sensible to the thermometer; but it will be given out, if the temperature of the substance is reduced to the original point. Thus, while heat is apparently lost, it is only stored up, ready to do work, and the substance possesses a certain amount of potential energy, or possibility of doing work. It would be easy to convert this potential energy into dynamic energy, or in other words make it do the work of which it is capable; and if we could measure all the actual and possible energy in the universe, we should find that the sum of the two was always constant, although each might vary in amount at different times. We may say, in passing, that ignorance of or unbelief in this principle has caused many to waste their lives in vain endeavors to construct perpetual motions, or to create force.

Now as different substances vary greatly in their molecular constitution, expanding and contracting the same amount with widely differing degrees of force, it is to be expected that the quantity of heat that will raise one substance to a given temperature may produce a less or greater degree of sensible heat to another; and we find in practice that such is the case. On the material theory of heat, this was explained by saying that one substance could contain more of something called caloric than another, and hence the term "capacity for heat" is still occasionally employed. But, adopting the mechanical theory of heat, we say that different substances require different amounts of heat to raise them to the same temperature, because the amount of interior work differs in each case, and because one body has more particles to be heated, for the same volume, than another. On this theory, we use the term "specific heat" instead of "capacity for heat," and define specific heat to be the number of units of heat required to raise the temperature of a unit of weight (say one pound or one ounce) of a body one degree. By a unit of heat, we mean the amount of heat required to raise a unit of weight of water, at its maximum density (about 39·1 Fahrenheit), one degree in temperature. The unit of weight is ordinarily taken as one pound. Very careful experiments have been made by Régnault on the specific heat of water at different temperatures, and a law has been determined for its variation: Specific heat at temperature $39{\cdot}1^\circ$ (T)=1 (C). Then $C=1+0{\cdot}000000309\times(T-39{\cdot}1)^2$, or the specific heat of water at any temperature, indicated by Fahrenheit's thermometer, is unity increased by 0·000000309 times the square of the difference between the given temperature and 39·1°. EXAMPLE: What is the specific heat of water at a temperature of 80°? Answer: $C=1+0{\cdot}000000309\times(80^\circ-39{\cdot}1^\circ)^2=1{\cdot}00052$.

The specific heat of many solids, liquids, and gases has been determined experimentally, by methods which we propose to explain. The values obtained in this way are average approximations, since the specific heat of a substance varies with the temperature. If a pound of water and a pound of mercury be heated to the same temperature, and allowed to cool, it will be found that the mercury cools about 30 times as fast as the water; hence we say that the specific heat of mercury is about one thirtieth (more accurately, 0·03332). This means of determining specific heat, called the method by cooling, was used by Régnault in many of his investigations on this subject.

Another method of determining the specific heat of a substance is that by fusion of ice, observing the amount of ice that is melted in cooling a given weight of the substance a certain number of degrees.

The method by mixture is readily available, and gives very accurate results if carefully conducted. As some of our readers may like to experiment a little in the subject of specific heat, we will give a few details of this process. It is conducted on the principle that, if definite weights of any substance and water, at given temperatures, are mixed together, the temperature of the mixture will depend upon their respective specific heats. The vessel in which the water is placed should be surrounded with non-conducting materials to prevent the radiation of heat, and should contain a sensitive mercurial thermometer, finely graduated. The substance, if a liquid, can be heated in another vessel; if a solid, in some heated liquid; and if a gas, it can be heated in a closed vessel and plunged into the water, a correction being applied for the heat imparted to the water by the containing vessel.

It is evident that when a heated substance is immersed in the water, all of the heat lost by it is not given up to the water, some being absorbed by the metal of which the vessel containing the water is composed, and some being absorbed by the mercury and glass of the thermometer. The weights of these substances can be reduced to equivalent weights of water, and added as a correction. Thus, let W=weight of water employed, P=corrected weight, A=weight of mercury in thermometer, a=specific heat of mercury, B=weight of glass in thermometer, b=specific heat of glass, C=weight of vessel containing the water, c=its specific heat. Then $P=W+(A\times a)+(B\times b)+(C\times c)$, or the corrected weight of the water is equal to the actual weight increased by the products of the other materials absorbing heat multiplied by their respective specific heats. By using this corrected weight in the calculations, we take account of all the heat absorbed by the materials of which the instrument is composed. We will now show how to calculate the specific heat of a solid or liquid, from data obtained by experiment. Let M=weight of substance, s=its specific heat, t=original temperature of water, m=temperature of the water after the heated substance has been immersed in it, T=temperature to which the substance is heated. Then the number of units of heat lost by the substance, when it is put into the water, must be the weight of the substance multiplied by the number of degrees of heat lost multiplied by the specific heat of the substance, or $M\times(T-m)\times s$, and the number of units of heat gained by the water will be its weight multiplied by the degrees of heat gained, or $P\times(m-t)$; but as what the water gains is just equal to what the substance loses, we must have $M\times(T-m)\times s=P\times(m-t)$, or $s=[P\times(m-t)]\div[M\times(T-m)]$; hence we say that the specific heat of a substance is equal to the product of the corrected weight of the water multiplied by its increase of temperature, divided by the weight of the substance multiplied by its loss of temperature. EXAMPLE: Suppose that we have 2 pounds of water in a copper vessel weighing 0·5 pounds, and that the mercury of the thermometer weighs 0·1 pounds, and the glass, 0·3 pounds; also that a solid or liquid (weighing 0·75 pounds, whose specific heat we wish to determine), when heated to 180° and put into the water, raises the temperature of the latter from 60° to 70°. The specific heats of the copper, mercury, and glass, will be found in any table of specific heats; and applying the rules, we find that $P=(2+0{\cdot}1\times0{\cdot}03332)+(0{\cdot}3\times0{\cdot}19768)+(0{\cdot}5\times{\cdot}09515)=2{\cdot}110211$ pounds, and $S=(2{\cdot}110211\times10^\circ)\div(0{\cdot}75\times110^\circ)=0{\cdot}25578$.

Te find the specific heat of a gas, it must be enclosed in a vessel and heated, so that the heat imparted to the water is received not only from the gas, but also from the containing vessel. If we call E the weight of the vessel, and e its specific heat, we shall have the equation $M\times(T-m)\times s+E\times(T-m)\times e=P\times(m-t)$, whence $s=[P\times(m-t)]\div[M\times(T-m)]-[(E\times e)\div M]$, or the specific heat of a gas is equal to the quotient of the product of the corrected weight of the water and its gain of temperature divided by the product of the weight of the gas and its loss of temperature, diminished by the quotient of the product of the weight of the vessel containing the gas and its specific heat, divided by the weight of the gas. EXAMPLE: If we have 0·25 pounds of a gas enclosed in a copper vessel weighing 0·5 pounds, which (on being heated to 200° and put into the water, the instrument being the same as in the last example) raises the temperature from 60° to 68°, what is its specific heat? By the rule: $S=[(2{\cdot}110211\times8^\circ)\div(0{\cdot}25\times132^\circ)]-[(0{\cdot}5\times0{\cdot}09515)\div0{\cdot}25]=0{\cdot}19968$. There is one other correction, of which we have not spoken. Some of the heat is lost by radiation, though this will be very slight if the apparatus is properly constructed. The amount can be ascertained, however, by experiment: heating the water, and observing how long it takes to lose a given number of degrees of heat. Tables of the specific heat of various elementary and compound substances will be found in most modern text books on physics.

CAMPHOR.

A correspondent, who has suffered from the undue use of camphor, asks for information concerning its usual effects upon the system. It should be known that the physiological action of camphor is not yet understood; but judging by the symptoms that follow the taking of a moderate dose, we are justified in calling it a nervous stimulant. It is somewhat like opium and alcohol, therefore, in its action, when given in small quantities; but when taken in large doses, it causes excessive irritation to the nervous system, producing convulsions and death.

Camphor has another action, more important to be mentioned because many people, depending on this medicine to cure all the trifling pains of life, are constantly taking it; this action is to irritate and congest, and finally to inflame, the mucous lining of the stomach, causing in the milder cases a form of dyspepsia, and in the more aggravated, ulceration of the stomach. From these two actions, namely, that of nervous stimulant and of local irritant, come all the good and evil of its use. As to its constant employment, the same reasoning will apply as to the use of other stimulants. However beneficial opium or alcohol may be in sickness, every one will acknowledge that opium eating or tippling is dangerous to health. Moreover, investigation has established the fact that the constant use of stimulant, of whatever kind it may be, results in degeneration of nervous power. If we remember, also, that camphor produces local injury to the stomach, we readily see how unsuited this drug is to be a household remedy.

Let us add a word for the benefit of those who depend on their "bottles of medicine" for good health. There can be no greater harm done to the constitution than to take medicine unnecessarily. If a person is not sick enough to ask advice of a physician, he is not sick enough to need medicine, and he will recover quite as rapidly by leaving the feeling of *malaise* to the cure of the great physician, the natural renovating power of his system.

CRUDE PETROLEUM FOR FUEL AND FOR ILLUMINATING GAS.

To the Editor of the Scientific American:

I find two recent articles in your paper which I think demand some correction or modification. I refer to the editorial entitled "The Flowing Oil Wells of Pennsylvania," etc., and to an article copied from the *Journal of Gas Lighting* entitled "Mineral Oils for Gas." Through the courtesy of a friend, recently, I was invited to go to the shops of the Philadelphia and Baltimore Central Railroad Company, located at Lamokin, Pa., to witness experiments in burning crude petroleum as a fuel for stationary engines. I found, upon a careful examination into the process, that it was being successfully and economically done. In starting the fire, a pan containing two or three gallons of benzine is placed immediately under the burner and cylinders, and ignited; and when consumed, the cylinders are sufficiently heated to turn on benzine, into the inside cylinder, which rapidly vaporizes. When the cylinders are cherry red, and ten pounds of steam are obtained, the benzine is turned off and the steam and crude oil turned on. It was found necessary to use benzine until the cylinders were properly heated, as crude oil would not all vaporize unless the cylinders were red hot. After that is attained, there appears to be no difficulty in burning crude oil; and on an examination of the cylinders after the experiment was made, there was no evidence of carbon; but on the contrary, they were as clean as when they left the hands of the machinist. [The vaporizing apparatus, we understand, consists of a burner, an iron cylinder in which steam is superheated, and another iron cylinder in which the superheated steam is brought into contact with the crude petroleum.—EDS.]

In a conversation with the Master Mechanic of the road, Mr. Danfield, he informed me that, although he doubted its practicability before the experiment was made, he was now thoroughly convinced of its adaptability for steam purposes; and it being against his previous convictions, he had used all the appliances that the shops afforded to break down its power, but without effect.

However, what I particularly wish to get at is the economic view. You state that, "in markets where coal is worth $6 per tun, petroleum must be supplied at 3½ cents a gallon or $1 per barrel, in order to compete as a fuel with coal." In actual experiments made in the above case, at Lamokin, Pa., seven gallons of crude oil per hour was consumed on an average for four days, at a cost of forty cents per hour. When wood or coal is burned, the cost is from seventy to eighty cents per hour, in the same engine. This would seem to leave a wide margin between your ideas and the actual experiments made.

In the article on "Mineral Oils for Gas," the writer admits that, if the carbon could be got rid of, there would be no doubt that mineral oils would be found a most useful substitute for coal in the production of gas of a high illuminating power. This process to my mind most effectually disposes of the carbon objection. The carbon is not only got rid of, but is actually made fuel to the flame. Mr. Kendrick, the inventor, claims that he can make a pure fixed gas by this process at 60 cents per 1,000 feet, with oil at 8 cents per gallon.

These facts, or rather experiments, seem to be at variance with your editorial and the article in the *Journal of Gas Lighting*. I have for many years been a reader of your valuable paper, and I am constrained to write to you these facts as they came under my observation, for the purpose of getting your opinion upon them. If the process which Mr. Kendrick employs in burning crude oil is not practical, will you oblige me by pointing out its defects?

Locomotive No. 4 on the Baltimore Central Railroad is now being fitted up with one of Mr. Kendrick's oil vaporizers and burners for the purpose of running with oil as a fuel. It will be complete in about ten days from this writing, when further developments will, no doubt, be made. I understand that it is the opinion of the officers of that road that it will prove a success, not only in point of economy but in getting rid of the handling of coal, smoke, sparks, etc., that are so annoying to passengers.

HENRY L. ACKER.

Norristown, Pa.

REMARKS BY THE EDITOR.—Our correspondent has omitted to give the exact quantity and cost of coal and wood, as delivered at the place of trial. He has also failed to say

whether the fuel used in converting the water into steam, before the latter is superheated in the apparatus, is included in his statements of cost. It is very evident to us, from the alleged difference in the resulting costs per hour, that our correspondent has been misinformed on that head, and we need the full data in order to point out the error.

Making the ordinary allowance of 4 pounds of coal per horse power per hour, the amount consumed by the 40 horse power engine would be 160 pounds per hour. The expense, according to our correspondent, was 80 cents, which is half a cent a pound, or $11.20 per tun. This appears to us to be a high price for coal in Lamokin, Pa., which we believe is on the railway and only fourteen miles from Philadelphia, where coal is selling for less than $5 per tun. It appears to us that coal ought to be obtainable in Lamokin at a price not exceeding $5 per tun, at which rate the cost of running the engine in question would be 36 cents an hour. The comparative calorific values of crude petroleum and coal are as 2 to 3. That is to say, 2 pounds of petroleum are equal to 3 pounds of coal. Hence, if it requires 160 pounds of coal per hour to run the aforesaid engine, it ought to require 106⅔ pounds of crude petroleum to do the same duty, or a little more than 15¼ gallons of petroleum, allowing 7 pounds to the gallon. Our correspondent, however, states that the cost of running the engine, when petroleum was used, was 49 pounds or seven gallons of oil, costing 40 cents per hour; which would make the cost of the crude oil, delivered at the establishment he refers to, $2.40 per barrel. It may be that, in the present depressed state of the crude oil market, the article can be delivered in Lamokin at $2.40; but if so the price is exceptional.

We have stated the relative calorific values of the oil and coal at 2 to 3, which gives the oil 50 per cent greater heating power, weight for weight, than coal. This is a result deduced from the chemistry of combustion and from the records of careful engineers, after many trials, allowing every possible point in favor of the oil. But if the information furnished by our correspondent is correct, then they get, at Lamokin, more than one hundred per cent more of heat from petroleum than from coal, a statement which we can hardly credit. We hope that our correspondent will give us the exact data as to the respective costs of oil and coal, at Lamokin, and such other information as may assist the elucidation of the real economics of the subject.

In respect to the manufacture of illuminating gas from crude oil, our correspondent gives us no information further than the statement of the inventor, which, we understand, is not based upon actual experience in the manufacture of permanent illuminating gas, but is an opinion he has formed, judging from the ease with which he produces combustible gases by his apparatus. We think it probable that he will find it more difficult to make permanent illuminating gas than to run a steam boiler with crude petroleum. We shall be happy to receive and chronicle any new facts concerning either of the foregoing subjects.

RESCUE OF THE REMAINING SURVIVORS OF THE POLARIS.

The good news comes to us from Dundee, Scotland, of the safe arrival there in good health of all the remaining survivors of the Hall arctic expedition; consisting of Captain Sidney O. Buddington and twelve others. After leaving their encampment on the Greenland coast, which they did in the latter part of June, 1873, in open boats, they sailed southward, encountering many dangers and exposed to the severest hardships. They landed at various points and searched everywhere for cruising whalers. On the 20th of July, 1873, they had the good fortune to fall in with the Ravenscraig, a Scotch whaler, on board of which they were hospitably received, and subsequently conveyed to Dundee. They return to the United States at once.

Captain Buddington reports that, after that fearful night which separated him and his vessel from his comrades upon the ice, he never saw them again. It was with difficulty that the Polaris was kept afloat that night, and they momentarily expected she would go down. But they finally reached the shore, where the vessel was beached, and the party wintered in a hut on the land, being supplied with skins and walrus meat by the natives.

The incidents and results of this latest and most eventful polar expedition may be briefly summed up as follows:

On the 29th of June, 1871, the steamer Polaris, Captain Charles F. Hall, sailed from New York on a voyage of arctic exploration. In August, 1871, she had reached latitude 82° 16', the highest point ever attained by any vessel. Soon after this the ship went into winter quarters at Polaris Bay, latitude 81°38', and Captain Hall organized sledge and boat expeditions with a view to further northerly explorations. Soon after his return from one of these expeditions, he was taken ill and died, on November 8, 1871. He was buried on shore, and there his remains rest, near the north pole which he so ardently endeavored to reach.

On the death of Captain Hall, Captain Buddington, previously second in command, became master. On the opening of the ice in August, 1872, Captain Buddington, finding further progress northward impossible, determined to return home, and the ship started for the south. She was now unfortunately caught in the ice, and drifted down helplessly for two months, receiving injuries which caused her to leak badly. Such was the continual crushing of the ice against the vessel that Captain Buddington caused a portion of the provisions and a part of the ship's company to be landed on the ice, expecting that all the others might at any moment be obliged to follow. On the night of October 15, 1872, a terrible storm and utter darkness set in, during which the Polaris broke away from her icy moorings, leaving the hapless party of nineteen persons on the ice. They had provisions, boats, and clothing. Next day they saw the steamer, but were themselves unseen by those on board. Days and weeks passed, and still the little party waited for relief, clinging to the ice cakes, exposed to the most extraordinary perils, washed by the seas, drenched by the rains. Their supplies of food were swept away, but one or two guns were still retained, with which they occasionally succeeded in killing seals and bears, and this preserved their lives. On the 30th of April, 1873, after 6½ months dreary drifting, they were descried upon the ice by the British sealing steamer Tigress, rescued, and safely landed at St. John's, Newfoundland.

The recent rescue and landing of their former companions at Dundee completes this remarkable arctic narrative, which for thrilling adventure and extraordinary incident has no parallel in the previous records of fiction or fact.

THE FAIR OF THE AMERICAN INSTITUTE.

Judging from the number of articles already in position in the Hall of the American Institute, and from the fact that, as we are informed, the applications for space are in excess of the accommodations provided in the large area, the forty-second Fair has every prospect of surpassing in no small degree its predecessors of last year. The exhibition of 1872, though in many respects a decided improvement (especially in mode of management) on previous displays, was deficient in number and variety of new devices entered, a fact probably due to the attention of the people being diverted by the excitement of the political campaign; while such defects as existed in the conduct of its affairs may with fairness be ascribed to official experience in endeavoring, for the first time, to put in operation many radical and much needed reforms.

We have already noted several changes in the organization of the management. So far as we understand the latter, the occupation of the managers, save as a body, seems gone, and the personal control with which departmental committees have heretofore been invested, regarding the articles in their respective sections, is given to one general superintendent, Mr. Charles W. Hull. A board of directors, regarding whose duties no official whom we have yet met seems to have any very clear idea, has been organized: while the sub ordinate officers, clerks, etc., remain as before. The post of superintendent of machinery, a position invented last year and ably filled by Mr. R. H. Buel, has been rechristened as chief engineer, and is in the hands of Mr. John T. Hawkins, an engineer and inventor quite generally known.

Several alterations for the better have been made in the interior of the building. A large amount of space in the passage from the main hall to Third avenue has been converted into rooms for exhibitors, judges, and the press, affording accommodations both necessary and ample. The silvered monstrosity, supposed to be a statue, which surmounted the soda water fountain is conspicuous by its absence, and we are also pleased to note that the badly distorted and much confused Goddess of Liberty, which, accompanied by an impossible category of implements, formed a scenic decoration on the main arch facing the entrance, has been removed to a less conspicuous position. The work of art substituted is a shade better, representing a more appropriate subject; but as a production, it would be difficult to discover one in which every law of perspective or drawing is more systematically set at naught. We can only repeat, in this connection, remarks already made to the effect that, while such admirable decorative artists as Gariboldi and others who might easily be named are within access, it is hardly creditable to the Institute to exhibit second rate efforts ostensibly as the best representatives of the progress of this branch of art.

It is hardly possible to forecast with much accuracy the nature of the coming display as regards numbers of especial articles. There appear to be fewer sewing machines than ordinary, and more heavy articles in the machinery department; but, as yet, arrays of empty cases are more prominent than complete exhibits. Space, we understand, will not be reserved, no matter how long ago bespoken. It is the intention to fill up the building as quickly as possible, and exhibitors who imagine that they can come long after the Fair is in progress, and thus avoid waiting through the first few weeks and slim attendance incident to that period, will, we fear, find themselves debarred altogether.

In noticing the various entries, our custom of occasionally strolling through the building and commenting briefly on such as strike us as novel, ingenious, and interesting, will be as heretofore followed. Mere lists of exhibits are doubtless very entertaining to the proprietors as gratis advertisements, but, to the general reader for information, they are excessively dull.

KNITTING AND WEAVING MACHINERY

is represented in quite full force. At present Lyall's positive motion loom and corset weaving apparatus are in operation. The last mentioned device is one of the most important and interesting in the Fair; but as we desire to obtain some further particulars regarding it, the detailed explanation which it deserves is deferred to next week's notes. Messrs. Tiffany and Cooper, of Bennington, Vt., exhibit two knitting machines, one of which is in operation. The invention is designed to manufacture ribbed tops for stockings or cuffs. Briefly, there are two sets of needles, upon one of which, standing vertically, the thread is placed. The second set are barbs, and come down from above, catching the stitch. Then a presser, acting against the point of the barb, presses it in, making an eye, over which and the old loop it drives the stitch. The thread leads from bobbins above to horizontally moving guides. One set of the latter operate until a sufficient length of material is knitted; a bell then rings, and a second series of guides, carrying a lighter thread, come in play, thus marking a space for the division of the fabric. The cuffs or bottoms are turned out with perfect welts, slack courses, and splicing threads, all put in without stopping the machine. By using different colored yarns on the two sets of guides, fancy articles may be produced. From three to ten rolls of fabric are knitted at a time. The mechanism is remarkably well contrived; and, as exhibited, works to a charm. From twenty-five to thirty-five dozen ribbed tops, we learn, can thus be made in a day.

THE MAIN ENGINES

this year are one of 125 horse power, built by Jerome Wheelock, of Worcester, Mass., and driving a 22 inch belt; and, on the other side of the passage, a Hampson & Wheelock machine, of 20 horse power. The large engine is somewhat on the Corliss plan and is a fine piece of workmanship. The valves are nearly underneath the cylinder, and are of the ordinary slide description, but are made to taper outwards in their box, so that the pressure from inside keeps them tight, thus obviating the necessity of stuffing boxes. There is a variable cut-off, arranged in the chest just between the valves, which communicate with the governor.

THE DELAMATER HOISTING MACHINE

is a gigantic affair, capable, we are told, of lifting 15,000 pounds two hundred feet per minute. The engine is a 40 horse power Rider horizontal, which connects with a main fly wheel, 8 feet in diameter and 14 inches in face. The mechanism, though large, is quite simple. The drum, which is five feet in diameter, is loose on the main shaft, and is operated by gearing on a smaller shaft which communicates with the main shaft by friction pulleys. The latter are thrown into or out of gear by moving the small shaft by a toggle joint and lever; so that the drum is either rotated by the cog gearing or left to revolve loosely in the contrary direction for lowering, its motion being then controlled by a suitable brake.

A SILK-MEASURING APPARATUS,

known as Dunn's patent, is an ingenious little arrangement for determining the length of thread or silk, and thus detecting any fraud in case the same is purchased by the pound. It consists of a light wheel, fitted on a sliding pinion, traversing the surface of the spooled thread, and is connected with clock work moving two registering dials. The thread is thus measured after it is spooled, while the operation of spooling is not interfered with. Another form of the same device is exhibited for the use of consumers who desire to test the length of thread already spooled. A crank and spindle wind the thread on a new spool, and dials indicate the amount reeled off. This operation is usually so tedious that a small machine, which seems to perform its work very quickly and accurately and which can be readily attached to the corner of a counter or table, will doubtless prove acceptable to both dealers in and consumers of thread. While this device winds the material, another machine is exhibited for roughing out the spools. In fact, the invention makes almost any small wooden article, in the way of bungs, spool blanks, pill boxes, etc. Mr. J. T. Hawkins is the inventor, and the apparatus was described about a year ago in our columns.

MAKING BUTTON MOLDS.

At present, however, a novel attachment has been combined with it, in order to make button molds of the large size usually worn by ladies on redingotes. The improvement is a revolving steel head, in a cavity in which are arranged cutters and a small drill. The stick of wood, squared to suitable size, is fed by an ingenious appliance into this opening. There it encounters, first, a pair of cutters which turn off the edges, and then another set which give its end a convex form. Meanwhile the drill pierces a small hole in the center. A cam arrangement then comes in play, and carries the wood over against a circular saw which cuts off the mold. The stick then returns, and the same operation is repeated. The speed of the machine is at the rate of 5,000 revolutions per minute, and a mold is finished every second. Three hundred gross, we were told, can be turned out in a day.

Among the small inventions, so far exhibited, is a

SEWING MACHINE ENGINE,

which consists of a little oscillating cylinder attached to the table, having a driving pulley in line with the small wheel of the machine. A boiler holding enough water for a day's work supplies steam, and occupies a small space on the floor in rear of the apparatus. The throttle valve regulates the supply of steam and is connected with the treadle of the sewing machine, so as to be governed with the foot.

New Exploration of the Amazon River.

Among the most recent exploring expeditions is that undertaken during the present year for the exploration of the Amazon river, by Professor James Orton, the well known naturalist, of Vassar College. We have just received our first instalment of correspondence from him, the publication of which we shall begin in our next issue. Our latest advices from this enterprising traveler are dated August 19, 1873, at which time he had paddled one thousand miles up the Great River, taking notes and making surveys and observations *en route*. He had an immense distance yet to go before reaching the Cordilleras, which he expected to cross, and to reach home *viâ* Panama.

The letters of our correspondent are full of interest concerning the marvelous region which he is exploring. He speaks of unbroken forests covering a space eleven hundred miles in diameter, and other equally astonishing revelations of Nature.

THE Neapolitan papers state that, from observations taken on Mount Vesuvius, new earthquakes are expected.

THE PLANET MARS—IS IT INHABITED?

PART 2.

Having determined the existence of a vaporous envelope around Mars, similar to the clouds which float in our terrestrial atmosphere, if we assume the same to be aqueous, we must believe in large bodies of water from which it originates. But other fluids besides water generate vapor; hence, unless direct proof be adduced to the above effect, the hypothesis, that the vail observed is a cloud screen existing in an atmosphere like our own, is without substantial foundation.

The telescope has told its story, and a more wonderful instrument must add the sequel. The spectroscope, in the hands of the eminent English physicist Huggins, solves the problem. The planets reflect the light which they receive from the sun; and if their rays be passed through the prisms, we find in their spectra the solar spectrum, just as if it had been reflected by a mirror. Dr. Huggins on his first observation of the planet was unsuccessful, but at the opposition of Mars in 1867, he attained important results. On directing his spectroscope, attached to a powerful eight inch refractor, toward the star, he noticed that the spectrum obtained was crossed near the orange portion by black lines similar in position "to lines which make their appearance in the solar spectrum when the sun is low down, so that its light has to traverse the denser strata of our atmosphere." The question to determine, then, was: Were the lines due to the passage of the light through the atmosphere of the earth or through that of Mars? Turning his instrument toward the moon, then nearer the horizon than the planet, so that the atmospheric lines, if they appeared at all, would be much clearer in the moon's spectrum than in that of the object of his observation, Dr. Huggins found that they were totally absent. It was thus demonstrated beyond peradventure that the bands belonged to the Martial atmosphere, and not to that of the earth; and hence two aerial oceans, analogous to each other, encompass both planets.

But, it may be asked, what produced these lines? Carefully noting their position, the observer found them to be the signatures, not of oxygen or nitrogen, but simply of the vapor of water, of the same chemical composition as our own, oxygen and hydrogen. This proved, in this direction we need go no further; the existence of sea, of cloud, snow, ice, fog, and rain is demonstrated. Reasoning from this basis, we can trace the presence of winds which shift the masses of vapor from place to place, of aerial and ocean currents, of rivers flowing to the seas, of a climate tempered in the same manner as our own, and of copious rain fall which must nourish the land and cause the production of vegetation. If, further, there be continents and oceans, similar geological forces to those of the earth must be at work; there must be upheavals and depressions, mountains, valleys, and water sheds, in fact a miniature of our earth.

Here, then, millions of miles away in space, is another world, a small one, it is true, and seeming to the eye no larger than our engraving, which represents its appearance



at the present time; but it has water, air, light, winds, clouds, rains, seasons, rivers, brooks, valleys, mountains, all like ours.

"All the circumstances necessary for the production of animate existence being there, under what pretext, then," demand the believers in the habitability of the planet, "can it be asserted that living organisms, such as, under precisely similar conditions, exist upon our own earth, do not live and flourish there? Can it be that the sun, air, water, and earth are held in bonds and prevented from combining in organic evolution? Or can it be credible that, while every drop of water on our earth is peopled with millions, another world is a desert?" In our previous paper we observed that, owing to the eccentricity of its orbit, the amount of light and heat received by Mars from the sun must vary considerably. Further, we may add that, while the earth is 92,000,000 of miles from our source of light, the distance between that luminary and Mars is fully 141,000,000 miles. From this difference, and the relative sizes of the two planets, we can determine the amount of heat transmitted to Mars as compared with the quantity reaching the earth; and the average daily supply is found to be as two to five. More nearly, when Mars is closest to the sun, he receives somewhat more than half as much heat as the earth; when furthest, his supply falls to a little over one third that of our sphere. The sun would appear, to a person on his surface, to be about one third the size that it does to us.

Considering, now, the question of the Martial heat, it seems to be of much smaller importance than it really is. The sun is the great storehouse of power, and the heat we obtain from him underlies all motion and life. If the supply from this source were diminished, manifestly life, as it now is upon the earth, could not be maintained. If we take away half the fuel from under a boiler, the engine, although it may work, will no longer be of the same efficiency. Imagine this reduction to have taken place ages ago, "before the sun's rays in a potential form," as Tyndall expresses it, were buried in the deposits of the carboniferous epoch, and consider that it would require 108,000,000 of horses, working night and day for a year, to develope the work equivalent to the energy in a hundred million tuns of coal—one year's produce of our mines. If, then, Mars, which we have proved to receive a far less quantity of heat than the earth, has been thus deprived during countless ages, it must be apparent that, if it require existing circumstances upon the earth to maintain the creatures thereon, the absence of such circumstances on Mars clearly shows the unfitness of that planet as a habitation for beings.

The point next arising is: Whether Mars be possessed of an inherent heat sufficient to compensate for this deficiency of solar heat, or has the planet enough heat stored up to render it an abode for living creatures? It is very probable that Mars has parted with much more of its inherent heat than the earth, for it is known that, of two bodies equally warmed, the smaller cools the more rapidly. We have no reason to believe that Mars has been hotter than our globe, and hence, as its sphere is smaller, it must now be a much colder body. If, then, we are to adopt the theory that the climate of the planet resembles our own, we must assume that there is a peculiarity about its atmosphere which enables it to retain a larger proportion of the sun's heat than can our aerial envelope. In such case, considering the constitution of such an atmosphere to resemble our air—a necessary hypothesis, if we are to believe in the existence of the beings with which we are familiar,—it must be much more dense, reasoning from the fact that there is a steady decrease in warmth as we ascend to the upper regions of our own atmosphere, due to the increased tenuity of the air.

We may presume that every planet has an atmosphere proportioned to the matter contained in it. Hence, the mass of Mars being about one fifth that of the earth, we must infer that its atmosphere is equal to one fifth part of the earth's. But the surface of the planet is fully two fifths that of our globe; hence, over each square mile, there would be a much less corresponding amount of air. In addition to this, we have already noted that in Mars exists less than two fifths the attractive force of the earth, the proportions being about as 38 to 100. The atmospheric pressure would therefore be reduced in proportion, even if the planet had as much air above each square mile of surface as there is above each square mile of the earth. This quantity of air would be twice as much as we should infer from the mass of Mars, and we should require five times as much air to have an atmosphere only as dense as our own at the sea level. An atmosphere about twice as dense as this would perhaps give a climate as mild, on the average, as that of our earth; but we can hardly assume that Mars has an atmosphere exceeding ten times in quantity what we should infer from the planet's mass.

If, now, we suppose that the Martial air is moderately dense, comparable, in fact, to our own air, then, since we know that considerable quantities of aqueous vapor are raised into that air, we must, from the circumstances already considered, conclude that there would be a precipitation of snow which would keep the surface of Mars permanently covered. But this is not the case, as Mars is not a white planet; and so we must assume so great a rarity of its atmosphere that sufficient water vapor can never be raised to produce a permanent snow envelope by precipitation. Consequently it is probably the most satisfactory course to return to our first assumption, namely, that the Martial atmosphere bears the same relation to the mass of Mars as the terrestrial atmosphere to that of the earth. Under this hypothesis it can be shown that the atmospheric pressure on Mars corresponds to about 4¼ inches of the mercurial barometer. Can man exist for any length of time in such an atmosphere?

In the great balloon ascent of Coxwell and Glaisher, in 1862, the enormous hight of 37,000 feet above the sea level was attained. At 29,000 feet Mr. Glaisher fainted and did not revive until the balloon had descended and returned to the same point. At 37,000 feet the barometer stood at 7 inches, and the thermometer at 12° below zero. Coxwell became almost paralyzed, and only saved the life of himself and his fellow aeronaut by seizing the valve rope with his teeth, and thus allowing the gas to escape. If, by extreme fortitude, one man has managed to live at two miles above the fainting level of another, could human beings generally exist in an atmosphere reduced to five sevenths the density?

We have shown that Mars has, therefore, not only a far greater degree of cold, but an atmosphere of much greater tenuity than that of the earth, conditions manifestly incompatible with the existence of terrestrial creatures: a conclusion easily attained by considering the life (mere microscopic animalculæ) found on the mountain peaks of our earth, beyond the last stages of vegetation, where the air is rare and extreme cold prevails.

We have now presented sufficient data to form a clear idea of the arguments which go to prove the unsuitability of Mars as a habitation for the higher orders of beings. Did space permit, we might continue and refer to the atmosphere, which must be at least 100 miles high, and the winds which must prevail, which carry aqueous vapor, in the form of snow, to the poles. Here great masses of glaciers are heaped, which sometimes disappear, leaving vast gaps discernible even at forty millions of miles away, producing convulsions which must affect the entire planet.

The weight of evidence, it seems to us, is against the existence of beings of a nature with which we are familiar. No terrestrial creature could live even in the torrid zone, so cold and dismal must it be. Even vegetable life, however hardy, would not survive a single hour. If inhabitants there be, they must be of different form from us, to correspond to the decreased attraction of gravity; if red vegetation exist, their eyes must be different from ours; to live in such an atmosphere their respiratory organs must be totally unlike our own; and thus we might go on specifying points of variance until we find that, in the end, there is no more possibility of Mars being inhabited by beings like ourselves than there is of the sun or Jupiter being similarly peopled. In fine, we cannot say whether other worlds are or are not abodes of life. We can assert with reasonable probability that on no other planet are there conditions suitable for the existence known in our globe. Whether there be beings in the fiery vapors of the sun, on the molten mass of Jupiter, in the bleak deserts of the moon, or in those remote parts of the universe, from which our entire solar system seems but as a single bright star, is a problem within the knowledge of only Him "to whom all things are possible."

Exposition Awards.

The *Commercial Bulletin* thinks that it is time that the practice of exhibition rewards should be abandoned. Any one who has seen the inside and secret workings of exhibitors, to obtain the coveted prizes, knows that lobbying and friendship have much to do in determining awards, and that they who have friends at court are seldom found empty handed when the day for awarding prizes arrives. And even those who, in all honesty and from the merit of the articles which they exhibit, are rewarded are, by their brother exhibitors and especially less successful rivals, accused of lobbying in some form or other. If exhibitors did but know it, the benefit which they derive from industrial expositions comes not from diplomas and medals, but from the fact that vast numbers are brought to see and inspect the machines and products exhibited.

A SIMPLE TREE PROTECTOR.

The first frost—and it has already made its appearance in the northern part of New York and the New England States—is apt to cause sad havoc among our young fruit trees,



tropical plants, and ornamental trees, before the gardener is prepared for it. The device represented in our engraving is therefore of timely importance and will prove of value to nurserymen and agriculturists generally. The *Ironmonger*, from whose columns we extract the illustration, states that it has recently been introduced in England, and that in construction it is simply a conical frame of galvanized iron wire, supported at its apex by a wooden post driven in the ground beside the tree. It is only needed to cover the wire with cloth, or even newspaper, to render the tree safe from the frost.

The *Utah Mining Gazette*, published at Salt Lake city, adds to a paragraph from the *Mining and Scientific Press* (in which the editor states that Arizona wants more practical miners and fewer speculators without means, more men of capital, and no mining experts or wiseacres) that Utah, also, would be far better off if she had fewer "experts and more men with plethoric bank accounts. It is these experts—at swindling—that have already done us so much damage. Like Arizona, we want a new class of speculators."

SUCH is the marvelous ductility of gold that a single ounce of the pure metal may be drawn out into a wire thirty three miles in length.

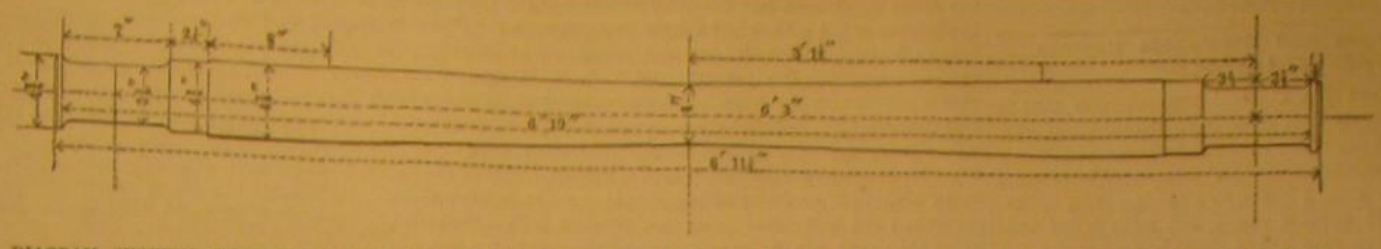


DIAGRAM SHOWING FINISHED DIMENSIONS OF STANDARD AXLE ADOPTED BY THE MASTER CAR BUILDERS' ASSOCIATION, JUNE 18, 1873.

DRAW HEADS.—The standard hight of drawheads, adopted by the Association, is 2 feet 9 inches from top of rail to center of drawbar.

Condoling by Electricity.

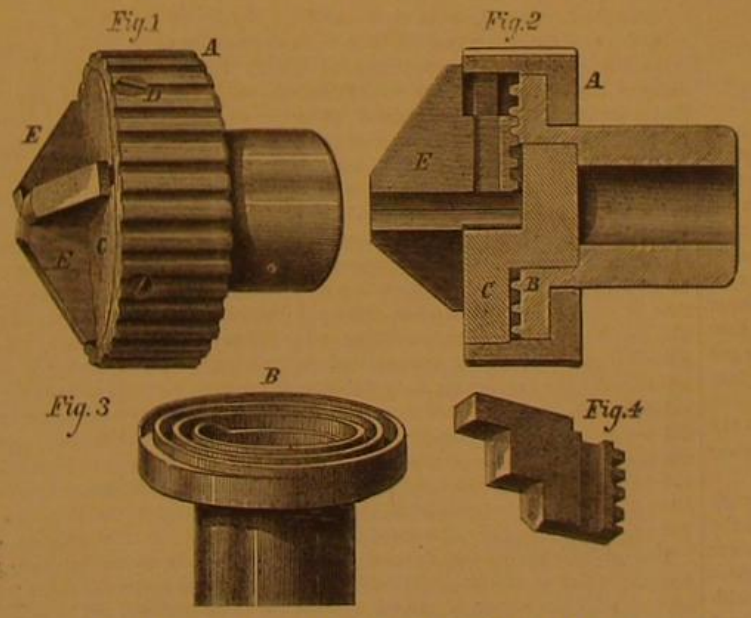
On the recent occasion of the death of Mr. C. L. Goodwin, superintendent of the Northern New York division of the Atlantic and Pacific Telegraph Company, the various operators of the division united in a meeting of condolence in the following remarkable manner: All the stations included in that division were connected into one circuit,, extending from New York to Albany, thence *via* Troy to Saratoga and return to Albany, westward to Syracuse, and *via* Oswego, Clyde, and Rochester to Buffalo and Niagara Falls, back from Buffalo *via* Auburn, Seneca Falls, etc., to Auburn again, being over twelve hundred miles of wire. Each person remained in his own office and all the instruments were so connected that the remarks made by one operator upon his instrument were sent through all the other instruments. Promptly at 2 P. M. (Buffalo time) New York called the meeting to order. Buffalo moved that Mr. Hauff, chief operator at New York, be made permanent chairman. The motion was seconded by Troy, and carried. The chairman then suggested that Mr. McCoy, manager of the Buffalo office, be nominated as secretary, which the meeting unanimously resolved in the affirmative. Various speeches were made and the resolutions were then read and adopted, and an adjournment then followed. The meeting was entirely harmonious throughout, and the state of the weather and condition of the wires peculiarly favorable to its success.

SELF-TIGHTENING DRILL CHUCK.

Our illustration represents an ingenious appliance which, it is claimed, is self tightening, and may be caused to hold any drill of a size within the compass of its jaws with complete firmness, and this with no further trouble to the operator than a clasp of the hand. That such an improvement is of value, both as applied to the drill as well as to the lathe chuck, will be evident to every mechanic even without the further corroboration of its merits found in the substantial victory which the manufacturers assure us was won by the device at the Vienna Exposition.

The material used in the construction is forged steel in every part, except the jaws, for which the best and most carefully tempered cast steel is substituted. The shell or case, A, Figs. 1 and 2, contains the working portions and, as will be noted from the sectional view, is provided with a shoulder within, flush with the face of the scroll, B. On this shoulder, and at a slight taper, is driven the plate, C. The latter is thus made to form a close joint and still may be easily removed, while it is afforded a support calculated to bear the strain (often caused by inexperienced persons driving it upon the arbor) from the screws, D, by which it is held in position. The plate is fitted in the usual manner with tongue and grooves, and is also provided with a center which serves to center and steady the back end of the drill, and thus insure the proper holding of the tool in its place.

In order to give greater strength, and also to guard against the entrance of any dirt through the slots into the working parts, the jaws, E, are made with projections, the upper parts of which, when the chuck is open, are flush with the outside of the shell. The inner sides of the jaws, as shown in Fig. 2, are provided with segments of screw threads which engage with the face of the scroll, B, Fig. 3. The latter is provided with a tapering hole which is held on the center of the lathe in the usual way, the shell plate and jaws revolving around it. Outside the shells grooves are placed to favor a firm grasp of the hand around the chuck, so that the device, when in use, is thus self-tightening, the strain of the tool while cutting serving to make it hold more securely.



THE VICTOR SELF-TIGHTENING DRILL CHUCK.

The size represented in our engravings, No. 3, retains drills from ⅜ down to 0; while the next form, No. 4, holds from ⅜ down to ¼ inch. The jaws are made rounded at their outer ends so as not readily to catch hands or tools near them. An extra set of these appliances, of the form shown in Fig. 4—which make a lathe chuck of the apparatus,—are furnished when desired, and, as we are informed, may be substituted for those in use in the space of three minutes.

For further particulars address the manufacturers, the Hubbard and Curtiss Manufacturing Company, Middletown, Conn. The article itself may be found at the factory, at the above address, or at the warehouse, No. 82 Chambers street, New York city.

CALFSKIN TANNING IN EUROPE.

Mr. Jackson S. Schultz of this city, now in Europe, in a letter to the *Shoe and Leather Chronicle* gives the following interesting particulars of his visit to Mercier's great tannery:

The calfskin tanneries of Mr. Raichlen, at Geneva, and Mr. Mercier, of Lausanne, both situated on the Lake of Geneva, are among the largest, if not the very largest, in all of Switzerland; and with the exception of one, Mr. Mercier's tannery is the largest calfskin tannery in Europe, or perhaps the world.

Mr. Mercier many years since found out—what has been the experience of all other tanners—that to excel in the trade, attention must be given to one single department, and for these years of his triumph and success he has devoted himself to the wax calfskin trade exclusively.

He does not depend at all upon his home market for a supply of skins, but lays all Southern and Eastern Europe under contribution.

These skins are brought to him invariably "flint dry," not even drysalted. They come in compressed bales, and these are opened, assorted and piled away in a cool, dark loft or storehouse in large compact piles, to be withdrawn at the rate of about 500 per day, for his daily use.

These skins are so perfectly cured and so uniform in condition that it is seldom that one skin in a hundred breaks or indicates the fact that it has been dried. Even the grain does not show a crack, as is too apt to be the case with us, where skins are dried in the sun or otherwise exposed.

These skins are soaked in the usual manner and are softened in wheels precisely as our best tanners are now softening their light stock, with this difference: In the construction of the wheel, there are four compartments, instead of being, as with us, one open space. These compartments turn the skins more actively, and Mr. Mercier says the force is sufficient to do the work of either "softening" (breaking) or rinsing and otherwise cleansing the skins. It will be seen after a moment's reflection that a wheel divided into four compartments or segments must turn the contents four times as frequently as if left in the whole wheel.

The liming of the calf at this tannery presented no new features. They are fully limed, so that the hair comes freely. The skins are washed in the wheel after being unhaired, and worked with a stone worker to remove the remaining short hair. Great care is manifested throughout to keep the grain sound, and to work every part of the skin uniformly, so that no more lime will be left in one part of the surface than another; the tendency of an omission in this respect is to cause the grain to color unevenly and appear clouded when tanned.

The most remarkable fact to which I wish to call attention is this: Mr. Mercier declares it unnecessary to break the nerve—and he certainly devotes less labor to this end than any other manufacturer I have met. He does work all the flesh off with a worker, but when this is accomplished I did not see that an additional stroke of the knife was given to soften the pelt or break the nerve. Each man thus worked off the flesh from about one hundred and twenty skins per day; from the amount of work thus performed it can be estimated about how much labor was bestowed.

The next remarkable fact I wish to mention is that Mr. Mercier, in common with all other calfskin tanners in this section, entirely omits bating, as we practice it. They use no other bate than some liquor.

The acid which forms, known as "gallic acid," and which is abundantly found in all oak yards, is the only bate here employed. This acid liquor, it is well known, will kill the lime (neutralize it), and will, with a few days' handling, remove all appearance of lime from the pelt. When thus reduced and brought back to its normal condition, then Mr. Mercier treats his stock to the usual nourishing process. He begins this process by a solution of liquor made from spruce bark, which, as I had occasion to say before, is very abundant and comparatively cheap all through this country. The strong acid from this bark has a wonderful tendency to plump. Mr. Mercier is disposed to attribute these remarkable plumping powers to the resin or sap in this bark. But it is proper to say that this practice is a specialty in this tannery, and is seen nowhere else.

When the skin is slightly raised and fairly colored, it is laid away in oak bark. This process of laying away is universal in this country. The skin is folded so that the grain of the neck and shoulders is folded on the grain of the butt, that is, doubled over. The bark only comes in contact with the flesh. In some tanneries, I notice, they vary this practice by putting two skins of about the same size together, grain to grain. This, I judge, with all respect for the experience and practice of Mr. Mercier, is an improvement upon his method.

The object of this practice is variously considered; some say it is to prevent the over tanning of the grain and to induce, as far as possible, the tanning from the flesh side. This object is desired to make the grain tough, so that it will hold the stitch when sewing the side linings. Others say it is to aid the color of the skin. My own judgment is that it may aid and help to produce both of these results, and therefore the practice is justified.

The bark is laid on the skins fully one to two inches thick, and all the interstices are filled with bark and stamped down solid. I should judge that not more than half the number of skins are laid in the vat that our practice would call for.

When the vat is filled with skins and bark thus put away, the vat is run up with water or weak sweet liquor, most frequently with water, although Mr. Mercier's practice is to run liquor from his leaches; but I judge that only spent bark was placed in these leaches, and consequently the liquor was little more than the washings of the bark.

These skins are allowed to remain for three months, and in Mr. Mercier's case two such layers, and in most other cases three such layers, occupying nine months, completes the tannage of the skins.

I need not say to any intelligent tanner that skins prepared in this careful way and tanned by this slow process must yield a very tough skin. The grain must be soft and yielding, requiring but little scouring, and I think beyond the working of these skins on the flesh over a beam and the softening in the wheel before scouring, the skin gets but little labor—hardly so much as is bestowed by our practice.

The stretch is left in the skin and not taken out in the effort to get out the old grain, as our system of strong liquors compels us to do.

The shaving, whitening, blacking, etc., is after our method and is in no sense an improvement. Of course where so many skins are tanned, and the selections and classifications begin with the raw material, there can be no difficulty in rendering the most severe classifications possible in putting up the skins for sale.

All that it is further necessary to say, in regard to the manufacture of Mr. Mercier, is that he devotes himself to the work of making as good leather as can be made, and he has succeeded. Whether he makes more or less profit, whether he makes as many pounds of leather from the skins taken in hand by him as an English tanner would, is quite another question, and one I fancy he does not care to consider. He sacrifices everything to toughness—to wearing qualities.

Mr. Mercier showed me some French coppice bark which cost him five cents per pound, or $100 per tun, although his usual coppice bark cost him but $40 per cord, or two cents per pound, and he considered the former profitable even at this high price.

He confirmed my opinion that the spruce bark contained little or no tannin, and although for the purposes indicated he did use a small quantity, at about the price of one cent per pound, he did not look upon it with much favor.

If this view is true, what kind of leather must that be which is made out of spruce bark exclusively? More than half of the bark used in sole leather tanning throughout Germany and Austria is this spruce.

M. B. writes to suggest the construction of a spherical metallic balloon, 70 feet in diameter. Such a sphere would lift 11,225 lbs.; and if made of metal weighing ¼ a lb. to the square foot, it would weigh 7,647 lbs., leaving 3,578 lbs. of lifting force available. The balloon could be raised and lowered in the air by an engine of half a horse power, and no gas need be lost or ballast thrown out.

ERRATUM.—In Professor Morton's article on "The Magic Lantern as a Means of Demonstration," on page 163, in place of 18, 14 and 16 inches as the radii, read 4½, 3½, and 4 inches. The Professor's attention was called to this oversight by the kindness of Mr. R. S. Bosworth, of Adams, N. Y.

Correspondence.

Combined Steam and Bisulphide Engines.

To the Editor of the Scientific American:

Your correspondent Mr. C. H. Aaron suggests that it would be better to apply heat directly to bisulphide of carbon, by putting it in the boiler instead of water, and dispensing with the steam engine altogether. Many men have made the same suggestion since I began to experiment in utilizing the latent heat in exhaust steam, and have fallen into the error of supposing that power could be produced with much less heat when it is applied to the bisulphide of carbon than when applied to water.

The difference in the amount of fuel that would be required to produce a horse power an hour with the two fluids is by no means as great as most persons imagine. To illustrate: 4 lbs. of coal will run an engine of 1 horse power an hour, if the boiler and engine are well constructed. If the boiler is filled with the bisulphide of carbon instead of water, 4 lbs. of coal will run an engine of 1¼ horse power an hour. If a combined steam and bisulphide engine is used, the 4 lbs. of coal will work the steam cylinder 1 horse power an hour, and the exhaust steam from this cylinder will work the vapor cylinder nearly 1¼ horse power during the same time; and we get about 2½ horse power from the same fuel that would be required to produce 1 horse power with steam alone or 1¼ horse power with bisulphide of carbon alone. This I have proved by trial many times.

In other words, with the combined engines, the same heat is used twice and produces two results; and I know by actual tests that the latent heat in the exhaust steam from an engine will do nearly as much work when used to heat a bisulphide boiler as the coal, burned to make that steam, originally would have done had it been burned under the bisulphide boiler in the outset. The loss of heat by using the steam in an engine does not exceed 95 per cent; and the exhaust will heat, to 200°, 95 per cent of the water that the coal used to make that steam would have done. The loss of heat is entirely due to the radiation from the pipes and cylinder; it does not make the slightest difference in the amount of heat it contains, whether the high pressure steam is used to produce a large amount of power in an economical engine or whether it escapes direct from the boiler. The theory that the heat extracted is in exact proportion to the power produced is theory only, and cannot be sustained by any practical tests; but on the contrary, heat is no more destroyed or used up in producing power than water is by flowing through one wheel to another at a fall below.

Another popular error is that a large amount of the heat produced by combustion goes up the chimney flue, in a well set boiler. I have put a bisulphide boiler into the smoke stack of a steam boiler and found that more work could be done with the exhaust steam from one engine, when applied to a bisulphide boiler, than with the heat escaping from the smoke stacks of twenty-five engines of the same size.

I hope that these facts will convince your correspondent and others that more work can be done with a combined engine where the heat is used twice than with a single engine where it is used but once.

Springfield, Vt. JOEL A. H. ELLIS.

To the Editor of the Scientific American:

I have read C. H. Aaron's remarks on the steam engine; and I wish to say that a pound of steam at any temperature contains about 1,150 units of heat; of these not more than 250 go to working the engines, even when the feed water is heated to 180°; the rest is blown off through the exhaust pipe or enters the water of condensation. Fifty years ago, the Cornish steam engine made one horse power per hour out of 2½ lbs. of coal; to-day the average of all engines running will not be less than 4 lbs. of coal per horse power per hour, the very best compound condensing marine engines requiring 2 pounds of coal per horse power per hour.

The units of heat in a pound of coal, when tried with the mechanical equivalent (772), ought to produce 2 horse power for 1 hour.

We have been exercising our ingenuity in making every imaginable style and shape of engine, cut, off, catching the gases going up the chimney, etc. So far as they go, these are good; but they do not go to the root of the evil, which is, preeminently, the 966·6 units of latent heat which pass out with the exhaust steam. The half of this may perhaps be utilized by making it heat a second boiler containing a substance with a low boiling point, which substances render latent a small quantity of heat. Such are ether, gasoline, bisulphide of carbon, etc.; all these boil at about 100°. Ether in passing into steam renders latent only 163° of heat.

With regard to putting the fire directly to the boiler containing these substances, it would be very dangerous; and I doubt not, if Mr. C. H. Aaron were to try it, the chances are that he would not long be able to eat apple pie even though it be seasoned with quince. And it would be of little practical utility; because, when the specific heat of a substance is low, the steam is proportionally weak, that is, although 1 unit of heat will raise 1 pound of water 1° and 1 pound of ether 2°, but the steam of the ether will only have half the power of the steam of the water.

Wilmington, Del. J. W. H.

The Patent Right Question.

To the Editor of the Scientific American:

Several of your correspondents have given opinions on this question, arguing in favor of certain general principles which seem to me to be essentially wrong. Permit me to say a few words on the other side, though we all come to the same conclusion, but for different reasons. Mr. H. A. Walker says: "A citizen has a right to claim from the State only such protection in the use and ownership of property as shall redound to the general good." J. E. E. says: "I cannot see that an inventor has any inherent right in his own discovery." Both of these propositions, I call fundamentally wrong. The citizen claims protection from the State for his property because it is his, independently of the State, and the State itself exists, simply by the universal consent of the individual members, because it is only by union that each can be protected; and without that union there would be and could be no such thing as public good. If this principle be correct, all Mr. Walker's reasoning fails.

As to the other *dicta* of J. E. E., I must say that, in my opinion, the inventor has as much inherent right to his own discovery (exclusive right, I mean) as he has to the use of his hands or his teeth. But he is powerless to enforce that right; to do so, he becomes a member of a community or State, each member of which, by mutual agreement, binds himself to all others; so that, if any one will invent a new thing that is useful, they will all protect him in the exclusive use and profit of that thing. But only for a limited time, for the cost of a perpetual monopoly would be too much. Under this condition, the inventor has an inducement to invent, and the State the benefit of the free use of the invention finally. CHARLES STODDER.

Boston, Mass.

To the Editor of the Scientific American:

On reading H. A. Walker's letter on page 132 of your current volume, I can see very plainly that a citizen has the exclusive right to whatever he produces with his head or hand, and none but a thief or robber can take it from him without obtaining his consent, and remunerating him for it. The best protection to the individual is for the best interest of the State. The State has no right to my service, in any capacity, only as I sell it, and the idea that it has is only one of those barbarisms which advancing civilization has failed to eradicate. The above will do also for J. E. E., and I will add that the idea of reward for doing good and punishment for doing the opposite is as old as man; and if the inventor benefits the public, he is entitled to a reward, simply because he does so. J. E. S.

Portland, Me.

Water as Fuel.

To the Editor of the Scientific American:

I observe in your issues of April 5 and July 19, under the head of "Water as Fuel," some observations on the newly invented Stevens steam furnace exhibited in San Francisco. Will you allow one who has seen its workings, and had its objects stated to him by the inventor, to correct a few errors in those communications?

First, I will mention to the *Alta* reporter that the "tremendous roaring" is caused simply by the escape of steam from the pipe, as would be the case if there were no combustion at all, and not, as he seems to think, by the chemical action. Next, the inventor is not so unscientific as to think that steam can be decomposed simply by striking disks of iron, or by any other mechanical means. It is true that it is practicable to decompose water by contact with red hot iron, but only at the expense of the metal, which is oxidized, hydrogen being set free; but this is far from being the design of the inventor, he using the disks of iron only to deflect the current of steam on to the jet of oil. As stated by him to me, the objects of the inventor are: To decompose superheated vapor of water in presence of red hot carbon, thereby getting abundant oxygen in a very small space, and then to burn the carbonaceous matter to carbonic oxide. The merit of the invention consisting in having at command a limited space where the temperature is very high. This would make the furnace specially valuable for reducing very valuable ores, and for other metallurgical operations. He did not pretend to economy of fuel, and such a device could not possibly be economical when no arrangements are made to introduce air to consume the hydrogen set free from both oil and water. Oil is used, being the only fuel that could be fed constantly into the right spot.

The inventor knows that as much heat is necessary to decompose water as will be produced by combining the oxygen set free with the carbon of the oil. But if his ideas are correct, he gets, as I said, an abundant source of oxygen. I make these corrections for the benefit of those of your readers who might be misled. H. O. L.

Stockton, Cal.

The Thermal Expansion of Mercury.

To the Editor of the Scientific American:

In your clear and useful article on the "Properties of Saturated Steam," in your issue of August 9, current volume, there is an error, derived probably from a similar error on page 61, of Charles T. Porter's useful "Manual on the Steam Engine Indicator," to which work you refer in terms of just commendation.

The coefficient for the expansion of mercury for each degree of Fahrenheit's scale, as there given, is 0·0010085, and you reproduce it exactly. As given by Rankine ("Steam Engine," art. 107, I, p. 111), it is 0·00010085, and it is so given in Rankine's "Civil Engineering" and Young's "Physics." Your coefficient is therefore ten times too large, and may mislead the inexperienced. I have called Mr. Porter's attention to the error. J. C. HOADLEY.

Lawrence, Mass.

REMARKS BY THE EDITOR:—We are much obliged to our correspondent for calling attention to this error, which was reproduced, as he supposes, from Mr. Porter's valuable and, in general, very accurate work. Applying the correction to the problem given in our article on the properties of steam (page 81, current volume of the SCIENTIFIC AMERICAN), we find that the expansion of mercury is $61{\cdot}11 \times 0{\cdot}00010085 \times (80-32) = 0{\cdot}3$ inches, and the corrected hight of the column $= 61{\cdot}11 + 0{\cdot}3 = 61{\cdot}41$ inches. We advise our readers to make a note of this correction, and affix it to the article.

A Toad in the Solid Rock.

To the Editor of the Scientific American:

The other day Mr. Moses Gains of this place, while digging into a bank, found a toad embedded in the hard pan. He came to a stone some 2 feet square; and after digging this out, a man who was with him observed something black: taking his pickaxe, he carefully dug it out, and it proved to be a toad. It was some six inches below the surface of the stone, and its place of concealment was as smooth as if it had been made of putty. The toad was about 3 inches long and very plump and fat. Its eyes were about the size of a 3 cent silver piece, being much larger than those of toads of the same size such as we see every day. They tried to make him hop or jump by touching with a stick, but he paid no attention to them.

How came this toad embedded, 5 feet below the surface under a stone, in that hard pan? What did he subsist on? Will such toads live on being brought to the light? Is there any air in the ground, on which a toad could live, and how long must we suppose that he had been there?

New Hartford, Conn. A. W. ARNOLD.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of July, 1873:

The number of visits made during the month were 1,108; boilers examined, 2,300; internal examination, 1,112—these were very thoroughly done, including examination of bottoms and all fire sheets, as well as flues and tubes and boiler attachments; external examinations, 2,029. The hydraulic pressure was applied in 180 cases. These were, in most instances, boilers so small, or of such construction, that an inspector could not get into them; but, in addition, the hammer test was applied externally while the boilers were under cold water pressure. Number of defects in all discovered, 1,123; dangerous defects, 275. The dangerous defects were in most cases such as were liable to result in accident at any moment, and they were in many instances caused by bad management. The defects in detail were as follows:

Furnaces out of shape, 49—9 dangerous; fractures of plates, 56—20 dangerous; burned plates, 53—34 dangerous. These defects were from various causes. In some cases, the fires were too fiercely urged from insufficient boiler capacity. In other cases, the boilers were not properly constructed. The builder, anxious to provide the greatest area possible of fire surface (very likely to outbid his rival), had placed his tubes so near together that, when the fires were driven, the heat was so great that the water was nearly or quite all forced away from the iron, and, having no protection, it could not be otherwise than burned. Another difficulty: tubes and flues are often placed too near the shell of the boiler. The space is sometimes not more than one inch, when it should be not less than three inches. Even four inches would be better. There should be abundance of room for good circulation of water. We have found fire sheets, tubes, and flues badly burned from want of sufficient water space between them. Another difficulty, and one which causes many boilers to be burned, is that they are not opened frequently enough. Cleaning is neglected. Potatoes, or some solvents of scale are used in the boiler, the scales are thrown off and down into the bottom of the boiler, and, instead of having it removed through the hand-holes or man-hole, it is allowed to remain, and, becoming conglomerated, prevents the water from protecting the fire sheets, and they become burned and contorted, or, as it is generally called, "bagged" and buckled. Hundreds of boilers are injured or ruined in this way every year. Have your boilers constructed so that no tube or flue shall be nearer than three inches to the shell. If tubular, have the tubes placed in vertical rows, and not staggered—the water will circulate much more freely and the tubes can be much more easily cleaned, and scales will not be as likely to fill up the space between them. We have had some bad cases of late, where the spaces around staggered tubes were filled with scale. Cases of blistered plates, 182—31 dangerous; deposit of sediment, 261—36 dangerous; incrustation and scales, 223—15 dangerous. The danger of these defects is sufficiently explained above. External corrosion, 88—18 dangerous; internal corrosion, 52—12 dangerous; internal grooving, 28—3 dangerous; water gages defective, 72—5 dangerous; blow-out defective, 23—10 dangerous; safety valves overloaded, 29—7 dangerous; steam gages defective, 149—16 dangerous—dangerous varying from —17 to + 50. Where there space, we should say something on this defect. We have often enlarged upon it, but will leave it for a future report. Boilers without gages, 83; cases of broken and dangerously loose braces and stays, 50—21 dangerous; boilers condemned as unsafe and unfit for future use, 18.

THE railway link, of about eighty-five miles, between Cairo, Ill., and Jackson, Tenn., is progressing rapidly, and is expected to be finished about next October. On the completion of this road, Chicago will have an uninterrupted railway line to Mobile and New Orleans by the Illinois Central Railroad, over which passenger trains will run the entire distance without change of cars.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 12.

VIENNA, September, 1873.

It is with mingled pleasure and regret that we take leave of Vienna and of this vast exhibition.

Several weeks of unremitted toil—of the most fatiguing kind of toil, in which body and mind have both been severely taxed from early morning until late in the afternoon, day after day, without relaxation,—have prepared us to look with pleasure to an early departure. There is probably no severer labor imaginable than that of examining critically the exhibits here grouped in the Machinery Hall. And when the visitor has kept at his work all day, the physical exertion of walking or standing so many hours, together with the mental strain which is occasioned by the uninterupted work of examining and comparing competing machinery and novel methods, are found to be singularly exhausting. The excessive heat of the summer has also been seriously enervating. Yet probably no one can finally determine to take leave of this splendid collection of

THE WONDERS OF MODERN ART AND INDUSTRY

without some reluctance. If he is a lover of the beautiful, the great picture gallery, containing contributions from the finest collections of Europe, the statuary, and the thousands of magnificent creations scattered in every direction throughout the vast enclosure, must still attract him. Hundreds of these beautiful objects would well repay him for the time which might be required to revisit them, and scores, equally beautiful, remain yet undiscovered. If he is essentially utilitarian, he desires to investigate more thoroughly some new and interesting process, or to trace the growth of some established department of industry, to learn more of some recent invention, or to examine yet a little more fully the construction of some novel machine. Here no one is ever satisfied. The longer the exhibition is studied, the more does the student find to occupy his attention. The task, once entered upon, becomes almost as endless as the study of Nature itself, and hardly less remunerative.

The engineer, however, who attends the *Welt-Austellung* soon finds that, to learn thoroughly the lesson which he has come here to study, he must pursue his investigations at a distance from, as well as within, the exhibition limits. He finds here a splendid exhibit of machinery and of manufactured products, but, to see the processes and the methods by which these products are created, he must visit the establishments which have contributed them. We therefore propose to leave at the earliest possible moment, after the most important work is done here, and to spend the remaining portion of available time in visiting some of the most successful or most interesting of those establishments in various parts of Europe, and also, where possible, to see something of that system of technical schools which has done so much for Germany.

Taking a farewell stroll about the grounds and buildings, we have found almost as much to interest us as on the first day of our visit. Even the Machinery Hall, where these several weeks have been almost exclusively spent, seems to be still rich in novelties, and we have not yet lost interest in many objects which are now quite familiar to us. At one side, and almost unnoticed before, we find one of the most singularly interesting exhibits to be seen in the building. An old glassblower's lamp and a roughly made reel, standing before a case containing a few new but not, apparently, remarkable specimens of woven goods, form a group which does not appear at all attractive. But when the exhibitor makes his appearance and, sitting before his lamp, begins to heat and to draw out a little rod of glass and to wind off, from its red hot semi-fluid point, a thread finer than that of the silk cocoon, and when it is found that this glass thread is spun and woven like silk, and that the cloths and made up garments, and the hats and feathers, and strong flexible cords exhibited, are all made of a material which we are accustomed to regard as the best illustration of combined inflexibility, brittleness and hardness, the collection awakens extraordinary interest. Cloaks, capes, ladies' and children's hats with their elaborate trimming of ribbons and feathers, muffs of apparently a curly fur or fleece, and dozens of other articles, are shown, having all the suppleness and softness of silk, with a remarkable variety of coloring. These

GLASS TEXTILE GOODS,

the exhibitor claims, wear well; and, if soiled, are readily cleansed by washing in strong lye or dilute acid. The visitor, after examining this extraordinary collection, finds himself prepared to believe that the story told by a classic author of the discovery, by the ancients, of flexible glass has at least some foundation in fact.

In another part of the hall we meet with a train of "three high rolls," such as have now been long used by our own ingenious engineer, Holley, here exhibited as a new invention by a gentleman well known on this side of the water. In still another place, we discover the peculiar and very excellent form of bridge column, constructed of four rolled iron beams, having a section formed of the quadrant of a circle with each extremity turned outward to form a flange, which has so long been used by some of our best builders of iron bridges; this is also now claimed as a new invention here.

In some of the many cases in which well known American inventions are brought here by foreign exhibitors, they have been undoubtedly either "pirated" and adopted precisely as they have been brought out in the United States, or with slight modifications, which are usually claimed to be improvements. In other instances, the European inventor has actually produced the device contemporaneously with and independently of the American. Piracy is probably not unusual in those countries where the patent code is so incomplete and so unjust to foreign inventors, and instances of it occur quite frequently here, probably, although it is often difficult to distinguish the pirate from the contemporaneous inventor. The latter deserves as much of credit as the former does of reprobation. It is particularly creditable to produce an invention in a country where the talent for invention is so rare, and where it finds discouragement rather than assistance by existing legislation. In the majority of observed cases, however, the foreign exhibitor pays a royalty to an American patentee.

The aid which American inventors have extended to Europe is well illustrated in the agricultural halls, where

AGRICULTURAL MACHINERY,

and particularly mowing and reaping machines, are found in large numbers, all embodying the inventions of American mechanics. The English are now building some fine machinery of this class, and particularly excel in threshing machinery and steam engines for agricultural purposes, a direction in which our own people are doing too little. The German builders are also just entering upon this field. The English machinery is well built, substantial and finely finished, but American farmers would probably hesitate about adopting it on account of its weight, and would prefer our own styles which, while equally well made and quite as well finished, are much lighter and yet are exceedingly strong; and which, if rather less substantial and durable than the English machines, cost less and may be expected to last until later improvements shall have caused other styles to supersede them; that is to say, quite as long as is necessary or expedient.

Hofherr, of Vienna, is the only continental builder who has attempted to compete with American exhibitors of mowing and reaping machines. His machine, though creditable and doing good work, is far too heavy for our market and in several respects inferior to the best American machines The English builders have all declined to compete at the field trials. The official trial was therefore a contest between American machines.

The American styles of

STEAM PUMPS

are finding an extensive sale in Europe, apparently, and some firms are building under royalties to American patentees. The Earle pump is exhibited both in the United States section and by their European builders, Decker Brothers, of Canstatt. The Cameron Special pump appears to good advantage in the exhibit of the great English manufacturers, Tangye Brothers. The Selden pumps, exhibited in the United States section, seem to attract attention and to receive much commendation.

The European exhibits would not attract very much attention in the United States. The exhibition of centrifugal pumps, by the two firms of Gwynne & Co. and J. & H. Gwynne, of London, are more interesting; not so much, however, on account of the novelties to be observed there, as because of the fact that the wonderful adaptation of the centrifugal pump to raising large quantities of water, where the lift is comparatively low, has been most convincingly illustrated by these pumps.

One of these firms is now building eight pairs of pumps to be used in draining the extensive Ferrara marshes in Northern Italy, where the quantity of water to be raised is stated to be 2,000 tuns per minute—enough each minute to float a large ship—and the highest lift is 12 feet. This quantity amounts to 650,000,000 gallons per day. The pumps are stated by the agent to have disks of five feet, and nozzles of fifty-four inches, diameter. Each pair is driven by compound engines, of 27½ and 46½ inches diameter of cylinder and 2½ feet stroke of piston, furnished with steam by a boiler having more than 700 square feet of heating surface.

The proper construction of the centrifugal pump is not usually well understood by builders, either at home or abroad, and both theoretical investigations and careful experiment are probably required to assist in perfecting existing designs; but it is well known that the centrifugal pump affords the best known means of raising very large volumes of water to moderate hights, where the first cost of apparatus is a matter of consequence; and in extreme cases, as the one above given, it is the only form of pump which can well be used. The sale of centrifugal pumps in the United States, as well as abroad, is becoming an important branch of business, and when builders shall succeed in fulfilling guarantees of an efficiency, under moderate lifts, in ordinary work, of seventy per cent. they will confer a great benefit upon the world and secure corresponding rewards for themselves. Experiment and competition are gradually producing a much desired and greatly needed improvement.

As we take a last glance at the long Machinery Hall and its crowded exhibits, the embodied inventive genius and constructive talent of the world, past as well as present, we feel that we are leaving it with our task hardly commenced and with an oppressing sense of the hopelessness of any attempt to accomplish it fully, were the whole period of the exhibition available. Indeed a lifetime would hardly suffice to make the best mechanic, of the thousands who visit it, familiar with all that he probably would desire to learn.

As the Machinery Hall may be considered to contain the apparatus with which the material civilization of the world has been produced, the

EDUCATIONAL DEPARTMENT

of the *Austellung* may be looked upon as the illustration of the system of machinery by which we are to-day endeavoring to aid the advance of the more purely intellectual part of the work of civilization. The collections in this department are not as extensive as they might be, or as they were expected to be. The ordinary and standard apparatus which are everywhere used in higher schools and colleges, text books in every branch of study for all grades and in every language, maps and charts, the familiar forms of physical and chemical apparatus, are all illustrated, with some few novelties, but with rare examples of strikingly interesting innovations or improvements. The school apparatus and furniture from the United States, our American text books, the French illustrative apparatus for very young pupils, the apparatus exhibited by London and Paris makers of philosophical instruments, are all attractive and exceedingly interesting to all who appreciate the public as well as private benefits which follow the adoption of effective and truly practical methods of education. The German exhibits of apparatus for technical instruction, we have found exceptionally interesting, both as constructions and as illustrations of German methods. Models exhibiting kinematic combinations, the various kinds of gearing, elements of machines, modes of transmission of power, models of typical forms of important machines, and other models illustrating processes of metallurgy and engineering, are here in great variety. Supplied with such apparatus, our American technical schools would, with their advantages of excellence of material in their classes, probably excel any schools even of Germany, in the efficiency of the education which they would confer upon their students. A few of our professedly technical schools are already nearly as well provided with this kind of *matériel* as are the German, and one or two of our schools are even superior to the continental schools in this particular, with perhaps one or two exceptions. It will probably not be long before we may expect to find ourselves in a position to offer to our young men all the advantages at home which they now seek abroad, and, in addition, some which can only be had in a country like our own, and among a people like ours.

Here we are compelled to take leave of the great *Welt-Ausstellung*, a gigantic failure financially, but yet a stupendous creation, which entitles those who have inaugurated the scheme and who have, with even moderate success, conducted its administration to far greater credit than the world generally will be inclined to accord them.

The result of her venture may be the temporary financial prostration of her government, but it can hardly be doubted, by those who have had the privilege of visiting the exhibition and of studying its political as well as its economical relations, that Austria will eventually derive from it, directly and indirectly, benefits which will far more than compensate her for all her pecuniary losses.

There are whole groups of exhibits, and numberless articles of specially interesting character, which well deserve notice, which we have had neither time nor space to give them in this short, hastily written and ill digested series of letters.

To the *Art Journal*, the London *Engineering*, and other periodicals devoted to special branches, we must leave the task of going more fully into detail and of giving more extended descriptions than would suit the pages of the SCIENTIFIC AMERICAN. One or the other of the editors of the second paper mentioned is always on the ground, and it is a gratification to learn that the vast amount of valuable engineering information collected by them will be published, at the close of the exhibition, in book form.

In the course of our journeyings among the manufacturing districts, and when visiting the great establishments of Europe, we may have occasion to refer again to a few important exhibits, while considering the methods adopted in their production.

R. H. T.

Cement for Making Concrete.

J. S. R., of Germanton, N. C., has read our article in our issue of August 9 on "Concrete for Building Purposes," and asks what the cement is made of, etc. In reply, we have to say that the cement is made from what is called cement stone. The stone is quarried from the mountain and burned in a kiln, similarly to the process for making lime. Cement is similar to lime, and is used with the sand instead of lime, in making mortar. It is termed "water lime" in some parts of the country, from the quality it possesses of setting or becoming hard under water. It may be procured in any of our principal cities. There are various qualities of it. It should be used with as little delay as possible after burning. To make garden steps or other pieces of artificial cut stone, it is safer to employ Portland cement. This is made in England, but is imported and for sale in New York city.

AUTOMATIC RAILROAD GATE AND SIGNAL.

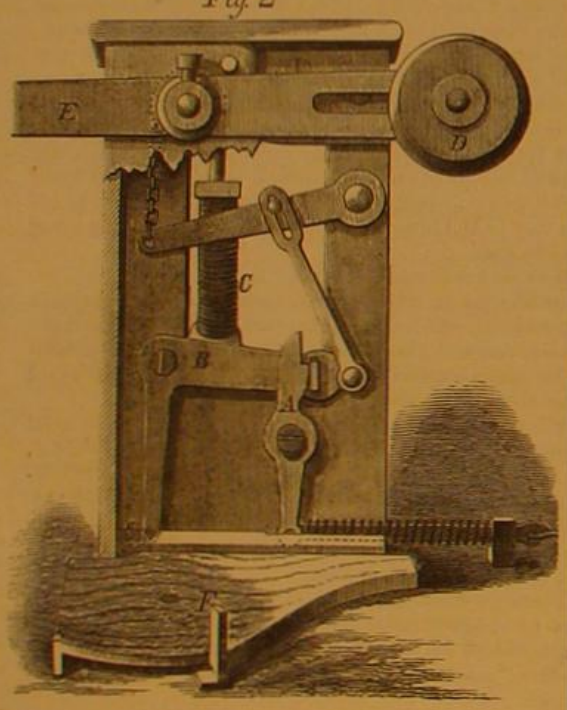
The frequent disasters at level crossings on railroads have called forth many inventions for the purpose of at once closing the roadway to vehicles and warning drivers of their impending danger; and we herewith illustrate a device, simple and apparently universally applicable, which is intended to automatically close the gates at cross roads, and to exhibit, to travelers going in either direction, an indication of the coming train.

In Fig. 1 is seen a perspective view of the apparatus, which consists of a gate, let down to the horizontal position by a coming train, and again elevated to the perpendicular by the same train when it has passed the point of danger. In the latter position, a signal, attached to the top of the bar, is clearly visible from a considerable distance. Fig. 2 shows the working of the device. As the locomotive approaches the crossing, a projection (seen in Fig. 1 close to the engine near the rails is struck by a clutch on the post of the cowcatcher; this pulls a wire or rod (laid parallel to the track and partly underground if preferred) which draws the catch, A, away from the projection on the bell crank, B, as represented in Fig. 2. The horizontal arm of bell crank, B, is thus pushed down by spring, C, and, pulling on the connecting rod and pivoted horizontal lever, shown above, turns, by the chain on the end of the latter, the pulley or signal bar, E (dotted lines), thus overcoming the weight, D, and throwing the bar down across the road. As the train comes immediately opposite the gate, the clutch on the cowcatcher strikes another projection, F, moving the lever (shown in dotted lines, Fig 2), which pushes in the vertical arm of bell crank, B. The projection on the horizontal arm of the latter is thus raised, so that, by the action of its spiral spring, the catch is drawn under and in connection once more with the lug. The pressure of the end of the catch on the latter raises the connecting levers, compressing spring, C, and allows the weight, D, to lift the bar to a vertical position, leaving the apparatus ready for the approach of the next train. The form of gate and of signal can, of course, be adapted to suit varying circumstances.



WALKER'S AUTOMATIC RAILROAD GATE AND SIGNAL.

Fig. 2



This device was patented on April 15, 1873, to Mr. Richard Walker, of Hopedale, Mass., who may be addressed for further information.

The New Straw Burning Steam Engine.

An interesting trial has been made at Vienna, before several German professors and landed proprietors, of the patent steam engine (illustrated and described on page 403 of our volume XXVIII) which utilizes as fuel straw and other vegetable products. This engine is one of the novelties of the exhibition. A 10 horse power engine was used for the experiment, making 140 revolutions per minute, and the brake was loaded for a duty of 19 horse power. 355 lbs. of straw was carefully weighed, consisting partly of straight rye and partly of loose broken wheat straw, purposely mixed in order to test the capabilities of the engine for burning all kinds of fuel of this description. It required 46 minutes to consume the straw, steam being kept up during the whole time at a pressure of 70 lbs. per square inch with the greatest regularity. This result gives a consumption of about 24·5 lbs. of straw per horse power per hour, and as an engine burning average coal under similar circucumstances would have required about 6·4 lbs. per horse power per hour, it appears that rather less than 4 lbs. of straw are equal to 1 lb of coal. In thrashing, about nine sheaves of straw are required to thrash 100 sheaves of wheat or barley. Everybody present was highly satisfied with the results of the experiment, as it has long been the desire of the eastern farmer to find some means of using steam power without incurring the enormous expense of bringing coal and wood from a long distance. This invention completes another link in the history of the steam engine, and will enable every farmer who grows more straw than he requires for the use of his estate, and who is miles from a coal mine or forest, to use steam instead of animal power, and at far less cost than hitherto.

THE DANBURY DRILL CHUCK.

This invention, of which illustrations in detail are herewith presented, is a three jawed lathe chuck, so constructed that the three jaws are simultaneously moved in radial directions by the revolution of a single right and left hand screw. The action is direct and positive, and, it is claimed, cannot clog, set, or in any way get out of order.

In the sectional views, Figs. 1 and 2, A represents the case, which is made in two parts, suitably secured together, and in the face of which are three slots for the sliding jaws, B B′ B′. Resting in bearings in the case is the shaft, C, upon and near the ends of which are formed screw threads, cut in opposite directions and extending nearly to the linear center of the shaft. It will be observed that these screws are of different pitch.

Fig. 1

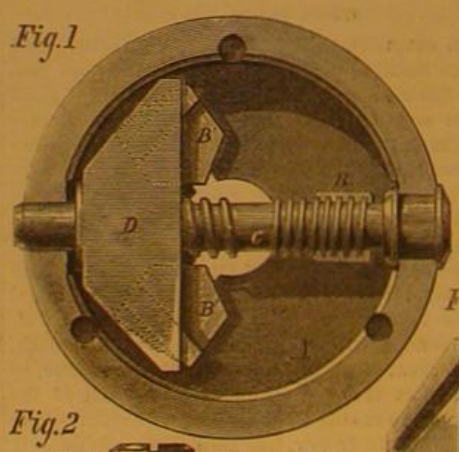


Fig. 3



Fig. 2

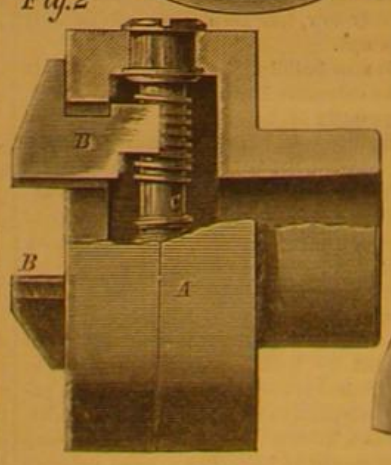
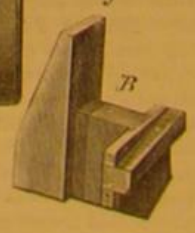


Fig. 4



The shaft, C, is directly in line with and above the slot in which moves the jaw, B; and from the section, Fig. 2, it will be understood that the latter is provided at its inner end with a segment female screw meshing with the male screw of least pitch on the shaft; so that, as said shaft is rotated, the jaw, B, is caused to approach or recede from the center of the chuck.

D, Fig. 3, is a yoke piece, through which the screw of greatest pitch passes, and thus actuates it in a direction opposite to the motion of the jaw, B. Upon its under surface are two diagonal grooves into which enter corresponding ribs on the jaws, C′, Fig. 4. As the yoke piece, D, is moved, the jaws, C′, are thereby caused to slide in their radial slots. The motion of the three jaws is made isochronous by a proper ratio of pitch between the screws on the shaft.

The main points of advantage claimed for this invention are strength, accuracy, durability, and cheapness. It is stated to be the most powerful chuck made, and to hold drills from 0 to ¼ (full size of drill). By turning down shanks to ⅛, t will retain drills up to one inch inclusive, and this, it is said, without slipping even in the most difficult work.

The chuck has now been in use for six months, giving good and satisfactory results, and is sold with a full warrant as to efficiency, etc.

Patented by Mr. C. H. Reid, August 12, 1873. For further particulars address the manufacturers, F. A. Hull & Co., Danbury, Conn.

IMPROVED PLOW ATTACHMENT.

The invention herewith illustrated is an attachment to the ordinary plow, and is designed to open furrows or channels in the soil of suitable depth to receive potatoes, and afterwards to cover the latter with earth. The device consists simply in a plate, C, pivoted and secured by a screw and nut to an elbowed arm. The vertical position of the support drops into a socket, as shown on the rear of the mold board when in use, or, when not employed, is carried by the staple represented on the plow beam. It will be understood that the furrow left by the plow is too deep for potato planting, and hence the primary object of the attachment is to partially fill the channel with the loose earth thrown up by the share. A bed of friable soil is thus prepared, excellently suitable for the germination of the seed. To cover the latter, it is simply necessary to use the plow without the attachment, the ground being thrown up and over the potatoes by the moldboard in the ordinary way.

Fig. 2

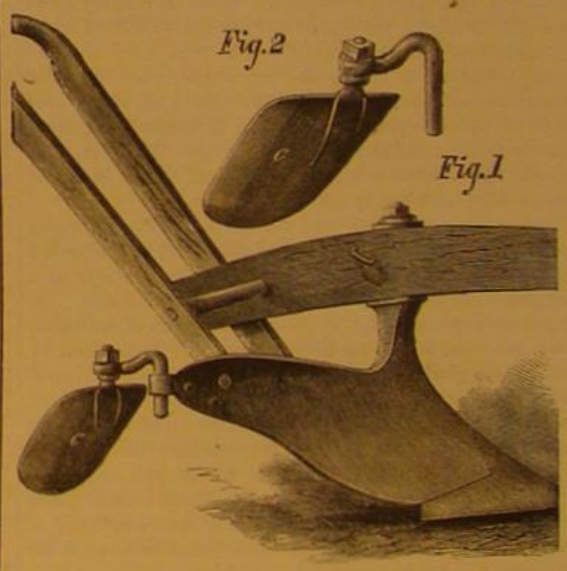


Fig. 1

The device can be placed in the socket with the end of the vertical part of the arm either up or down, it being suitably secured while in the latter position, so that the downward reach of the plate can be adjusted to plow in grain, etc., to any desired depth. Properly arranged, it is stated, the implement is well adapted for putting in manure or plowing grass ground.

The seed potatoes are of course deposited by a suitable dropper or other convenient means. It is also claimed that a result of using the invention is that the digging of the hills, when the vegetables are ripe, is attended with much less labor than ordinarily. The apparatus is simple, very quickly attached or removed, and readily adapted to the plow. The patentee is a practical farmer, and informs us that he has found it in operation a useful and valuable tool.

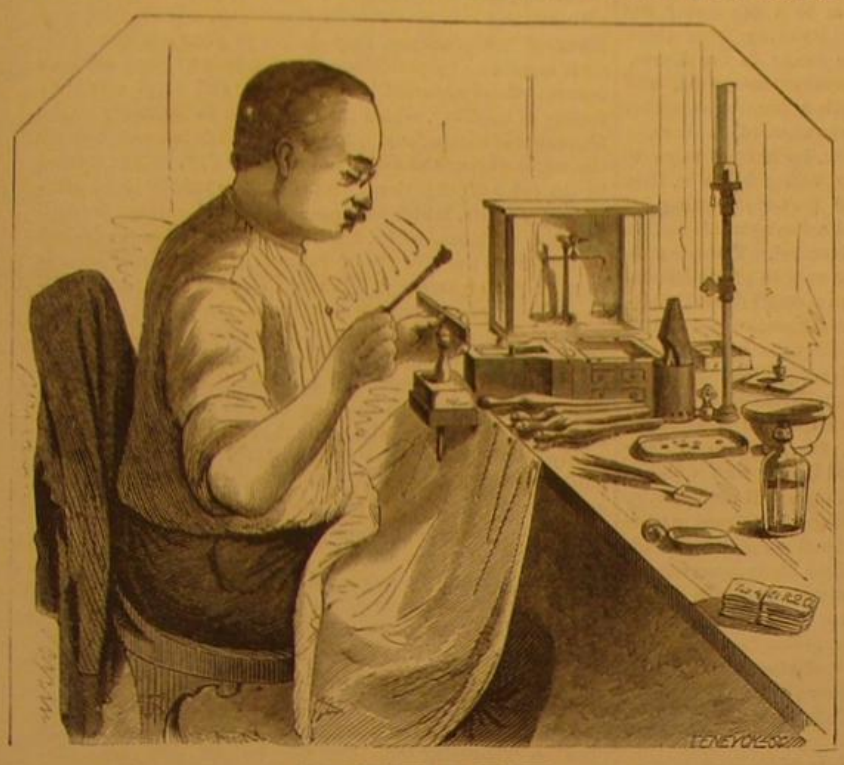
Patented through the Scientific American Patent Agency, Aug. 12, 1873, by Mr. William Donnelly, of Calverton, N.Y

NEW YORK AND LONG BRANCH RAILWAY.—The northern section of this road, the New Jersey Central's Long Branch line, is rapidly approaching completion, and, it is expected, will be open to Perth Amboy about October 1. The bridge over the Raritan between Perth Amboy and South Amboy is nearly finished. It is about 3,000 feet long.

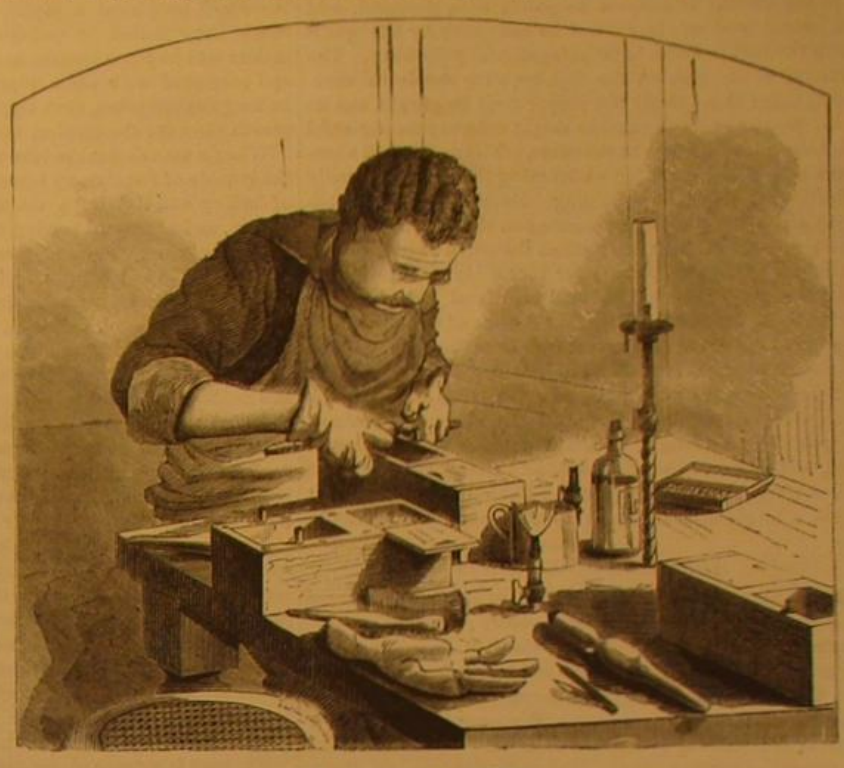
[*Continued from page* 207.]

dles. Taking a fragment of a stone that had already been operated upon, he fastened it in a second spindle in similar manner. Next, with an implement in each hand, he brought the diamonds together, steadying the shanks of his tools against two metal projections on the edge of the box before him. Applying the second diamond to the rough gem, with a quick grinding motion he rapidly cut a notch in the latter; it was hardly the work of an instant, but the line was perceptible.

At this point our curiosity prompted us to ask explanation, and suspending his labor, the cleaver showed us that there were flaws in the stone which had to be cut off and, besides, other pieces to be removed to give the gem its proper shape; so that probably, of the whole rough jewel, hardly one half would be available. We looked wisely for the flaws but utterly failed to detect them, a fact not be wondered at when we were informed by the artist that this ability constituted an important part of his art. "Indeed," he observed, "I have to know the structure of a diamond far more intimately than a physician that of the human body." As hardly any two stones are alike, and no rule can be laid down for the work, no idea may be gained of the consummate skill which enables a man to pick up a tiny fragment, glance at it once, and instantly detect not only flaws or streaks but where they are located, in the heart or on the surface, to make up his mind exactly what microscopic pieces must be removed, their size, and how they may be cut to turn them to best account, and, finally, how to so divide the stone as to produce the best color. And all this so quickly that, although we saw half a dozen stones operated upon, we asked afterwards: When the workman had examined them? We had not noticed the single swift look given at each, as one after another was split by the artist as he continued his explanations.



THE CLEAVER OR *KLOVER*



THE CUTTER OR *SNYDER.*

Fig. 4



SPLITTING THE DIAMOND.

We left the diamond, to indulge in the above digression, with a streak cut across it at the point at which it was to be divided. Placing the spindle containing the gem upright before him, the operator placed one of his knives directly over the cleft. The knife used was nothing more than a piece of steel, perfectly flat, with a square edge, and about six inches long. It is ground blunt purposely, for if it were keen, the hard stone would quickly turn the edge. Tapping the back of the blade lightly with his iron rod, the artist split off a fragment and then, melting his cement and removing the parts, showed us a clean smooth cut (see Fig. 4).

"But is not this a very risky performance?" we almost involuntarily exclaimed. "Suppose that you make a mistake?" The workman smiled superior, and explained that such is hardly possible, though he admitted that it would be a very easy matter to halve the value of a gem by a single false stroke. Imagine a $5,000 diamond—and that is not a large one—thus treated; $2,500 irretrievably lost by a single tap of the hammer! But then, with good sized stones, the work does not seem so difficult as with jewels no larger than pin heads, so small indeed that, in some cases, they number as many as 300 to the carat in the rough, or 400 finished. An idea of the relative sizes, proportionate to the weight of the stones, may be gained from Fig. 1, representing diamonds of 1, 2, 3, and 4 carats. Of course nothing is wasted; the dust that falls through the false bottom of the box, we shall find again in the hands of the polishers, while the odd scraps are cut into rose diamonds, or the little sparkling grains used for inlaying initials and similar fine work in gold jewelry.

Fig. 1



THE SHAPES IN WHICH DIAMONDS ARE CUT.

Leaving the *klover* at his delicate labor, we were afterwards conducted to the cutter or *snyder*. Three workmen were engaged in shaping the diamonds after the rough forms indicated by the work of the cleaver. Regarding these shapes, a word is here necessary. The brilliant (Fig. 2) displays the luster of the stone to the greatest advantage, and is described as obtained by two truncated pyramids united together by one common base, the upper pyramid being much more truncated than the lower. *a* is the crown and *e* the collet, the two principal divisions formed by the girdle, *c*. *d* is the table, and the opposite side below, the culasse. The faces are called facets, and, including table and culasse, may number sixty-four. The rose diamond (Fig. 3) has a crown but no collet, that is, one side is flat; and it is usually made from stones and fragments which would not, without loss, form good brilliants. Then there are table diamonds, which are flat and have little luster, and bastard diamonds or those of mixed shape. The brilliant and the rose are the general types, and those with which we have in the following description to deal.



THE SETTER.

THE CUTTERS.

Our artist has graphically depicted the cutter at his work in the engraving. The same form of box used by the cleaver is before him, and the diamonds are fastened by cement, as before, in the ends of spindles. The cutter's labor is purely "diamond cut diamond." The stone to be cut is held in its setting firmly in the left hand, while the cutting piece is moved by the right. Both gems are of course affected by the mutual abrasion, but the attention of the workman is directed to but one. Very slowly the faces are ground away; no measurements are taken or angles calculated. The eye is the only guide, and it seems to be a faultless one. As soon as the first stone was finished, the diamond used for cutting it is operated upon, so that diamond No. 2 is, in turn, cut by No. 3, this by No. 4, and so on. Again the gems were handed to us for examination; all their mica-like sheen was gone; and, were it not for their form, they presented no different appearance from rough quartz pebbles. The friction dulls them, for they are ground together with considerable force, the workman being obliged to protect his hands by thick coatings against the rubbing action of the tool.

POLISHING THE DIAMOND—THE SETTER.

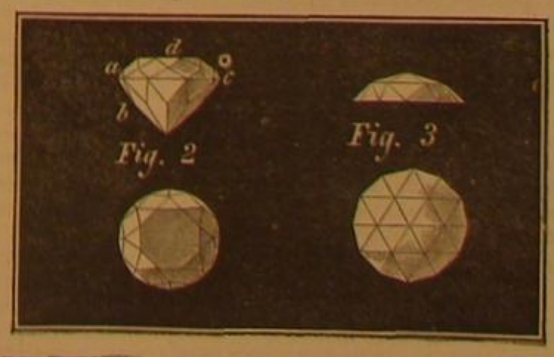
The polishing operation next claimed our attention; and ascending to an upper story, we found the polishers or *slypers* at their work, each man with a machine before him, as represented in the large engraving on our front page. In addition to these workmen is the setter, and with him we have first to deal. At one side of the room was a small charcoal furnace in which a number of metal acorns seemed to be roasting. Each of the latter consisted of a copper cup about an inch and a half in diameter, provided with a stem of stout wire of the same metal and filled with plumber's solder. As these rested on the glowing coals, the setter occasionally tried the hardness of the solder with his forceps until the metal became of about the consistency of putty. Quickly removing an acorn, or, to use the technical name, a "dopp," from the fire, he placed it upright in a small stand. Then he fixed a diamond exactly in the center of the plastic metal, and, with his fingers, coolly molded the latter in conical shape around it. Burning seemed to have no terrors for him, and although when the dopp was plunged in water it hissed at a great rate, the hand of the workman showed no effect of the heat. Each brilliant, large or small, has to undergo this operation once for each facet; that is, the setter must reset it so that every one of its facets in succession may be exactly horizontal and outside the holding metal, in order that each face may receive its proper polish—an operation requiring no small amount of delicacy and skill.



THE DOPP.

THE POLISHERS.

Again referring to the large engraving on our front page, the polishers were seated before long tables, on which were swiftly rotating horizontal disks fastened on vertical spindles, the lower ends of which revolved in antifriction steps. The disks, we were told, revolved at the rate of 2,000 turns a minute, and yet the bearings kept perfectly cool. The machine is an invention of Mr. Hermann's and an improvement upon the old apparatus used in Amsterdam, a specimen of which he exhibited to us. The construction of the latter



seemed very rude and primitive, being formed almost entirely of wood: the bearings, it is stated, were continually heating and wearing out.

The disks or *shives* are circular plates of a composition containing both iron and steel, and are made and turned in the establishment. They are ground in lines, at an angle from center to circumference, so as to hold the oil and diamond dust used in the polishing operation.

Three diamonds, set as above described, are ground at once, by each polisher. The stem of the dopp is fastened in tongs or clamps, the extremity of the latter being supported by legs an inch or so high. Two thirds of the dust ground off in the cutting is allowed to polish each diamond, and this, mixed with oil, is applied to the stone by the quills which the men seemed to be phlegmatically chewing. The adjusting of the gem on the disk requires wonderful accuracy in order that exactly the proper facet be ground and no more; for the slightest mistake might cut away an angle and produce serious damage to the stone. The reader will share in the astonishment we felt on learning that this extremely delicate work was done by feeling. So sensitive is the touch of the artist that he tells by pressing on the stem of the dopp exactly whether it lies true against the shive or not, and by his fingers adjusts the stone over incredibly minute angles and distances. This goes on until each facet is brought to the requisite brilliancy. Standing by one of the machines, we saw, as the diamond was removed from time to time from the disk, the bright spot on its dull face gradually enlarge, as heavier weights were put upon the tongs to press the stone with increased force against the shive. Sometimes the gem defies all efforts, the hard outer coating refuses to yield, and then it is passed from hand to hand, and for weeks each workman tries to conquer it. Sometimes they fail; at others, a bright spot at length appears, and the difficulty is over.

RENEWING INJURED STONES.

It is to this portion of the establishment that injured stones are sent for repairing. We were shown a number of diamonds that had been through the Chicago fire. They had become intensely heated and then suddenly cooled. A white hard film had formed over them, necessitating as careful repolishing as the unfinished gem. We were told that it is a common fault among jewelers to thus hurt the stones during the process of setting them. The difficulty can be easily avoided by allowing the diamonds to cool gradually instead of plunging them at once into cold water. It is the sudden transition and not the heat that does the injury.

ABOUT THE WORKMEN AND THEIR PAY.

Our examination here concluded, for polishing is the last process. The workmen, numbering thirty-five in all, we learned, were all Israelites, and, with the exception of the cleaver, were paid by piece work. Their wages reach from 60 to 200 dollars a week, depending on the skill and experience of the artist. The greater number of carats manipulated and the more diamonds there are to the carat, the higher the price paid for the work. The establishment is necessarily organized with great strictness, and every diamond is weighed, registered and fully traced throughout its entire course. Large and valuable stones, before being operated upon, are made the subject of a consultation between the head of the company, the cleaver, chief cutter and chief polisher. Each gives his view, and thus the question of shape, color, etc., is carefully determined.

WHERE THE DIAMONDS COME FROM.

The diamonds are principally imported hither from Brazil. South African gems have caused no very marked effect in the market. They are fine, but, it is stated, more difficult to cut than those from South America. The Arizona swindle created considerable excitement when the first "salted" stones reached the trade, but of course the dismay of the diamond merchants was allayed when the fraud was exposed.

DIAMOND CUTTING IN ENGLAND.

We notice that diamond cutting has recently been introduced in Birmingham, England, where there is every prospect of the art reaching a flourishing state. Recent advices also inform us that a huge diamond has been discovered and brought from the Cape. It weighs 288⅛ carats in the rough, and when cut will be half as large again as the world renowned Koh-I-Noor.

PROSPECTS OF THE ART.

We see no reason why the art which we have described should not grow in this country to be an important branch of national industry. To Mr. Hermann, now the President of the New York Diamond Company, a corporation of wealthy gentlemen, founded by himself, belongs the credit of its establishment among us, and the consequent enabling of the artisans of the United States, who may be instructed in his *ateliers*, to compete with and successfully rival the monopoly which, for centuries, has maintained an exclusive and undisputed supremacy in the old world.

The Smokometer.

We have heard of the idea of laying oxygen in pipes through dwellings for purposes of ventilation and purification of the air, of the scheme for similarly supplying carbonic acid for the extinguishment of fire, and of the ingenious proposal to supply milk to our dwellings through conduits leading from suitable reservoirs. Further still, we have perused the glowing prospectus of the electric piano inventor, who proposes to give us the means of turning off or on a flow of music as easily as a stream from a water faucet, and we remember having read of the telephone by which the choicest vocal efforts of celebrated singers might be brought into our parlors as easily as the voice of the Bridget hailing us from the nether world through the speaking trumpet. But now we have found an idea which surpasses all. According to the *Virginia City Territorial Enterprise*, a Professor Maulesel is going to erect extensive works similar to those of a gas company. In these, there will be large retorts in which tobacco will be burned, and the smoke thus produced will pass through proper pipes to a large bell shaped receptacle, similar to a gasometer, where it will be cooled and purified and so scented as to have the flavor of the finest Havana cigar. From the smokometer a main pipe will lead up into the city, and from this will be small branch pipes leading to all the principal houses and saloons in the town. In every house where the smoke is taken, there will be placed a meter, similar to a gas meter but much more delicately constructed. Running from these meters will be pipes leading to all the rooms in the house, and connected with these pipes, at convenient points, will be long flexible tubes, each tipped with a handsome amber mouth piece for the comfort and convenience of smokers.

When a man desires to take a smoke, he has not to go to the trouble of hunting up tobacco and filling his pipe, then of finding and lighting a match, and perhaps burning his fingers, and afterward getting fire and ashes upon his clothes half a dozen times before his smoke is ended. There is none of this trouble and vexation. He has only to place the amber mouth piece between his lips, turn a small silver thumbscrew, and the cool, delicious, perfumed smoke glides into his mouth. By this ingenious and delightful arrangement, all danger of fires from pipes and cigars will be obviated, and millions in valuable property annually saved.

An india rubber receptacle filled with smoke is arranged in the breast, inside the shirt bosom, for smokers to draw from while walking in the street; and ladies, with whom it is conjectured the delicately flavored fumes will become very popular, are to have for their use elegantly carved amber mouth pieces, hooped about with gold and set with diamonds and other gems. When out walking their reservoir of smoke will be contained in the pannier, to which it will impart a much more symmetrical shape than can be attained by the use of newspapers; besides, by giving the rubber of the smoke tank a suitable thickness and strength, it will be found to be very convenient when the wearer desires to sit, as it will serve as a cushion, a something which is often a great convenience and comfort.

Maulesel is a name as yet unknown to fame; and it may be noticed, as a coincidence quite remarkable, that the generic name of the ingenious idea is contained in its last syllable. The Professor, we presume, is somewise connected with Professor Cantell A. Biglie, who recently aroused popular curiosity in this city by announcing, in widely distributed handbills, an aerial flight from the steeple of Trinity Church.

Three Hundred Miles of Oil Pipes.

The system of transporting oil, by means of pipes laid over moderate distances, has been in practice in the oil districts of Pennsylvania for several years, proving a convenient means for carriage and a profitable investment for large amounts of capital. While the success of the scheme has thus been demonstrated as applied to comparatively small sections of country, it remains yet to be determined whether the project can be carried out on a gigantic scale over more extended space. With the late discoveries in Butler county, Pa., it appears that interest in the plan, suggested we believe some years ago, has revived, and the idea of transporting oil through iron pipes, from Titusville over the Alleghanies to Philadelphia on the sea board, a distance of 260 miles, is now exciting considerable attention.

Mr. G. W. Platt, an engineer quite well known through out the country from the fact of having superintended the construction of the Holley waterworks system in various cities, gives, in a letter to the *Titusville Herald*, detailed specifications for the construction of a huge conduit of this description. He considers the scheme entirely practicable, and estimates its cost at $4,406,150. It is proposed to lay a cast iron six inch pipe, in a bee line between the points above named, which at one locality of its route will be 3,000 feet above the sea level; 40 miles of pipe will be allowed for undulations, so that the tube will, from end to end, measure fully 300 miles. Its contents will be 37,000 barrels of oil, and it is asserted that there will be no more difficulty in ensuring a flow through the bore than there now is in the water mains of London or Chicago, both of which systems each aggregate 300 miles in length. Between Titusville and the summit, a distance of 40 miles, eight pumping stations will be established, so as to relieve undue strain on the pipe. Each pump will have to raise the oil 300 feet. Water by the Holley plan of piston pumps is elevated to this hight, and the friction of eight miles (the space between stations) is overcome at the rate of a million gallons per twenty-four hours, which is equivalent to 23,000 barrels of oil, fluid measure. The cost of the five pumps, machinery, etc., is estimated at $50,000; in addition to which, there must be as many tanks of 25,000 gallons capacity, each costing $72,500, and finally a huge 100,000 gallon reservoir, worth $50,000 more at the summit.

Mr. Platt enters into detail regarding friction with the tube and other drawbacks, which, however, he proposes to obviate at once by establishing, if necessary, more pumping stations: and he finally concludes that 23,000 barrels may be delivered every twenty-four hours, at ten cents per barrel. He figures up the profits as follows: The pipe would deliver 7,300,000 barrels of oil per annum, which, at a transportation rate of 50 cents per barrel, would yield $3,650,000. The cost of running, together with interest on capital, amounts to $412,717, giving, therefore, a profit per annum of $3,237,738, supposing the line to be run at its full capacity. The pipe could be thoroughly tested with water and thus leakage obviated, while, it is believed that, it would be as indestructible as an ordinary water main. The loss from other sources of waste during transport, it is further considered, would not be so great as is now the case in the regular tank cars.

A Word to Apprentices.

"Forfex" gives our youths the following advice: "Education is the basis of all success in life. It is much to your interest to recognize this fact as early as possible. Your shiftless, elder companions in the shop will tell you that affluence and ease result from mere luck. With display of dignified independence, they challenge your admiration for their manliness by proclaiming themselves as good as those persons whose apparent leisure, luxury and dress awaken a feeling of hostility, which they endeavor to intensify by the bitterness of comparison. As you have little intercourse with the world during the active hours of the day, unless warned by the voice of experience you are apt to imbibe these hurtful impressions, which indicate vindictive jealousy, the consequence of dense, wilful ignorance. The senseless discord that destroys the identity of interest of capital and labor is born of such parentage. Persons advocating these sentiments are generally men who ridicule the efforts of young mechanics desirous of self improvement. They harangue idle crowds at strike meetings and demonstrations, which they are pleased to consider, in spread-eagle phrase, 'the efforts of downtrodden working men to achieve their independence.' Drinking saloons are the chosen theaters of their wordy disaffection. They crave applause, and endeavor, by mock heroism, to entice you to places where lost time and squandered earnings are not the only expenses; for, under their tuition, the root of false principles is made to flourish in the soil of intemperance. Such influences should be shunned as carefully as we avoid a loathsome disease. Every man will gravitate to the sphere of life for which his acquirements fit him, and neither higher nor lower. Those sterling men round us, who represent the wealth and weight of a great people, are but reaping the reward of time well spent; and could we retrace the course they have pursued, we would find the student's lamp illuminating the hours that end days spent in exhausting toil. You may be told that many educated men achieve but little in the great struggle of life; yet would they not have done much less if they had been aided by the brute force of ignorance alone? We know of a man, now occupying a position of responsibility under the government, who, some years since, broke scrap iron with a sledge for a foundery and axle forge, day after day, unsheltered from the weather; yet he found time to read at least one hour per day, as well as to educate himself in useful branches of learning. His first expenditure for mental improvement purchased a Webster's Dictionary, a year's subscription to a leading scientific journal, and a daily newspaper. He now owns a library which would do credit to a university, and he is known to and esteemed by our most prominent citizens. A different course when a young man would have enrolled him in that army which stupidly drudges out a mere existence.

As you value your future happiness, devote as much time as you reasonably can to education. Throw away your boxing gloves, for the exercise which they afford can be had from other sources, without pernicious associations. Let your shop mates dub you 'a flat,' if they choose, because you resign billiards, and know nothing of the mysteries of keno; and spend your evenings in the peaceful acquirement of knowledge, which brings length of days, and tranquillity unembittered by the experiences of the mere sensualist."

New and Remarkable Cannon.

The German journals announce that the recent trials of new guns on iron plated targets, which took place at Tegel, near Berlin, fully satisfied all expectations. The shot from the 11 inch ring cast steel gun penetrated an iron plate 12 inches thick, that from the 10 inch gun of the same pattern an iron plate of 11 inches, and there was force to spare in both cases. At Krupp's works, at Essen, trials have been made with the newly constructed 30½ centimeters (12 inch) ring cast steel gun, and the result justifies the belief that this gun will pierce 14 and perhaps 15 inches of armor. Thus, the strongest ironclad now existing, her British Majesty's ship Devastation, which is provided with an armor of 14 inches, will no longer be invulnerable if opposed to such guns.

Church Clocks and Chimes.

W. M. says that the Church of the Holy Redeemer, on 3rd street, between avenues A and B, New York city, has a very interesting clock. This specimen of workmanship was made in 1869, by Edward Emrich, of Rochester, N. Y. The movement is guided by an anchor escapement with solid jeweled pallets; the wooden pendulum is a 2 second one, its length being 14 feet; the weight of the movement is 100 lbs.; the hour-striking part has a weight of 600 lbs. and the hammer striking the bell weighs 32 lbs. The quarter striking part has 500 lbs. weight, bearing three levers for the three hammers striking the four quarters. The wheels of the clock are made of fine bronze and are as well finished as a watch. The dials are 8 feet in diameter and the figures are cast in composition. The same maker also finished in 1869 the clock and attachments to the great chimes of St. Joseph's Cathedral in Buffalo, N. Y. The chime numbers 43 bells, which were cast at Le Mans, France, and were ordered and imported by the late Rt. Rev. Bishop Timon, of Buffalo, after being exhibited in the World's Fair in Paris, 1867.

Secondary Spectra.

Professor O. N. Rood, of Columbia College, New York city, communicates a paper to the *American Journal of Science and Arts*, on the secondary or residual spectrum found on passing a ray of white light through two prisms of different substances arranged to compensate each other for color. This secondary spectrum is generally of small dimensions and peculiar appearance, and is due to the circumstance that the spacing of the colors in the two original spectra is not accurately correspondent. In dimensions, it varies with the amount of the disproportion of the original constituents.

The writer, after alluding to Sir David Brewster's investigations in the same direction, observes that, by proceedings of a different kind, he has succeeded in producing secondary spectra, comparatively gigantic in size, which display the fixed lines with a distinctness which allows the study of their peculiar construction by an ordinary spectroscopic mirror. The constituents used are one spectrum furnished by oil of cassia, bisulphide of carbon, or even flint glass, and the other a normal spectrum obtained by the diffraction grating. Thus it is considered that a very near approach is made to the maximum difference of spacing attainable in the present state of optical science; and hence to the secondary spectrum is given its maximum dimensions.

The lines of the solar spectrum not being adapted for the study of the arrangement of the secondary spectrum, a number of chemical lines of easy identification were selected. The cases considered in experimenting were three. 1. Where the opposing spectra are of equal or nearly equal lengths. 2. Where the spectrum from the grating predominates. 3. Where the prismatic spectrum is the longer of the two. Measurements are given, in each instance, of both primary spectra, also of the actual secondary spectrum due to the same in combination, and of the secondary spectrum obtained by construction. In the last case, Professor Rood finds that the distance of any two lines apart in the secondary spectrum will be equal to one half the corresponding distances in the primary constituents; and that the secondary spectrum, thus constructed, will always be half the size of the actual physical spectrum which it represents. From this, he deduces a formula by which, taken in connection with maps of the primary spectra, he is enabled to construct a correct map of the secondary spectrum in any case.

This construction furnishes a simple means of determining the size and arrangement of the secondary spectrum furnished by two prisms of selected angles, placed in any desired positions relative to the incident ray and to each other. The accuracy of the result depends on the exactness with which the measurements on the primary constituents are effected, and, it is considered, may practically prove useful in dealing with the secondary spectra in optical instruments.

In order to reveal the nature of the secondary spectrum at a glance and permit of its study in a qualitative way, instead of using the slit as a source of light, a pin hole is employed; and the refraction edge of the prism being vertical, the diffraction grating is revolved in its own plane, somewhat so that its lines shall be no longer vertical. This process reduces the secondary spectrum to a line which, on rotating the grating or prism, assumes various curves. It is considered, therefore, that a true secondary spectrum must be regarded as a resultant spectrum in which any two, even closely adjacent, lines are united; even although the actual union of different tints has not been effected and the general appearance still resembles that of one of the primary constituents.

A Trap to Catch Lions.

In Algeria, there is annually a great loss of life and property, by the depredations of lions. The loss of property is estimated at $50,000 a year. The inhabitants cut away the forests as a means of protection against the wild beasts. M. Cheret devotes himself wholly to their extermination. As an assisting means in this, his life work, he has invented a lion trap, made as follows:

The frame and bars are of iron. It is 10 feet long, 6 feet 6 inches wide, and the same in hight. Mounted on three cast iron wheels of small diameter, it can be moved on difficult ground. The upper part opens with folding doors, like a wardrobe, which close of themselves at the slightest shock given to springs of steel. Catches retain the lids as they fall, and imprison the animal as soon as he touches the bottom of the trap. The plan is to place this trap, properly baited, on the ground frequented by the wild animals, and then, when the game is caught, to wheel the machine away to some menagerie prepared for the purpose.

Fatalities from Lightning.

The human mortality from lightning is not generally on a large scale, and might be very much reduced by precautions on the part of builders; so thinks the *Building News*. Arago estimated that the number of deaths from this cause amounted in France to about 70 in the year; Bondin calculated that from 1835 to 1852 1,308 so perished; none in November, December, January, and February, but most in June and August. The lowest rate is assigned to Belgium, and the next to Sweden, the United States and England being about on a par. As a rule, however, these fatalities do not occur inside a structure of any kind. The peril, as experience shows, is less in a crowded town than in a village or in the open country, and, naturally, the more elevated structures are the most liable to be struck. Fuller, indeed, in his "Church History," asserts that there scarcely ever existed a great abbey in England which had not been, at one time or another, wholly or partially destroyed by lightning, and his citations, taken in comparison with the records of our own times, are certainly remarkable. In all cases it is the spire, the tower, and the dome which has been mutilated. As to ordinary habitations, all sorts of theories are in vogue on the subject of danger and safety. Some rely on thick glass in the windows, and some on register stoves; others recommend stone roofs instead of slate, and others tell timid people that they should live in a hollow. It is contended on this side that there should be the least possible admixture of metal in the combination of an inhabited structure; and on that, that all the bells beneath the roof should be kept continually ringing, just as, in obedience to an old superstition, cannon are fired at sea. The mass of evidence upon this topic points, however, to the one conclusion already suggested, that a good lightning conductor is the solitary safeguard; but that, unless good, it is worse than none.

Cumberland Gap Cave.

A correspondent, A. L. S., says, in reference to this remarkable formation, described in our issue of September 13, that, after General Morgan's retreat from that spot, the cave was explored for a distance of four miles by Confederate soldiers, and a new opening was discovered, 3 miles from the one mentioned by H. B. N. The place has never been thoroughly investigated, but chambers, far surpassing in grandeur that described by our earlier correspondent, have been found. In penetrating the rock, it is found that the new entrance leads for 6,000 yards through sandstone; and in this section of the cave, vast quantities of human bones of gigantic size were found, some of the skulls being large enough to put on over a man's head. It is intended, during the current month, to thoroughly explore the cave.

NEW BOOKS AND PUBLICATIONS.

PHYSICAL GEOGRAPHY. By Arnold Guyot, Author of "Earth and Man." New York: Scribner, Armstrong, & Co.

This is a very excellent work on a most interesting branch of study, and is a model school book, full of accurate information, placed before the reader in a lucid and concise style. It is well illustrated with maps and wood engravings.

A CATECHISM OF HIGH PRESSURE OR NON-CONDENSING STEAM ENGINES, including the Modeling, Constructing, Running and Management of Steam Engines and Steam Boilers. By Stephen Roper, Engineer. Philadelphia: Claxton, Remsen, & Haffelfinger, 624, 626, and 628 Market Street.

This is yet another handy book on the steam engine, and it contains much needed general information, as well as descriptions of many American improvements and specialties.

PRACTICAL DESIGNING OF RETAINING WALLS. By Arthur Jacob, A. B., A. I. C. E., late of H. M. Bombay Service. Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From August 29 to September 4, 1873, inclusive.

BLOWER.—P. S. Justice, Philadelphia, Pa.
BURNISHING PHOTOGRAPHS.—G. P. Critcherson, Worcester, Mass.
ELECTRIC TELEGRAPH.—J. B. Stearns, Boston, Mass.
GAS.—W. Steers, New York city.
PRINTING PRESS.—G. F. Pabst, New York city, *et al.*
RAILWAY CAR SPRING.—H. Gardiner, New York city.
SEPARATING METALS.—S. W. Kirk, Philadelphia, Pa., *et al.*
SEWING MACHINE.—J. Knous, Hartford, Conn.
SURFACE CONDENSERS.—J. P. Bass, Bangor, Me.

Recent American and Foreign Patents.

Improved Hame Fastener.

Thomas L. Booker, Shady Grove, Va., assignor to himself and E. H. Booker, Donaldsonville, S. C.—The object of this invention is to provide ready and convenient means for adjusting and fastening hames on the collars of horses and mules; and it consists in a connecting band, screw bolts, and clips at the ends of the hame. The invention is specially adapted for draft horses, and for plantation use.

Improved Rotary Churn.

William H. Bunch, Windsor, N. C.—The body of the churn is provided with a closely fitting cover, to the lower side of which, upon the opposite sides of its center, are attached wings or stationary dashers. These wings are made curved upon the side against which the milk dashes.

Improved Picture Hangers.

Franklin W. Ely, Duluth, Minn.—The picture frame has a web attached to it at two points, one being below the center of the frame or picture, and the other near the top. The web, similar to suspender webbing, is doubled at one or both points where it is attached to the frame; but to outer portion a ring is attached, with which the suspending cord is connected. The use of the slide is to vary the inclination of the picture or frame. By moving the slide upward, the web is shortened, and the frame is brought nearer to an upright position; and when the slide is moved down the effect is contrary.

Improved Candlestick.

Samuel D. Hill, Downieville, Cal.—This invention consists in arranging the socket of the candlestick for different sizes of candles, by making it in two pieces connected by a slotted band spring.

Improved Metallic Lathing.

Timothy O'Callahan, Boston, Mass.—The object of this invention is to furnish an improved metallic sheathing for the inner walls of buildings. The ceiling and side walls of a building may be covered with sheets of cheap metal, having stamped, cast, or otherwise connected to its face dovetail shaped studs. The studs are in the shape of truncated pyramids, with face recesses for the firm adhesion of the plaster to be placed around and over them. These sheets are to be nailed or otherwise secured to the wall. Much less plaster is required for filling the space between the studs than for covering the ordinary lathed wall, and the work is performed in less time, while the plaster dries quicker, and is not so liable to crack.

Axle Box and Sleeve for Vehicle Wheel.

William H. Cowell, Columbus, O.—In this invention the axle is made of wood and the skein is fitted to the axle in the usual manner. There is a nut on the outer end of the skein and the sleeve is made of sheet metal and fitted on to the axle over the skein. A recess opens in this sleeve for the retention of the lubricating material. The interior of the pipe box is chambered out for containing the lubricating material, and the box is cast on a chill, to render it hard and durable. The sleeve may be made of sheet steel or composition metal, and not being confined, except by a lug or other device, to prevent its revolving with the wheel, it may be turned, when worn, upon one side, thus presenting a new surface for the bearing.

Improved Advertising Lamp.

Francisco B. Warner, Paris, France.—This invention consists of a metallic frame of peculiar form, adjustably attached to a lamp post and provided with removable glass plates, upon which the advertisements are displayed.

Improved Portable Steam Engine.

Reinhard Scheidler and John H. McNamar, Newark, Ohio.—This invention consists in the improvement of the heaters of portable engines. The pump is arranged in a vertical position on one side of the boiler near the smoke pipe, attaching it to a vertical supporting plate having a concave side, fitting the boiler and bolted to it; also having a bearing at the upper end for a countershaft for driving the pump, said shaft extending across the top of the boilers, in front of the smoke pipe, to a bearing on the other side, where it carries a pulley for turning it by a belt from the crank shaft at the front end of the boiler. The plate is detachably connected to the boiler, so that it can be taken off readily for shipping. The portion of the shaft having the crank for driving the pump connects with the other portion by a cluten which is shifted by a lever, so that the pump can be worked or not, at will. This arrangement is claimed to afford a simple, compact, and reliable connection of the pump in a portable engine, so that it can be stopped without stopping the engine whenever it may be required to do so, which often happens, and causes considerable unnecessary delay in all portable engines having the pump directly connected to the cross head in the ordinary way. Moreover, it saves the unnecessary loss of power expended in running the pump when it is not required.

Improved Mallet.

Albert Holbrook, Providence, R. I.—The object of this invention is to furnish a durable rawhide mallet for the use of machinists and others in putting together, taking apart, fixing, or adjusting metallic or wooden machinery, and for all similar purposes. It consists in a mallet with one or more rawhide heads secured in a metallic socket, which is made of metal in one solid piece. The handle is secured in the socket in the ordinary manner. The socket or body has a recess at one or both ends which receives the heads. These heads are made of rawhide coiled up and dried, and then turned to the desired size and shape, and secured by means of a screw inside the socket.

Apparatus for Preserving Beer on Draft.

John W. Moore, Bellefonte, Pa., assignor to himself and P. Gray Meek, of same place.—This invention relates to means for introducing air into casks to take the place of the liquid drawn out; and it consists in the combination, with a flexible bag or air holder, of a valve and bellows mechanism of a novel construction. Into the bung hole of a cask containing beer or other liquid that would be injured by contact with air is fitted a hollow bung having a nozzle formed upon its inner end, to which is secured the mouth of the bag, made of rubber or other suitable material, and of sufficient size and elasticity to fill the cask when expanded. By this construction, as the liquid is drawn out of the cask, the air will enter the bag through the hollow bung and expand said bag to take the place of the liquid drawn out.

Improved Extension Table.

Christian Rieger, Morrisania, N. Y.—This invention consists in extension rails, hinged to the rails of the side table, and to extension legs. These extension rails are each made in two pieces, connected together by pivoted strips on the bottom and top of the rails. When the rails are extended, they are held in position by means of knob buttons. These buttons are attached to one part, and turn on a central pivot over on to the other part, thus holding the two pieces parallel with the rails of the side table. The cover of the table is in two parts, hinged together like ordinary card tables. When the extension rail is drawn out, the half of the table top is turned over on to it, thus making a square table. When the extension rails are folded, they are in a position with the half of the top turned back and resting on the other part of the top. There is a spring catch on the bottom of the drawer frame which engages with a lip on the side rail which holds the parts securely together. When the table is extended, the rails of the four sides present a uniform and finished appearance.

Improved Corn Planter.

William Mull, Rantoul, Ill.—In this invention the seed hoppers are attached to the frame of the machine. The ends of the dropping slide enter the lower parts of the hopper through holes in their inner sides. A spring has its upper end attached to a cross bar of the frame, and its lower end enters a hole in the dropping slide, to bring said slide back to its position when released from the device that moves it. To the slide, toward one end, is pivoted the end of a connecting rod, the other end of which is bent at right angles, passing through a short curved slot in a wheel or disk, and is secured in place by a nut or other convenient means. The wheel or disk is attached to the end of a short shaft which revolves in bearings attached to a cross bar of the frame, and to its other end is attached a bevel gear wheel, the teeth of which mesh into the teeth of a similar wheel attached to the axle, which revolves in bearings attached to the frame, and to its ends are rigidly attached wheels, so that the said wheels may carry the said axle with them in their revolution. In each end of the axle, at a little distance from the wheels, is formed a universal joint, so that the said wheels may accommodate themselves to the surface of the ground, however uneven said surface may be. A further use of the joint is to enable the wheels to be lifted by levers and rods when the machine is to be turned about, or the discharge of seed requires to be arrested.

Improved Door Fastener.

Henry Orcutt, Amherst, Wis.—This invention consists in applying a semicircular bar to a door and arranging a weighted lever to engage therewith (the bar being notched or perforated for the purpose), so that the door may be locked in any position, shut, open, or partly open. The contrivance is designed more particularly for stable, carriage house, barn and shop doors but it is alike applicable for doors of dwelling houses.

Improved Steam Generator.

Harry P. Wright, Bonaparte, Iowa.—This invention consists of secondary return flues, arranged in the masonry along the sides of the boiler, above the furnace, into which the heat is turned at the front of the boiler, instead of discharging into the smoke stack, thus economizing the heat by causing it to pass along the boiler once more than in other arrangements.

Improved Fireproof Shutter.

John B. Cornell, New York city.—This invention consists of a door or shutter composed of three plates of metal united together side by side, the two outer sheets being plane, and the middle one being bent in zigzag or other form, so as to form channels or spaces between it and the outer sheets for the circulation of air or water to cool the door or shutter in case it is exposed to fire, and prevent the transmission of heat through the door.

Improved Earth Boring Machine.

Joseph Burns, Anamosa, Iowa.—In this invention the square auger shaft has a screw point fixed in it permanently. The lower part of the screw auger is fitted so as to be adjusted relatively to the point, to use said point with it or not, and will have a set screw to fasten it where it is required to be. The upper part of the screw auger is arranged to slide up and down freely, and rests on the lower part when boring. By the bar or plate, in which it is fitted to turn freely and in which it is confined by the collar this part of the auger is connected to cords, which pass over pulleys under the platform to a drum, which is fitted loosely on the crank shaft, and clutches with it to be turned by it for elevating the borings when moved to the right by a lever, so that studs will engage, and it disengages them and lets the auger fall again when the lever is moved the other way. This shaft is the same one that is employed to turn the shaft for boring, and is itself turned by a shaft, pinion and wheel. The driving power is applied to the shaft by a belt from a steam engine, horse or other power; or it may be turned by hand.

Improved Mold or Box for Brick Press.

John McKenna, Cambria, Pa.—The press boxes for making fire brick have heretofore been cast solid and lined with steel. The steel facing soon wears away, so that the bricks are too large and untrue. The steel has then to be taken out and replaced with new, which can only be done at considerable expense. The object of this invention is to furnish a mold which shall obviate the difficulties experienced in the use of the usual press box.

Improved Plow Coupling.

Thomas L. Thrasher, Paris, Texas.—The invention has for its object to furnish an improved coupling for connecting two plows, to enable them to be guided and controlled by one man; and it consists in the bent bars strengthened at their bends by extra rods, provided at their lower ends with swiveled clamping plates and set screws, and at their upper ends with eyes, slides, and notches to receive the key.

Improved Flux for Smelting Ore.

Samuel D. Young, Elizabethtown, Ill.—In this invention is produced, by a calcining process, from fluor spar, an improved flux for iron ore; and, by a similar treatment of lead ores, mixed with fluor spar, the rapid separation of the calcined spar from the lead ores. In its natural state fluor spar is detrimental to the hearths of iron furnaces. The fluor spar, however, which is treated by the calcining process described forms a superior flux for iron ore without destroying the brick lining of the furnaces. The calcined spar, when produced from the lead ore with which it is formed, is turned thereby to satisfactory use in the arts, while the calcining process at the same time, by melting the minute particles of lead which are carried off by the old processes, increases the yield of the ore. The ore is also desulphurized, and the carrying off of particles of lead through the chimney prevented for the same reason, so that a greater percentage of lead is produced from the ore.

Improved Chuck.

Eli Horton, Windsor Locks, Conn.—It is a well known experience in case hardening jaws that the relative positions of the metallic particles change more or less, so that it is almost impossible to hold work and get it perfectly true. To overcome this difficulty the inventor has introduced on the face of the jaw a raised seat, together with a groove between the face and bite of the jaw, rounding off thereby the corner, and allowing the use of a Tanite or vitrified emery wheel, by which the raised seat may be ground perfectly true. On the face part of each jaw, on which the work rests for turning, is introduced a raised seat, of suitable size, together with a groove or recess formed in the corner of the bite and face of the jaw, removing and rounding off the same. The groove admits the use of an emery wheel for grinding off the raised part, so that work coming to a sharp corner will rest upon the ground seat and the bite of the jaw only, and assume a perfectly true position thereon, as an equal pressure is exerted on the same. Another advantage of the groove is that a grinding wheel without a perfect corner can do its work accurately, as it projects beyond the raised part into the recess formed by the groove, grinding the seat perfectly without fracture at the edges.

Improved Log Turner.

Esau Tarrant, Muskegon, Mich.—In this invention the forward part of the log deck is made inclined, so that when a log is rolled past its center it may roll directly upon the carriage, where it is stopped in proper position by the standards in the head block. A wheel or segment of a wheel has an axle which works in short guide slots in the middle part of the log deck. The wheel is preferably in the form of a half wheel or semicircle, and an axle is arranged in such a position that the straight side of the said wheel or segment, when turned into the horizontal position, may be a little below the top line of the log deck, so as to be out of the way of the logs when rolled upon said deck.

Improved Steam Engine Governor.

Anders Matson, Quincy, Ill.—In this invention a pipe conducts the steam from the boiler, and is connected with a chamber. The valve and seat are made of metal suitable for the purpose. The cylinder has a flange which fits steam tight into the base flange of the chamber. The cylinder is closed at the top and fits inside the valve. The steam presses equally on each side of the valve, so that it is balanced, and has free motion to regulate the speed of the engine. The top part of the shell of the chamber fits into the upright bow, so that the latter can be turned to give the driving shaft any required direction.

Improved Hydraulic Motor.

William Walter, Arkada, Washington Territory.—This invention consists in the application of the stream or body of water to a vertical cistern and cistern valve, which is balanced by a weighted lever, so that, on floating, the water rushes into a horizontal pipe and trough filled with water. The forward motion of the water, in connection with the closing of the cistern valve, produces a forward motion of a piston valve at closed end of horizontal pipe, which is connected to the machinery to be driven by it. Both the lever power and piston power may be utilized, as desired—the lever power for crushing quartz and stamping bones, the latter, by suitable transmission, for driving different machines.

Improved Spring Bottom.

In this invention, three bottom rails, preferably, are employed in one bed. The top slats are placed transversely upon three rows of springs that stand on the rails. Each slat is mortised, near the end, to receive a loop from each spring beneath, except from the middle springs, which have loops that lap around the slats. Straps are fastened to the head and foot pieces of the bed bottom, and pass through the loops of the side row of springs and over the slats, so that the said straps will serve to prevent the loops from being drawn down through the mortises of the slats. These several clasps form holders by which the springs will be evenly held upon the lower rails, and are a very convenient and practical mode of attachment for the springs, allowing them ready application and removal.

Adjustable Treadle for Sewing Machines.

Joseph McEvoy, Brooklyn, N. Y.—This invention consists of an arrangement of the treadle pivot rod, in curved slots in the end frames or other supports, for adjusting the treadle toward or from the front of the machine to suit the operator; the slots are curved to the axis of the crank shaft, so that the distance between the rod and the center remains the same. It is applicable to the table of a sewing machine, lathe, or any other machine to be worked by foot power.

Improved Drill Rod Coupling.

Robert A. Clark, Petrolia City, Pa.—This invention consists of one section, having a screw threaded portion at the end, of smaller size than the rod screwing into a socket in the end of the other section by a right hand screw, and a sleeve screwing on the two sections by a left hand thread down against a collar on the lower section, by which the joints are locked so that they cannot work loose.

Improved Device for Dressing Saw Teeth.

William Rowe, Westerville, Ohio.—This invention consists in a slotted clamp, provided with recesses to receive the saw, to which it is secured by clamp screws, and an anvil, which is placed under a saw tooth, and clamped in place against the same by a wedge pin. The anvil is placed directly under the inner side of the saw tooth, so that the same rests fully thereon: then the set screws are firmly applied to the saw, so that the tooth can be forged or dressed to the width and thickness required.

Improved Grain Dryer.

Richard J. Williams, Ottumwa, Iowa.—The preparation of grain for grinding by toughening the husk or bran has hitherto been done by moistening the grain and then heating the same, the main object being the dampening of the bran and keeping dry the inside of the grain. The drying the grain after moistening does not only take longer time, but has also a softening influence on the interior, which is to be avoided, while by heating the grain first and dampening it afterward the husk will toughen in less time and the inside part of the grain remain perfectly dry. This apparatus is constructed on this principle; and consists of a series of tubes which pass the grain through the heating chamber into the steam chamber. The ends of the tubes which enter the steam chamber are perforated to facilitate the moistening process. By means of different steam chambers and increased admission of steam, husks of different texture may be prepared and passed through at the same time.

Improved Tree Protector.

George H. Hume, Paola, Kansas, assignor to L. C. Crittenden, Geo. H. Hume, and Chas. W. Carr, of same place.—This invention consists in providing the metal slats composing the protector with sharp downwardly projecting spurs. The protector, placed around the tree, is made of upright sheet metal slats which are connected by wire bands, so as to be held together around the tree. The lower part may be bent outwardly to rest on the ground. The slats may be made of any suitable material, preferably of sheet iron; and are covered with coal tar or other preservative against the influence of the weather. For still further protecting the trees against rabbits and other destructive animals, the slats may be provided with projecting parts or spurs placed at convenient hights.

Improved Fruit Crate.

Daniel Crane, of Saginaw, Mich., assignor to himself and Charles A. Lee of same place.—In this invention staves or slats are placed a suitable distance from each other, according to the use for which the crate is intended, and in number according to the size or diameter desired. The heads may be two or more in number, according to the size and number of compartments of the crate.

Improved Shingle Machine.

Alanson Anderson, Chadwick Mills, N. Y.—This invention consists of two reciprocating block holding frames, which are alternately moved against a horizontal circular saw by means of the vertical saw shaft in gear connection with slotted lever arms. The blocks are properly set in frames by tilting platforms, as in other machines of this class, the same being operated by a pawl and ratchet mechanism, in connection with a bent lever and spring arrangement for engaging and disengaging the blocks.

Improved Weeding Hoe.

Henry S. Crossland, Dresden, Texas.—This invention consists in a hoe with an inclined cutting edge; the object being to enable it to enter the ground more easily and to prevent dirt adhering to the blade underneath the eye.

Improved Harvester Rake.

Samuel Clevenger, Vibbard, Mo.—This invention consists in a slide, toothed bar, slide rod, guide, rake head, rake bar, trip pin, two shafts, four gear wheels, and two segments of gear wheels, in combination with each other and with the frame, the platform, and the drive wheel of a harvester. By this construction, as the rake head begins to move inward to sweep a gavel from the platform, the guide enters a notch in the under side of the rake head, which allows the rake head to drop, so that its teeth may move along the platform and carry the grain with them. As the rake head begins its outward movement, the pin strikes the inclined inner end of the guide plate and moves its outer end forward, so that the slide attached to the rake head may slide along the said guide which raises the forward part of said rake head, so that it may pass back without its teeth coming in contact with the grain upon the platform.

Improved Micrometer Gage.

Antoine Bonnaz, Paris, France.—This invention is intended for measuring articles in minute fractions, and with unusual accuracy. A frame supports upper and lower screws formed with threads, whose section shows an equilateral triangle, and which are reversed in their direction. A milled head or knob, swiveled on a screw, is fastened in the head of the upper screw. A plain outer socket is rigidly attached to this screw, while the knob has a downward flange extending over the upper part of the socket. Between this part and the knob is a washer having a series of springs which produce within the three parts a frictional connection that will cause them to turn together until a resistance is met with, adequate to overcome this friction. Packing rings are let into annular recesses of sockets to exclude dust. A numerical circular notation is made upon the movable socket and a linear notation on the stationary socket.

Improved Air Gas Machine.

Pelag Werni, Newark, N. J.—This invention has for its object to furnish an improved apparatus for forcing air in uniform quantities into a carbureter. The invention consists in the combination of series of water sealed vessels, toothed uprights, segmental toothed gear wheels, shafts, inlet pipes provided with valves at their inner ends, outlet pipes provided with valves at their outer ends, water sealed vessels, and discharge pipe with each other; and is an improvement on a device patented on July 23, 1872, to the same inventor and Henry Curliss.

Improved Seed Separator.

Frank C. Miller, Blue Earth City, Minn.—In this invention, a hollow sheet metal cylinder has its interior surface studded with numerous small cells, too small for the grain, but large enough to admit the cockle and other small matters, to be retained and carried above the grain, and thus separated from it. A stationary trough or receptacle extends through the cylinder from end to end, and is arranged with one edge close to the surface of the cylinder near about the center vertically on the upwardly moving side, so that the matters contained in the small cells will be carried above it and then fall into it. A small perforated cylinder is arranged in the hollow sheet metal cylinder to receive the grain first, and separate the large coarse matters. The foul matters accumulating may be scraped out at one end from time to time.

Improved Tool Receptacle.

Levi L. Lamb, Chelsea, Mass., assignor to himself and Sewell K. Lovewell, of same place.—The object of this invention is to furnish, for the use of mechanics, artisans, and machinists, an improved die stand, into which the different dies for marking metal work are placed and protected against loss or accidental damage; and the device consists of a case of suitable material, surrounding a block with holes, corresponding to the number of dies, into which they are inserted through a perforated top, and inclosed therein by a revolving cover plate.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

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Old patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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Notes & Queries

P. C. G. asks: How can I take India ink from a linen shirt bosom?

C. H. W. & Co. would like some one to give the process of churning butter from milk on a large scale, as is done in large butter dairies in New York.

G. C. B. asks: How can I make sheet iron soft and malleable? Are there any books on the subject?

A. L. T. asks: Can you give us a recipe for something to mix in with putty, so as to prevent it from falling from the sashes?

D. B. W. asks: How fast ought the reels of a bolt, of the following dimensions, to run? 2 reels of 52 inches diameter, 20 feet long, with 5½ inches fall to each reel. The cloths are as follows: 1st reel, No. 11 Dutch anchor brand. 2d reel, 9 feet No. 8, 6 feet No. 4, and 5 feet No. 0. These reels run at 37 revolutions per minute. We make too much seconds flour, and it is very coarse. The shorts are very bad and very light. 2d. Ought reels to run faster or slower with little fall? I contend that the flatter the reels, the slower they ought to run, as the flour will not travel so fast as it does in reels with more fall, and consequently it will get more knocks on its route through the reels. [There is such difference in the practice of millers that we place your letter before them, in preference to answering it ourselves, as we could only give you general figures. We think, however, that your reels are running rather too fast.—EDS.]

Answers to Correspondents

W. O. C. asks: 1. What is the difference in composition between white corn and yellow corn? 2. The common text books on physics say: A falling body will pass through 16,1/6 feet of space in one second. Is that space to be regarded as a vacuum, or as filled with air? 3. Where can I find a book giving the rate of fall of bodies of different specific gravities through water? 4. Is the upward motion through water of bodies specifically lighter than water a uniform or accelerated motion? If accelerated, what is the law? Answers: 1. There is no essential chemical difference. 2. In a vacuum. 3. There is no general law governing the rate of fall of different bodies through water. The rate will depend not only upon the specific gravity of the body, but upon its shape, whereby its resistance to the water in falling through it will be more or less modified. 4. The force with which a body specifically lighter than water is urged upward is equal to a weight which equals the difference between the weight of the body and the weight of an equal bulk of water. The motion of bodies either falling or rising through water is at first accelerated, but becomes uniform when the resistance of the water equals the acceleration force. Consult Jamieson's "Mechanics of Fluids."

W. B. M. asks: Is there a cheaper, less dangerous to handle, or more practicable, solvent for silicate of soda than nitric acid? Would water dilute this mixture? If not, what will? What I want is a glaze for articles made of hydraulic cement. Answer: The proper solvent for silicate of soda (soluble glass) is boiling water. We do not know how nitric acid could be used without decomposing the silicate.

E. D. S. asks: Can silver be precipitated from the resulting solution of washed photograph paper (chloride of silver) by metallic or sulphate of iron; or must it (the paper proper) be first reduced by sulphuric acid by iron, as we now do? The former, as recommended in your journal of August 23, is much easier, but I thought it an error. The chloride of silver is formed by floating a chloride paper on a nitrate of silver solution. Please give proportions of iron to the ounce of silver. Answer: The method of precipitating metallic silver, given in the answer referred to, is one practiced in Germany on a large scale in treating certain ores of silver. In this process the chloride of silver, which is insoluble in water, is shaken up in contact with metallic iron and water. Water alone will not dissolve the chloride of silver from your photographic paper, but a solution of ammonia will. You can then add twice as much metallic iron or zinc as there is chloride of silver.

A. G. Jr. asks, in reference to the conversion of starch into glucose: Can it be accomplished in open vessels by the use of such a small proportion of acid as one tenth of 1 per cent? If not, what proportion of acid must be used to convert it with 5 or 6 hours boiling. Would the free acid, SO_3, be detrimental to fermentation? Would bringing the rightly acidulated solution to the boiling point and then stirring in the starch diffused in tepid water do, or must the starch be gelatinized first and then boiled? How can I easily determine as to the time when the starch is mainly converted into glucose and not into dextrin? Answer: Glucose is manufactured on the large scale, especially in continental Europe, in the following way: A mixture of starch and water at a temperature of about 120° Fahr. is made to flow gradually into a vat containing water, acidulated with 1 per cent of sulphuric acid, kept at the boiling point. In about half an hour the starch is converted into sugar. The liquid is drawn off, and the sulphuric acid neutralized by the gradual addition of chalk, till there is no longer any effervescence. Sulphate of lime precipitates, and the clear solution, after concentration by evaporation, is set aside to crystallize. The molasses is drained off and the sugar dried at a gentle heat in a current of air.

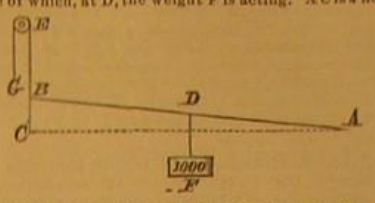
H. M. C. says: I am building a small boat. If I give it a coat of shellac, would the water take it off? Would it be as good as paint? Could you not suggest some way to varnish a boat? Answer: You can make waterproof varnish as follows: Pale shellac 8 ozs., borax 1 oz., water 1 pint; digest at nearly the boiling point until dissolved; then strain. It would perhaps be better to give your boat a good coat of paint before applying the varnish.

P. R. asks: 1. Is slate a mineral or vegetable substance? 2. When was slate introduced into use for roofing purposes? 3. In what country was it first used for that purpose? Answers: 1. Slate is a mineral substance, consisting of silica and alumina, with varying proportions of iron and other metallic oxides. 2 and 3. The history of the use of slates for roofing purposes indicate Europe as the place where they were first used, but at what date is uncertain.

L. T. B. asks: How can I remove the bituminous substance from the Egyptian mummies? It obscures the hieroglyphics underneath. Answer: If the substance you refer to is bitumen, try naphtha as a solvent. Rub with a sponge or cloth soaked in the naphtha.

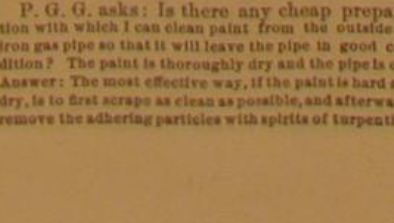
G. W. S. asks: What is the best way to extract grease from pork cracklings, and what is done with the residuum? I understand that potash is made from it. Answers: Digest the pork cracklings in bisulphuret of carbon, covered closely to prevent evaporation and in the cold, until the fat is dissolved. The fat extracted by the bisulphuret of carbon can be recovered by careful distillation, and the fluid recovered by condensing it in a receiver surrounded by ice, while the fat remains behind. The residuum not dissolved is valuable in the manufacture of prussiate of potash (potassium ferrocyanide), which is largely used in the manufacture of Prussian blue.

A. K. asks: 1. How can I calculate the loss of power caused by forces acting on levers under different degrees? A B is a lever supported at A, on the middle of which, at D, the weight F is acting. A C is a horizontal line 20 feet long, B C is 6 inches long, D F and E B C are vertical lines. How much power will a weight of 1,000 lbs. at F exert at D, and how much at E or G, not counting friction? 2. What shape must I give the spokes (or their substitutes) of a metal wheel, leaving it perfectly balanced as to center of gravity? I want it to be as strong and light as possible. Answers: 1. The pressure at E or G is equal to the weight multiplied by its distance from A, measured in a horizontal direction, divided by the distance of E from A, measured in a direction perpendicular to the direction of the cord B E. 2. If the wheel is for a carriage, observe the practice of the best builders, who have worked out the matter pretty thoroughly in light trotting wagons.



W. F. McK. asks: 1. Is there any cement or paint for shingle roofs that will stop the leaks? 2. Why is it that, when glycerin is used in the manufacture of printers' inking rollers, less glue should be used? I would naturally suppose that more glue would be required. Answers: We would recommend you to apply Portland cement, mixed with water to the consistence of ordinary mortar, over the coating of ordinary sand and lime. This will set hard in a short time and is a good waterproof cement, as well as a comparatively cheap one. Do not mix more cement than you can conveniently use at once, as it soon sets. 2. The object of using glycerin, which is a non-drying material, is to keep the rollers soft, and the greater the proportion of this, the less, of course, the proportion of glue in a given quantity of the compound.

O. S. says: The force exerted in the direction B A is 20 tuns. B C is a lever 12 inches long with a fulcrum at C. The point B is 3 inches above the center line. Required the weight at D necessary to hold the point B in equilibrium. Also required a rule to determine the weight of D, with C B at any angle. Answer:



Disregarding friction, the weight required at D, in the given case, will be about 5·145 tuns. The weight for any position of the lever may be found by multiplying the 20 tuns by the distance of the point B above the center line, and dividing the product by the square root of the difference of the squares of the length of the lever and the distance of the point B above the center line.

B. C. asks: What cheap substance will prevent lubricating oil from gumming and separating after being manufactured? It is composed of equal parts No. 1 whale oil, No. 1 lard oil, best imported soaps, and exhaust water. Answer: The cause of oil gumming is owing to oxidation, the oxygen being absorbed from the air. You cannot prevent this unless you can use it where it will not come in contact with the air. The uncombined water will always separate from the oil, on account of its greater specific gravity. Thanks for the back numbers.

A. L. asks: Will muriate of tin evaporate or change its quality and lose its strength (so as to be unfit for use in dyeing) if left in a bottle or vessel open to the action of the air and exposed to the heat of the sun? Answer: The compound of tin to which you refer, being a volatile substance, of course is lost, if left open to the air. It should be kept in close vessels.

A. B. asks: 1. Would it not require a current of air blowing at the velocity of a storm to carry the big balloon to Europe in the short space of time that Mr. Wise has calculated on? 2. What is asbestos? 3. What shall I mix with English vermilion or Prussian blue to give them a consistency for marking like pencil leads? 4. How can I make a good permanent marking ink for marking dry goods? Would a solution of vinegar and iron shavings answer, or would it be injurious to the cloth? Answers: 1. No, although to an opposing force the velocity of the current of air which Mr. Wise expected to meet would be decidedly felt. When once the balloon reaches such a current, there is no opposing force, the balloon being carried with the wind. This wind might blow a hurricane, and yet be unfelt by the occupants of the car. For a balloon to reach Europe in 30 hours, a velocity of from 30 to 40 miles would be sufficient. This velocity is not nearly so great as the wind sometimes attains, namely, 100 miles an hour. 2. Asbestos is a silicate of magnesia. From its property of withstanding heat is derived its name, which signifies in Greek "unconsumable." It is found, among numerous other localities, on Staten Island. 3. Use fine clay. 4. A good recipe for an indelible ink, to be used with a stencil plate, is: Dissolve asphaltum in amber varnish, and add oil of turpentine until of proper consistence. Color with lamp black.

W. W. E. asks: Is the following, intended for a fluid gas liquid, a dangerous compound? "To make one gallon: Add to one gallon gasoline, 1 table spoonful of salt, 1 tablespoonful of sal soda, half as much alum, 1 piece of alkanet root 1 inch long." What is gasoline? What is alkanet root? Answers: Gasoline is highly rectified naphtha obtained from petroleum, very volatile and inflammable, explosive when mixed with air, and consequently very dangerous to handle. Alkanet root is the root of a deciduous plant which the botanists term *lithospermum tinctorium*. It contains a fine blood red color, which it freely gives out to oils, fats, wax, spirits, etc., and is used by druggists, perfumers, varnish makers, etc. It grows in Asia Minor, Greece, and Hungary. The additions you propose to make to gasoline would not sufficiently destroy its inflammable properties, so as to render it safe to handle in open vessels.

P. G. G. asks: Is there any cheap preparation with which I can clean paint from the outside of iron gas pipe so that it will leave the pipe in good condition? The paint is thoroughly dry and the pipe is old. Answer: The most effective way, if the paint is hard and dry, is to first scrape as clean as possible, and afterwards remove the adhering particles with spirits of turpentine

A. G. asks: What is the cause of the explosion of fulminates, if effected by a blow? Is it the amount of heat developed, or only the change or disturbance of the particles, independent of any temperature? Answer: Both the causes that you have named may be considered as conjointly effecting the decomposition and explosion of the fulminates. Friction and percussion, however, seem to be the chief causes, as fulminating mercury explodes violently by both friction and percussion, but burns with almost a noiseless flash when kindled in the open air; and fulminate of silver which can hardly be touched with safety, may, when mixed with oxide of copper, be burned in a tube to determine its composition.

C. & Co. ask: What is iron pyrites used for, and where? Answer: Iron pyrites is used very extensively in England, and to some extent in this country, for the manufacture of oil of vitriol or sulphuric acid. To be of value for this purpose, however, it must be found in large quantities, and be easily and cheaply mined, and near means of transportation. Means have been tried, after burning it for the sulphur, to make the residue available as an ore of iron, but so far as known without success. If this should be accomplished, however, iron pyrites would be a much more sought for mineral than it is at present.

B. asks: How can I prepare crude india rubber so as to make a small balloon? Dissolving it and allowing the liquid to evaporate would answer the purpose, as the sheets must be very thin; but by what process can it be dissolved? Answer: The best and cheapest solvent for your use is carbon bisulphide, ordinarily called sulphuret of carbon. After the rubber is dissolved, pour it out thin upon a smooth, slightly greased surface, and leave until dry.

R. W. W. A. asks: How is the silver jewelry, known as oxidized jewelry, made? Answer: There are two distinct shades which can be formed in oxidizing silver. One is produced by chlorine, which has a brownish tint; the other by sulphur, which has a bluish black tint. To produce the brownish shade, wash the article with a solution of sal ammoniac. A more beautiful tint may, however, be obtained by using a solution composed of equal parts of sulphates of copper and sal ammoniac dissolved in vinegar. A fine black tint may be produced by a slightly warm solution of sulphuret of potassium or of sodium.

S. L. C. says: I have a pair of cavalry boots ornamented with considerable stitching around tops and sides of legs. This is all hand work, done with waxed ends. The wax exudes upon the boot, and nothing will apparently stop it. I have scraped it off with a knife and washed with benzine, apparently removing already enough to make a dozen pairs of boots; but they are now worse than ever, after lying unused for several months. Answer: We can only advise you to persevere with scraping and benzine; the wax must come to an end.

J. M. asks if there is anything that will soften buckhorn or bone so that it can be readily cut and carved, becoming solid after it is dried. Answer: Immerse the horn or bone in cool dilute hydrochloric acid, until the earthy matter is dissolved. The bone will thus be rendered transparent, flexible and elastic, and will dry hard.

J. W. B. asks: When is the sun on the meridian? Answer: When shadows are shortest. See Gillespie's "Land Surveying," pp. 190-192.

W. J. asks: In making artificial fibrin, do you separate the white from the yolk of the eggs? Answer: Break the raw eggs, one by one, into a dish containing cold water and let them remain for twelve hours. Then carefully remove them, one by one, and place in boiling water for two or three minutes, or longer, as desired.

E. N. C. says: Suppose you have a small amount of power to drive a saw mill, the majority of the timber being rather small, but occasionally there is a large stick; which would be the best, a 32 inch or a 42 inch saw, with 15 inch top saw? The 15 inch is to run only when the 42 inch is not large enough. Answer: We should prefer the 42 inch saw.

W. L. M.—The pressure of the wind at 15 miles per hour is 1 lb. 2 oz. per square foot. At 20 miles per hour, 2 lbs.

W. S. asks: 1. How do you determine the size of an air chamber, diameter of valves and amount of lift for a force pump? 2. How do you obtain the length of lever and throw of eccentric for a rotary valve? How do you obtain the diameter of a steam chest? Answer: It would require too much space to answer these inquiries in this column. Consult some standard work on the subject.

E. F. R. says: I have made brass lacquers according to various recipes which I have seen in your "Answers to Correspondents," and applied them in the manner described; but the work has a daubed look, and the lacquer will not adhere evenly. I have tried it at all temperatures. Dipping gives no better success. Does it require great practice to do it nicely? Or does it depend on the manner in which the brass is finished? Should it be very smooth or slightly rough? Answer: Polish your brass as smooth and bright as possible, and apply with a fine brush the following lacquer: Seed lac 3 ozs., turmeric 1 oz., dragon's blood ½ oz., rectified spirit 1 pint; digest for a week, frequently shaking then decant the clear portion.

W. W. P. says: 1. A ball is set in motion, and immediately thereafter everything is annihilated except the ball; will the ball stop or move on forever? 2. What is the best definition of inertia? Answers: 1. In the impossible case mentioned, the ball would continue to move with the velocity and direction (if these can be conceived of, in this connection) that it had at the time of the general annihilation. 2. Inertia is a body's incapacity to change its state of rest or motion without the application of some external force.

E. W. asks: What will take grease out of sheep skins? Answer: Try bisulphide of carbon.

J. W. C. asks: 1. Is a vein or pocket of lignite (brown coal) any indication of coal below or in the coal formation? 2. What book is best for an amateur mineralogist to study? Answers: 1. We should say not. Lignite is usually found in alluvial earths, or connected with rocks of the more recent formations; while coal, strictly so called, appears to be of the same age as the older secondary rocks, or immediately to follow them. Anthracite coal most frequently occurs in primitive or transition rocks. 2. Dana's "Mineralogy" is a standard work.

S. C. C. asks: Is there any chemical solution which will renew the color of the ink to an old and faded manuscript? It should be colorless itself, lest it should stain the paper. Answer: Try the application of a solution of nut galls with a soft sponge or rag to the writing, or damp with a strong solution of yellow prussiate of potash. The latter will turn the ink blue.

H. H. J. says: I have been studying upon a harvester to reap and thrash the grain as it runs, leaving the straw on the ground and delivering the grain to a proper receptacle; but I am told that the idea is not new. One man told me that such harvesters are used in California, but it takes 25 horses to run them. What is the reason that such a machine is not in general use? 2. Can a chemist ascertain by a quantity of scum on the water, whether it comes from any mineral or not? 3. Where in the United States is manganese found? Answers: 1. The reason such a machine as you speak of has not come into general use is probably either on account of the expense attending its employment, or its not being adequate to the work required, on account of a want of simplicity or easy derangement of parts. 2. He can. 3. Oxide of manganese is found in the United States in Vermont and Massachusetts.

W. F. S. asks: Will a ball fired from a rifle rise above a horizontal line drawn through the center of the barrel, or will it continue on a direct line? In neither case is the rifle elevated. Answer: The ball will follow neither of the paths mentioned, but will describe a curve, continually falling under the influence of gravity.

D. & W. say: A reservoir at a certain hight has a pipe leading from it, which pipe has a stopcock at its end. Is the pressure on each square inch of the pipe the same, whether the cock be open, allowing the water to flow, or shut, cutting off the water? If not, why not? No account is to be taken of the *coup de marteau* caused by closing the cock. Answer: The pressure will be different in the two cases, for the reason that when the water is in motion some of the pressure is required to overcome friction.

C. E. A. asks for the *modus operandi* of raising a number to a fractional power without the use of logarithms. For example, raise 2 to the power of $3\frac{4}{5}$. Answer: Raise the number to the power indicated by the numerator of the fractional index, and extract the root indicated by the denominator. In the example given, you should take the tenth root of the thirty-sixth power of 2.

J. B. P. asks what is asbestos, and what is its original formation? Answer: Asbestos is a mineral substance. It is a silicate of magnesia. It is composed of the three elementary substances, silicon, magnesium and oxygen.

G. R. B. asks: What should be mixed with ground asbestos to keep it from being blown out of stuffing boxes when used for packing? Will oil or tallow do? Answer: Try plenty of tallow.

W. S. A. asks: Would a balloon filled with smoke rise? Answer: Smoke really consists of fine particles of unconsumed carbon, which are elevated in the atmosphere by the warm current of air or gases from combustion in which they are suspended. These particles of carbon, however, after the air surrounding them has cooled, or after they have drifted into a cooler atmosphere, ultimately fall to the earth. The term smoke, though, as generally understood and as you evidently regard it, embraces both the unconsumed carbon and the surrounding hot air gaseous media. This would raise a balloon a certain hight until the hot air, etc., filling it, fell to the temperature of the surrounding air, when the balloon would fall.

S. asks: From 900 gallons liquor at 15°, how much evaporates at 22·5°, at 30° and at 36°? Answer: The question does not give sufficient data for an explicit answer. What is the alcoholic strength of the liquor, that is, what percentage of alcohol does it contain, and does the writer refer to Fahrenheit's or the centigrade scale?

C. M. asks for a recipe for removing printers' ink from paper. Answer: Printer's ink consists of a mixture of linseed oil and lamp black, a kind of very finely divided carbon. There is no solvent for the carbon, but the dried oxydized oil might be removed to some extent by sulphide of carbon or ether, and with it some carbon might also be washed away. On the large scale, when old paper stock is worked up for the manufacture paper, the ink is removed in the process of bleaching, where the pulp is exposed in a vat to the action of chloride of lime. The removal of the carbon of the ink in this process is due to mechanical not to chemical, action. The carbon is not bleached by the chlorine, but the severe mechanical operations through which the material is passed, as pulping, washing, etc., serve to wash away and obliterate all traces of the carbon of the ink. On the small scale, as removing the ink from a printed page, the only effective way is by scraping with a sharp knife.

W. P. H. says: In coating friction match ignitors with emery, put on with varnish, the latter does not hold the emery on to the tin firmly, and it does not harden. Can I use any other preparation instead of varnish, or can I put something into the varnish that will cause it to dry quickly? Answer: Your varnish probably does not contain a sufficient amount of spirits of turpentine or other dryer, or it is otherwise improperly prepared. Use a spirit varnish, consisting of shellac, broken fine, and yellow resin, each 1½ lbs., rectified spirit 2 gallons; or shellac 8 oz., alcohol 1 quart; digest in close vessel in warm place 3 or 4 days, then decant and strain. You can try a strong solution of glue, applied to the metal with a brush, like a varnish, dusting the emery over the surface of the glue while still hot.

A. says: The following question has arisen: A stood within three feet of a window trying to get the focal length of a watchmaker's eye glass, by forming the image of the window on a piece of paper and measuring the distance from the paper to the glass, assuming that to be the focal length. B, who was standing by, said: "Go farther back from the window; an object so close as the window is no fair test." A insisted that it made no difference: that a four inch lens would show the image at four inches from the lens, no matter how near or remote the object. The following statement was drawn up at the time; "The nearness or distance of an object from the lens does not vary the focus, that is, the image formed by the lens is constantly at the same distance from the lens, no matter what the distance of the object." B contended that the focus receded as the object advanced; or that the focus for near objects would be farther from the lens than for distant ones; and that the test to get at the rated focus of a lens was with parallel rays. Which was right, A or B? Answer: B was right. The solar focus would be practically the focus for parallel rays of the lens mentioned.

S. H. S. asks: 1. If green hams are put into a tank filled with brine (ham pickle) and a strong pressure put on the brine, will the meat take up the brine and cure faster than if there were no pressure? Will the brine be forced into the meat? 2. Are there any methods of curing hog meat in pickle, other than the one now used, namely, brine made of water, salt, saltpeter, molasses and saleratus? 3. Will honey mix with above brine and not be deleterious to same? 4. Can a flavoring be added to such a pickle, as lemon, vanilla, orange, etc.? Answers: 1. The brine will be forced into the meat at a greater or less depth, according to the pressure. 2. There are various recipes for pickle. The following is said to give a fine red color and superior flavor to ham: Bay salt, 3 lbs., saltpeter 2½ ozs., moist sugar 1 lb., allspice and black pepper, of each, bruised, 1 oz., water 9 pints; simmer together in clean covered iron or enameled vessel 7 or 8 minutes; when cool, remove scum and pour it over the hams. 3 and 4. Yes.

W. M. R. says, in relation to the idea published on page 137 of our current volume: Applying a 20 inch magnifier to a telescopic image is a good thought. I once looked at the image of my Gregorian with a spy glass, and saw things on the moon. I could not hold it still, but I wished that I could put them together properly. Answer: The ordinary compound microscope is "under-corrected" for use as an eyepiece, and must be specially made for the purpose. The small telescope is used for viewing the spectrum of the sun's chromosphere. The combination of collimator, prisms, and small telescope is attached to two parallel balance rods, one on each side of the large telescope.

H. G. says: Our power is a turbine wheel; and with the head and fall, we have, according to the makers' estimate, about 15 horse power. There are 2 lengths of shafting, each 40 feet, connected by 2 feet bevel gears, and at the extreme end of the said shaft, 80 feet from the wheel, the greatest amount of work is required of it. Upon the machine driven is a 5 feet drum, and this is connected with the main shaft by a 10 inch belt running over a 20 inch pulley. We use a tightener to keep the belt down. The distance from center to center of pulley and drum is 11 feet. There are eight journals or bearings in the entire shafting. When there is nothing to drive but the machine, what amount of power do I get, and do I not lose power by using the tightener? Answer: We could not answer this question without more data. It ordinarily takes some power to drive a tightener; but as it prevents the belt from slipping, there is a gain of useful effect.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

E. D. L.—The mineral specimen you send is apparently antimony.

V. E. H.—Beryl, a mineral composed of silica, alumina and glucina, and allied in composition to the emerald.

W. F. S.—Selenite, a transparent variety of gypsum.

E. W. T.—Pyrites in ferruginous quartz.

W. K. S.—Chrysocolla, a silicate of copper.

C. G.—Sandstone with the imprint of some fossil animal, or perhaps a vegetable nut.

G. W. S.—One is charcoal and the other pyrites.

T. B. J.—Ferruginous quartz.

A. G.—The green mineral occurring in spots in the specimen you send resembles malachite, a carbonate of copper.

G. A. F.—Your specimen of limestone is hard and compact enough for lithographic stone.

R. T.—Iron pyrites, only of value when found in large quantities.

L. M. L.—The mineral is sulphide of zinc or blende, a valuable ore of zinc.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Indelible Pencils. By R. B. F.

On Meteorology. By E. J. M., Jr.

On the Million Dollar Telescope. By J. H. S., and by J. S. P.

On the Cumberland Gap Cave. By A. L. S.

On the Bursting Strain on a Balloon. By T. W. B.

On Steel and Quill Pens. By W. V. R.

On the Compass on Board an Iron Ship By J. S.

On Lunar Acceleration. By J. H.

On Down Draft in Stoves. By C. W.

Also enquiries from the following:

A. E.—A. K.—E. M. D.—N. P. S.—D. M. B.—W. P. H.—W. S. B.—R. B. G.—W. S. & H.—H. W. P.—J. C.—T. A. S.—J. B. R.—G. H. H.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Correspondents in different parts of the country ask: Where can I obtain sulphuret of sodium? Who makes steam road carriages? Who builds really economical coal-burning portable engines? Where can I obtain Mushet steel? Who makes the best piston for steam engines? Where can I obtain a lathe for turning axe and broom handles? Is there a successful machine for separating pebbles or gravel from clay for brickmaking? Who makes steam engines at a cost of $30.00 each and under? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

September 2, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air compresser, H. P. Fairfield 142,432
Auger handle, F. B. Pease 142,410
Axle and thimble skein, A. Kessberger 142,344
Axle, wagon, G. A. Bolser 142,368
Bale tie, cotton, W. J. Orr 142,506
Bale tie, cotton, H. D. Starr 142,527
Basket, H. E. Jones 142,343
Basket, grain, H. E. Jones 142,341
Basket, grain, H. E. Jones 142,342
Battery, galvanic, A. L. Nolf 142,502
Bed bottom, spring, C. H. Dunks 142,377
Bed bottom, spring, Hill & Van Valkenburg 142,391
Bee hive, Walton & Cunningham 142,537
Beer, preserving, A. Adametz 142,429
Bell door, W. M. Preston 142,512
Billiard table cushion, J. E. Cam 142,495
Blind slat fastener, T. G. Springer 142,526
Boat detaching device, W. F. Morgan 142,496
Boiler, agricultural, C. M. Cloud 142,526
Boiler, steam, Douglass & Brown 142,350
Boiler, wash, E. Schofield 142,518
Bolt and rod cutter, H. Schmidt 142,354
Boot, West & Lee 142,424
Boot crimping block, Bordner & Sullivan 142,369
Boot and shoe insole, J. Gascoigne 142,332
Boot and shoe last, P. Ware, Jr 142,539
Boot soles, channeling, M. Wesson (r) 5,561
Boot soles, etc., skiving, E. B. Pierce 142,507
Boot uppers, crimping, A. Knowlton 142,402
Boots and shoes, P. Ware, Jr 142,538
Boring and drilling, J. J. Sheridan 142,416
Brick machine, P. K. Dederick 142,375
Bridge, J. B. Eads 142,378
Bridge foundation, iron, J. B. Eads 142,382
Bridge, iron, J. B. Eads 142,379
Bridge, iron, J. B. Eads 142,380
Bridge, iron, J. B. Eads 142,381
Bucket, butter, Gilberds & Harris 142,456
Building block, T. Hyatt 142,475
Building, fireproof, J. H. Walker 142,422
Buildings, wall for, T. Hyatt 142,474
Burner for heating, gas, J. Van 142,360
Can, fruit, M. O'Conner 142,503
Car coupling, F. E. Howard 142,395
Car coupling, H. E. Lowrie 142,467
Car coupling, A. Middleton, Jr 142,492
Car propeller, J. Day 142,443
Car body bolster, A. Ward (r) 5,560
Cars by air, propulsion of, W. H. H. Bowers 142,433
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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,239.—WATER WHEEL.—J. P. Collins. Nov. 19.

26,401.—DEFECATING SUGAR.—N. P. Brashear. Nov. 19.

EXTENSIONS GRANTED.

25,239.—ELASTIC HOSE TUBING.—John C. Boyd.

25,343.—STOVE.—E. M. Manigle.

25,344.—WIRING JOINTS.—A. C. Mason.

25,373.—PAPER BOX MACHINE.—S. B. Terry.

DESIGNS PATENTED.

6,832.—TAILOR'S GOOSE.—J. Hargrave, Cincinnati, O.

6,833.—FABRIC.—C. H. Landenberger, Philadelphia, Pa.

6,854.—CHAIR FRAME.—J. H. Travis, Charlestown, Mass.

6,855 to 6,864.—SHAWLS.—F. Wink, Philadelphia, Pa.

6,865 & 6,866.—CARPETS.—J. Crabtree, Philadelphia, Pa.

6,867.—ESCUTCHEON PLATE.—W. Gorman, New Britain, Ct.

6,868.—TOY RAIL CAR.—W. A. Harwood, Brooklyn, N.Y.

6,869.—CAPE.—M. Landenberger, Philadelphia, Pa.

6,870.—VAILS.—S. M. Meyenberg *et al.*, Paterson, N. J.

6,871.—OIL CLOTH.—C. T. Meyer *et al.*, Bergen, N. J.

6,872.—CAN.—H. G. Shook, New York city.

6,873.—BELT BUCKLE.—J. E. Smith, Waterbury, Conn.

TRADE MARKS REGISTERED.

1,430.—PENCILS.—American Lead Pencil Co., N. Y. city.

1,431.—HAIR PREPARATION.—M. T. Clackner, Baltimore.

1,432 & 1,433.—FERTILIZERS.—Dugdale & Co., Baltimore.

1,434.—MEN'S FURNISHING GOODS.—Fisk & Co., N.Y. city.

1,435 & 1,436.—STEAM PACKING, ETC.—J. Glanding & Co., Philadelphia, Pa.

1,437.—AXLE GREASE.—Palm Oil Axle Grease Co., Charleston, S. C.

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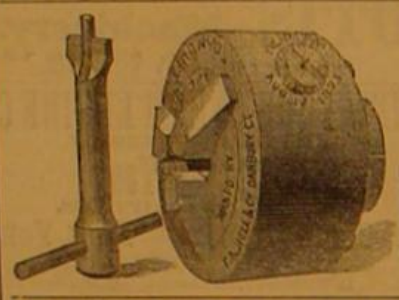
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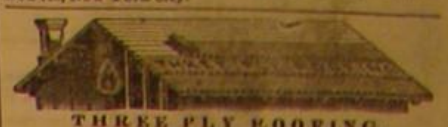
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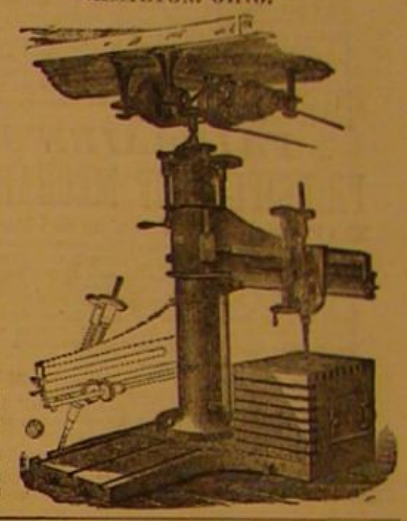
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Vol. XXIX.—No. 15. [NEW SERIES.] NEW YORK, OCTOBER 11, 1873. $3 per Annum. IN ADVANCE.

IMPROVED VARIABLE CUT-OFF.

It is hardly necessary for us to call the attention of engineers to the advantages gained by being able to close sooner or later the steam valve of an engine while the same is in operation. Instead of closing the throttle in order to prevent the machine working off steam faster than it can be generated, in cases where the fullest power is required, and thereby losing much of the elastic force by wire-drawing the steam into the cylinders, that valve can be thrown open. Then, by means of the variable cut-off, the full energy of the steam can be utilized, while the extreme pressure allowed is maintained in the boiler. And, on the contrary, if steam is made faster than the engines can work it off with a fixed cut-off, instead of holding up the levers by hand (as is sometimes the case) the variable cut-off again affords a means of employing the full capacity of the generators.

The cut-off herewith illustrated is especially adapted to poppet valve or side lever engines, such as are in general use on high pressure river steamers.

Fig. 1 is the design used on double engines, such as are in general use on stern wheel boats. Fig. 2 represents an enlarged view of the poppet head, A, Fig. 1, showing more clearly the operation of sliding blocks, C, and roller, D.

The poppet heads, A, Fig. 1, have each a long slot or mortise through which a lever, B, passes. The sliding blocks, C, Fig. 2, are arranged on the top of the lever, B, and under the roller, D, Fig. 2, immediately above the mortise pin, E, Fig. 2. The latter is fastened on the lever, B, works in a slot in the poppet head, and acts as a guide. The blocks, C, are connected by the rods, F, Fig. 1, to the T headed lever, G, which is pivoted to the upper end of the arm, H, that turns on the rock shaft, I. The arm is connected by the rod, J, with an eccentric on the main shaft. This eccentric moves the block, C, in an opposite direction to the piston head. The free end of lever, G, is connected by the rod, K, to the adjusting lever, L, which stands midway between the two engines. The semicircles between which the lever works are notched to correspond with minute divisions of the stroke. By changing the lever in the notches the lever, G, is raised or lowered thereby, and the blocks, C, are drawn nearer together or moved further apart. The steam is thus cut off sooner or later according to the position of the lever, L, which, as represented in our engraving, indicates that the steam is cut off at three tenths of the stroke. It will also be noticed that the inclined end of the block, C, at the right hand, has moved from under the roller, D, allowing the valve to be closed by means of the spring, M, acting on the bar, N.

This cut-off, it is claimed, greatly facilitates the handling of the engine, as, the cutting off being varied at will, the engineer need not leave the throttle when reversing the engines. Fig. 3 shows the device as applied to a side wheel or single engine, as used on side wheel boats, where each engine is handled independently of the other. The eccentric rod is connected to the right and left screw rod, O, at the swivel joint, P. The sliding blocks, C, are connected to the rod, O, by the nuts, Q, so that by means of the crank, R, at the hand of the engineer, the sliding blocks, C, are drawn nearer together or moved further apart by turning the rod, O. Thus the cutting off can be varied at will, when the engine is in motion, to any part of the stroke required, as readily as the throttle can be opened or closed. This variation, it is stated, is made without wire-drawing the steam or pounding the valve seat so as to cause any extra wear or additional expense for repairs. On the contrary the steam valve is guided in its motion. Its velocity, when closing, has been determined by the use of the steam indicator, and hence the angle of the sliding blocks, C. The exhaust valves are not in any way effected by the cutting off.

The invention has been in use for three years on the stern wheel steamer Chin-Du-Wan, in the form shown in Fig. 1, giving, as we understand, entire satisfaction, and this without costing one dollar for repairs. The steam valves, by their positive and accurate motion in closing, have been kept from leaking during the whole three years, while the exhaust valves have been repaired several times. The Chin-Du-Wan is owned by the California Pacific Railroad Company, and has two cylinders 18 inches by 5 feet stroke. The cut-off has also been in use two years on the steamer Petaluma (from the apparatus on which Fig. 3 was drawn), giving the same results as on the Chin-Du-Wan. The Petaluma has two 22 inch cylinders and 6 feet stroke, with single valves, and is owned by the Contra Costa Steamboat Company. The device is also in use on other steamers with like results, and on various land engines.

For further particulars regarding rights to manufacture, etc., address the patentee, Mr. Wm. B. Cross, Sacramento, Cal. Patented January 14 and August 8, 1871, through the Scientific American Patent Agency.

Fig. 1

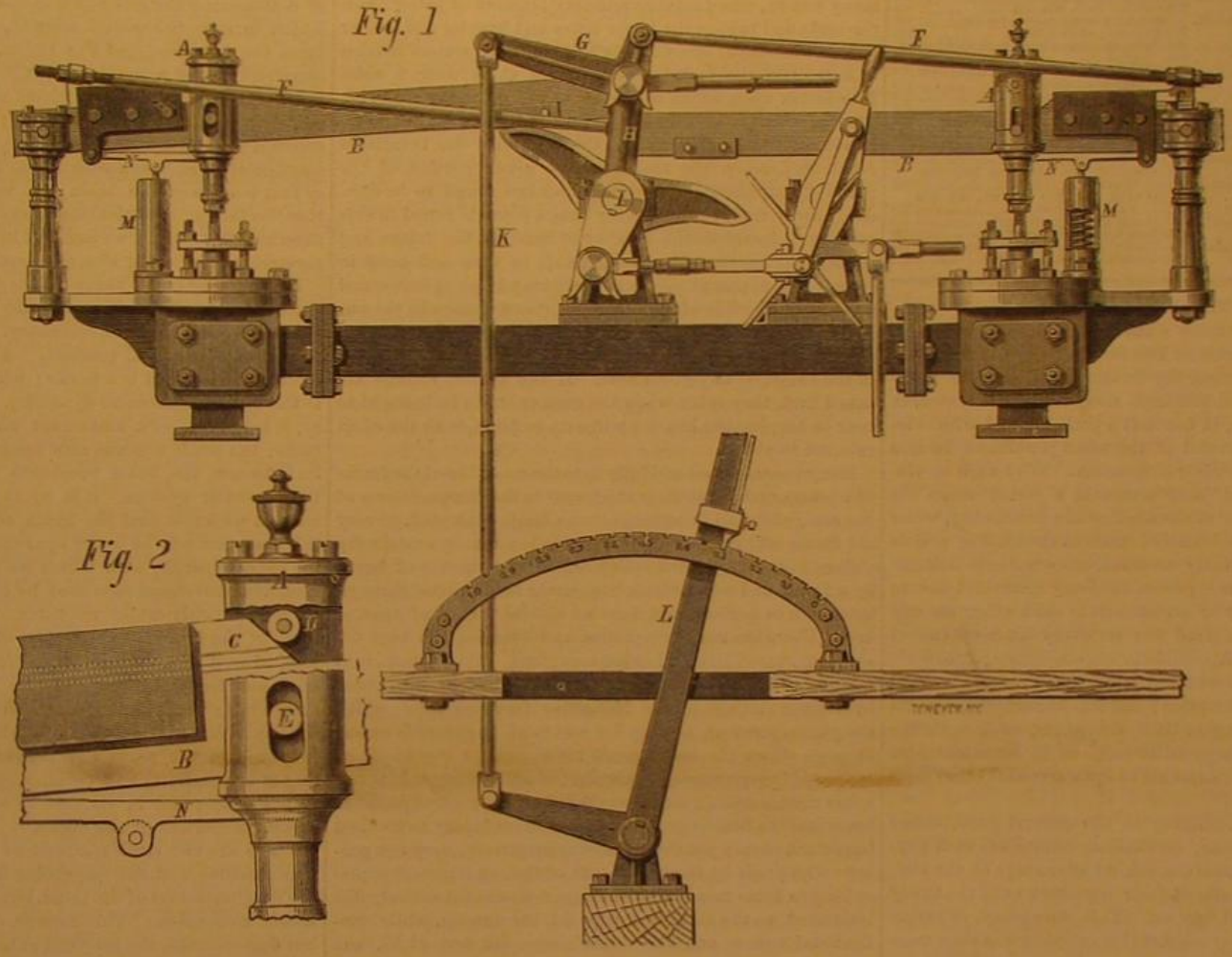
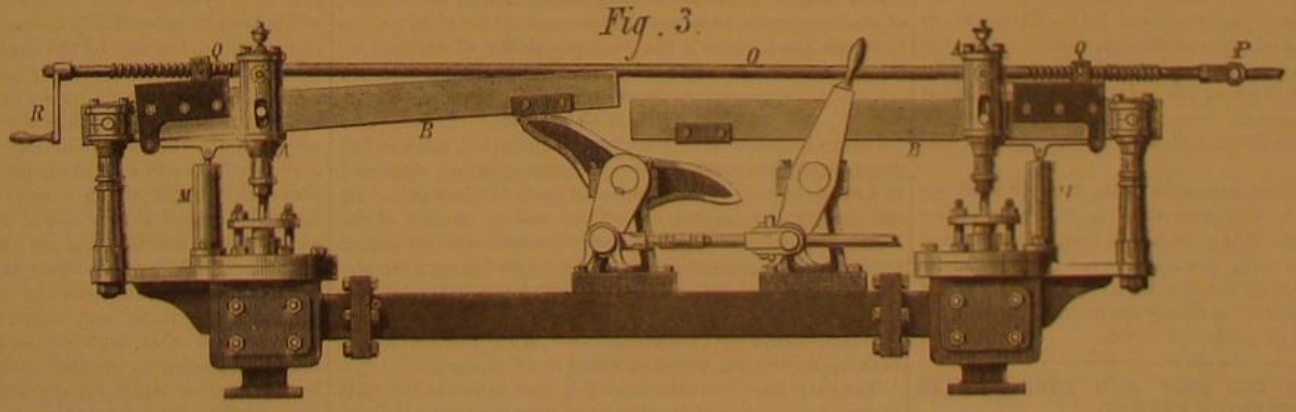


Fig. 2

Fig. 3.



CROSS' VARIABLE CUT-OFF.

A Possible Moses.

The reader of "Put Yourself in His Place" will remember the charming picture which the novelist draws of a child found floating in his cradle the day after the bursting of the Hillsboro' reservoir. Washed from some unknown home among the hundreds destroyed by the pitiless flood, this young navigator had somehow escaped the fate of his kinsfolk; and in happy unconsciousness of danger, was discovered drifting along, kicking up his heels and crowing at the unfamiliar brightness of the sky, and the pretty colors of the birds and butterflies that hovered around.

A sunken Ohio river steamboat afforded, the other day, a still more remarkable and affecting case of infant preservation. The steamer ran on a snag in the night, and sank in deep water, drowning several passengers, among them a number of children.

One of the parents was a Mrs. King, who was, with the rest of the passengers saved, sent on to Shawneetown, Ill., mourning her son as lost. The next morning, the men who went to recover the bodies of the drowned discovered a mattress floating in the cabin, which was filled with water to the ceiling. Peacefully sleeping on this dangerous bed lay a little boy, who had been upborne all night by the water-soaked yet still buoyant mattress. The spasm of hope aroused in the hearts of the bereaved mothers when news came of the miraculous escape of somebody's child, the joy of one and the agony of the rest when the saved was identified, no novelist could conceive or portray. The effect on the mother's future cannot be small. Will it have any influence on the boy's life? Time alone can tell. Certain it is that, if he turns out to be a king indeed, a leader of his fellow men for good, his followers will have a pretty tale to tell of providential interposition to prove the divinity of his calling.

Scoresby and other arctic voyagers and whale hunters have observed that whales have some means of communicating with one another at great distances. It is probable that the animals bellow in a tone too grave for the human ear, but quite within the range of the cetacean ear.

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Contents.

(Illustrated articles are marked with an asterisk.)

Amazons, up the..... 228
American Institute, Fair of the... 225
American scientific schools..... 226
Aniline black, printing with..... 232
answers to correspondents..... 234
Berlin—Letter from Professor R.H. Thurston..... 229
Boring machine, improved*..... 226
Brain, the mechanics of the*..... 224
Business and personal..... 234
Checker lozenge package*..... 226
Check to railway enterprises, a... 232
Cincinnati exposition, the..... 231
Coal beds, burning..... 230
Crisis, the financial..... 224
Cut-off, variable*..... 233
Energy in Nature, the manifestation of..... 228
Evaporation of water by plants the*..... 227
Floors of mortar in Mexico..... 227
Hay rake and tedder, combined*.. 230
Industrial expositions, the..... 232
Inventions patented in England by Americans..... 232
Lard as an unguent..... 229
Million dollar telescope, the..... 226
Moses, a possible..... 223
Notes and queries..... 234
Oils for iron, mineral..... 231
Oranges and lemons, packing..... 229
Patents, official list of..... 235
Patents, recent American and foreign..... 232
Phosphoric compounds, some new 232
Pianos are injured, how..... 224
Pinchers, shoemaker's*..... 232
Plane, improved match*..... 231
Roller and irrigator, combined*... 240
Sand and mud baths..... 224
Sash lock, holder, and weather strip, combined*..... 226
Scientific and practical information..... 225
Sewing machine patent, an old boot and shoe..... 224
Steam gage, improved*..... 231
Test for copper and tin..... 231
Test plates for the microscope.... 231
Ventilation of sewers*..... 232

THE FINANCIAL CRISIS.

One of the incomprehensible financial tempests, which occasionally rage with more or less fierceness in the monetary world, has appeared among the brokers and banking institutions of this city; and although now, it may be hoped, it has nearly passed over, it has left a path marked with victims, in the shape of several of the most prominent houses in a state of either failure or suspension. Why such a violent commotion should have arisen at a period when the business and industries of the country are flourishing, when there is no reason for a dearth of funds in circulation, and to what cause it may be justly ascribed, are questions difficult to answer. It seems as if people suddenly concluded not to lend or expend money or accommodate each other on any terms. Not only on railroad but on every other species of bonds, was it almost impossible to obtain funds; even governments could not be sold until the Sub-Treasury opened its doors for their redemption; and the banking houses not only declined to advance to their customers, even upon the deposit of unusually large collaterals, but in some instances refused to pay out the amounts of open accounts other than by certified checks.

The savings banks, sharing in the general grab, called in all funds due to them, demanding immediate cash payment; while they themselves, taking advantage of the law, refused to meet the drafts of their depositors until the thirty or sixty day notice had expired. This stringency, or rather emptiness, of the money market (for currency was thus completely locked up) created a panic; and, as usual, frantic appeals to the Government for aid, by placing in circulation the reserve fund in the United States Treasury, were made. This, being illegal, was justly refused by the President, so that the financial men of the community, among whom the storm arose and to whom it has been almost entirely confined, are left, with such aid as the redemption of the United States bonds (now ceased) may afford them, to return as best they can to their normal though never quiescent condition.

It has been the general impression that the effects of the panic would be felt by few other than the dealers in money and its equivalent; but it is to be feared that, although mercantile and manufacturing houses have not partaken materially in the disaster thus far, the result of the tightness of the money market will be seriously detrimental to the fall trade and the export of grain and cotton.

DISCOVERY OF AN OLD BOOT AND SHOE SEWING MACHINE PATENT.

The discovery is announced of an old English patent, granted July 17, 1790, to Thomas Saint, for a "Machine for Sewing Boots, Shoes, etc.," which is alleged to contain substantially the same mechanism as that which forms the basis of existing American machines.

We have looked over the drawings and specification of this old patent, and find them rather defective; still it is possible that the machine could be made to work. It makes the loop stitch, contains an awl for punching the hole for the needle, apparently employs the eye-pointed needle, and has a horizontal feed. But if anybody expects by the production of this contrivance in court to invalidate any of our existing patents for shoe machinery, we think they are destined to disappointment. The Saint machine, while it is interesting as an old curiosity, could not possibly be substituted for the effective devices employed in this country. The Saint invention bears about the same relation to modern sewing machines that the ancient revolving pistols do to the existing repeating fire arms. The first, indeed, exhibited the revolving principle, but practically were good for nothing. So of the early attempts at sewing machinery, including that of Saint; they may show the eye-pointed needle, the loop stitch, and a feed, but still are, practically, useless. The ideas of American inventors had to be adopted before sewing machines were made useful to the world.

HOW PIANOS ARE INJURED.

According to a prominent manufacturer, there are more pianos injured by improper tuning than by legitimate use and the consequent natural wear of the instruments. The frame of a good piano, fully strung and tuned, is made to resist a tension equal to about seven tuns. This severe strain relaxes as the strings recede from pitch, but is renewed when the piano is tuned; and it is frequently discovered, as a result of this repeated process, that the frame is bent or bellied; and at the hands of an ignorant tuner or one lacking good judgment, an instrument at this stage is soon injured beyond remedy. With reasonable use, a piano is expected to remain in good condition for seven years, and the best makers will so guarantee their instruments; but the incompetence and malpractice of certain so-called tuners sets the seal of destruction on thousands of instruments in from two to five years.

In tuning a piano, the correct method is to begin in the center of the instrument, on what is called middle C. Yet many tuners, when leaving middle C, instead of going down the scale and tuning the lower notes and heavier and longer strings first—thus immediately bringing the greatest tension to bear upon the frame, and forming, as it were, a solid foundation upon which to operate,—will go up the scale, beginning with the shorter and lighter wires and higher notes, leaving the bass strings until the last, with the invariable result that, when the tuning of the lower portion of the piano is completed, the upper octaves are found to be decidedly away from pitch. Every time a piano is tuned in this manner, it increases the liability of bending the frame and renders the instrument more difficult to tune and keep in tune. The apparent physical effect may be so infinitesimal as to be impossible of measurement, yet a change in the out line of the frame equal to but the thickness of a sheet of tissue paper will produce a difference of nearly a half tone in the sound of any given note. If the lighter strings are tuned first, they relax when the greater strain is brought to bear in keeping the heavier wires up to pitch, with the effect referred to above.

Many tuners do not carefully note the condition of the frame of a piano, and adapt their treatment to the circumstances of the case, with full knowledge that a bent, weakened, or very old frame will not stand the extreme tension or sustain the strings at the high pitch which can be put upon and borne by a frame and wires which have never been injured through ignorance or neglect, and bear no special marks of time or use. There are very few pianos, and those of the best description, that will stand at concert pitch. The piano manufacturers advise purchasers to have their instruments tuned by representatives of the respective factories from which the pianos are sent, as they are aware of the terrible ordeal through which the instruments must pass at the hands of tuners of every degree of intelligence and ability. It is but a fair presumption that the maker of an instrument ought to know how to tune it properly and without injury to its most important parts; yet there are, comparatively, very few persons who profit by the well meant advice, an impression prevailing in some minds that the suggestion is not entirely disinterested, as the makers charge $2 for tuning, while professional tuners and the music stores ask but $1.50, and some of the Bohemians but $1. But were the matter fully and generally understood by the owners of pianos, they would consider it greatly to their interest, even in the light of an investment, to have their instruments tuned by parties in whose hands there is the least possibility of accident or injury.

SAND AND MUD BATHS.

Baths of sand or mud have had a reputation, more or less deserved, for centuries; and at the present day are employed to a considerable extent in different parts of the world. By the former, the inhabitants of the eastern shores of the Mediterranean expect to cure their rheumatic and scrofulous troubles. The process of taking this "cure" is very simple; the patient buries himself almost completely in the hot dry sand, and remains thus, some time after a profuse perspiration has broken out; the perspiration is soon followed by a rash upon the skin, which subsides in a few days.

The little benefit arising from this cure is due in the main to the sweating, which frees the blood from impurities through the pores of the skin, which latter is locally irritated and excited to greater action by direct contact of the sand.

But the latter, the mud baths, so popular on the continent of Europe, among which those of Salzburg, Franzenbad, and Marienbad in Germany have the highest reputation, are really more beneficial. They are prepared in the following manner: Bog mud is thoroughly dried and sifted, then saturated with mineral water, the mixture being made so soft that the body can sink into it; the temperature is raised to about 112° Fahr., and the bath is ready. The baths may be either partial or complete, according to the part of the body to be treated; but in either case, the duration of a single bath is from thirty to fifty minutes; after which the body is cleansed by a warm water *douche*. They are taken daily, early in the morning, until relief is obtained. The diseases to which they are particularly suitable are some kinds of paralysis, muscular rheumatism, and the dull nervous pains which follow severe bruises and which are called weather pains. In former times, their efficacy was thought to depend upon the large amount of iron and salts contained in them, and which were absorbed into the blood through the pores of the skin. It was even supposed that there existed a magnetic current in the mud, which acted as a strong nervous tonic: but at present, the general belief is that the action is simply that of a universal poultice, giving to the entire surface of the body the heat and moisture which we apply to a sore finger in the bread and milk.

Any one who lives near a bog swamp can extemporize a bath, almost as efficient as those of the celebrated watering places, if he have the time and patience to make it; but instead of mineral water, he can use ordinary boiling water or water in which is dissolved a quarter of a pound of green vitriol and half a pound of rock salt. As the heat and moisture are considered the principal parts of this cure, other substances than mud may be used, which, although more expensive, are yet more cleanly; as, for instance, a fine sand or bran, or any material which will mix well with water and retain the heat for some time.

THE MECHANICS OF THE BRAIN.

"There is a just criticism," considers Dr. Edward Fournié, in a paper on the human brain, recently read by him before the French Academy of Sciences, "which may be applied to the efforts of Gall and of those who have followed his teachings in endeavoring to divide, classify, and localize all the manifestations of the human mind. It is that, in place of determining the seat and functional part of the elements which conduce to cerebral activity, a research which constitutes the physiology of the organ, the localizers have attempted to place a mass of manifestations resulting from the working of the brain without pretending to explain the working itself. In other words, they have replaced true cerebral physiology by a synthetic expression of a certain number of phenomena which they have associated with this or that portion of the brain; or, to illustrate, we are told that the faculty of articulate language has its seat in the anterior lobes, while we are left in darkness as to by what mysterious means the idea of speech is formed."

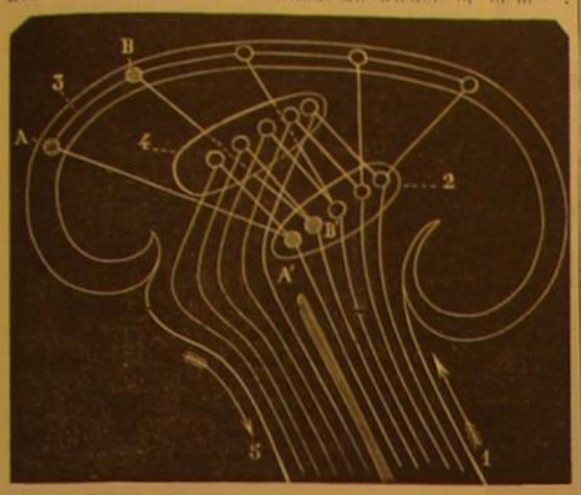
In the living body, three orders of organs may be recognized, the operations of which may be referred either to the laws of physiology or of chemistry. The liver, for example, furnishes a chemical product. A muscle is governed by mechanical laws; it is a motor; while the brain is referred to the laws of molecular dynamics. Like the electric battery, it is the seat of a movement which escapes our observations; but while the pile acts upon apparatus submitted to its influence, the brain manifests itself by its effect upon the muscular system. It is by the movements of the latter that we know that the brain acts, and the full value of this assertion will be better apprehended in considering that the speech (*parole*) with which we think was primitively a muscular movement provoked by cerebral activity, and that we repeat tacitly while we think. Now the essential property of the brain is to feel that which provokes its operation, as well as the act resulting from the latter. The liver does not feel the blood which it modifies, or even that it makes bile; the muscle has no knowledge of the nervous influence which contracts it, or of the displacement which it provokes in the parts, and the electric battery cannot feel that it is in activity and causing motion. Herein the brain stands alone; and in its faculty of sensation, we trace the special properties of the organ.

There are two rival methods of studying the brain—the experimental and the psychological. The latter classifies the manifestations of the mind, but does not explain its functional mechanism. The former, or phrenological system, but demonstrates the material substances through which the efforts of the mind receive a stable, permanent, and sensible form. The one refers to results, the other to physical means. It is only by using both methods, the boundaries between which have been but dimly defined, that our author believes he determines the seat of the anatomic elements which lead to the mechanism of cerebral functions.

The accompanying figure will render clearer the problem which Dr. Fournié sets himself to solve. In the region marked 1 are the nerves of impression, that is to say, the nerves which carry toward the brain the result of an impression received, and which occupy the posterior part of the medulla. These nerves end in region 2, known under the name of optic couches, and are composed largely of nervous cellules. Fibers leading from this center, under form of radii, place it in communication on one side with region 3, composed of cellules, and called the cortical couch of the brain; on the other, with region 4, similarly formed of cellules, and known as striated body. From this last portion lead the nerves which occupy region 5, the anterior part of the medulla. These five regions represent the principal localizations determined by science. It remains to determine their functional *rôles*.

Resembling, in this particular, all living organs, the brain, in order to operate, requires the intervention of an especial excitant. This is an impression received at the peripheric extremity of an impressing nerve. Its effect is to modify the vitality of the nerve, nearer and nearer, until the optic couches are reached, and there the nerve, in its turn, acts upon the cellule in which it ends. The result of this last modification of the cellule is the wonderful phenomenon known as simple perception. This faculty, then, has its seat in the optic couches, a fact capable of experimental demonstration, for if that region be destroyed in a living dog, the animal is insensible to any impression; for example, he cannot smell or see; in a word, he lives but does not feel. In man, when the optic couches are impressed, he simply feels—simple perception and no more. To feel *with knowledge* is, however, a different matter; it is simple perception *plus* something else. What that something else is, is the object of our investigation.

It has been already stated that a motion of the cellules of the optic couches is provoked by the nerves. This movement does not expend itself, however, in that particular region, for the couches are not isolated; hence it continues over the fibers of the white nucleus to end in the cellules which form the peripheric layer of the brain. These cellules are thereby, in turn, modified, and experiments upon living animals and pathologic observations enable the determination of phenomena corresponding to such influence. It has been known for a long time that, in the case of lunatics, the cortical couch of the brain is softened or more or less injured. If that region (3 in the engraving) be destroyed in dogs, a sort of foolishness ensues. The animal has all his sensations, as have lunatics, but he is without knowledge or memory.



Hence, while in the optic couches lies simple perception, in the region above alluded to live the reasoning powers just named.

In order to trace the connection which, therefore, must exist between them, let it be supposed that a brain, free from any impression whatever, is submitted to the influence of an odorous body. The movement of the olfactory nerves is transmitted to cellule, A', of the optic center, and the person recognizes an odor. The vibration continues its course to cellule, A, of the cortical couch, and modifies that region. If, now, the exciting body be removed, the man returns to his former negative condition—perceives nothing. Then, by any means, let the cellule, A, be supposed to be impressed with its proper movement, and thus to be transmitted backward this time to cellule A', which re-awakens to its special activity. The latter, however, corresponds to a perception of an odor and, consequently, the man will again perceive the same, although the object capable of provoking such a sensation is totally absent. Such is the first condition of memory. But this is merely an elementary fact; in order to remember, a relation must be established between what is and what has been felt—a link formed between past and present. Suppose that the odorous body is an orange, and that the senses of sight and smell are both provoked thereby. The visual impression will awaken the center, B', at the same time as the odorous impression excites A'; the former will then provoke cellule B, and the latter cellule A, as already shown. The person perceives in two ways, that is all. Now, after withdrawing the orange, suppose it to be submitted to a single sense; let it be held so that the person can see but not smell it. The cellule, B, is excited to activity as before, from the optic couches at B'; and moreover, being united by its prolongation to cellule A, it will determine in the last the special activity pertaining thereto. This, as already described, is reflected back to A', and the perception of an odor is awakened. Here, then, although the man is too far removed from the orange to smell it, that sense is nevertheless excited, and he will remember that the orange is an odorous body of such a perfume. Not only, therefore, will simple perception be excited, but perception with knowledge.

The cellules of the cortical couch of the brain represent, under form of dynamic modality *in posse*, all acquired ideas, and it is to the anatomic connections which unite these cellules to the optic couches that they borrow the possibility of awakening successively the center of perception to give birth to the phenomena of memory. A dream is nothing but the awakening of this center of perception, by the activity of the cellules of the cortical couch, while this same center is shut off from exterior influence. All the cellules of that couch are united among themselves, and they can mutually awaken their respective activities. It is enough if one operates to cause the rest to follow. The classification and admirable ordering of our knowledge is the work of the Creator; the brain is like tapestry, of which God gives us the canvas and we fill in the stitches in designs more or less grand.

Thus far we have referred to but a portion of the cerebral functions, the functional excitant and the functional matter. The duty of the organ does not consist merely in collecting determined elements; it is supposed to work with some object, to attain an end which is not within the brain itself but outside. There must then be particular motions which the organ projects without itself, and these are termed functional movements.

The path we have just assigned to the impressing movement or vibration of the sensitive nerves to the optic couches and thence to the cortical cellules is now the only route followed by such motion. The optic couches are united by special filaments to another nucleus of cellules called the striated body. Here end all the fibers of the motive nerves placed in the antero-lateral part of the medulla. There is a presumption already indicating the function of the striated body, which however is transformed into a certainty when, on destroying such portion of the organ in living dogs, the total cessation of physical movement succeeds. Reasoning from this we can explain the functional mechanism of voluntary and involuntary motion.

Involuntary movements take place when the impressing cause, a danger for example, is sufficiently sudden to awaken instantly the activity of the striated body and as quickly provoke, through the intermediation of the motor nerves, a determined motion of the muscles. The movements of the body are voluntary when the impressing cause acts slowly enough for the perception to travel to the cortical couches and arouse the activity of the cellules. It is not until after the examination of the impression, in connection with acquired knowledge, that the movement takes place. In involuntary motion, the effect is a start, a sudden withdrawal of a member, an inarticulate exclamation, etc. In voluntary movement, the previous examination causes a dominant impression to prevail in the optic couches which gives to the effort a motion as if it had been considered and reasoned upon. To the last belong the movements incidental to speech.

SCIENTIFIC AND PRACTICAL INFORMATION.

RELIGIOUS ELECTRICITY.

Recently in New York city, at the dedication of the new and splendid Jewish synagogue, corner of Lexington avenue and 53d street, a portion of the first chapter of Genesis was sung by the choir; and as the words "Let there be light and there was light" were uttered with a grand burst of melody, the whole church was instantaneously lighted up by electricity. Thus it is that modern science lends her aid to give effect to the solemnities of her servants.

RESTORATION OF OIL PAINTINGS.

It appears that the brilliancy of the colors in oil paintings is due to the optical properties of the substance, contained in the oil, known as linoline. By exposure to the air this substance, at first liquid, absorbs oxygen, becomes solid and transparent, firmly enclosing the particles of color. Linseed oil contains 80 per cent of this linoline. By lapse of time and physical and chemical changes, the linoline loses in some degree its transparency and the picture fades, those colors containing the least oil changing most.

Pettenkofer has discovered that the vapor of alcohol will renew the qualities of the linoline, and he restores old oil paintings by placing them over a tight box, in the bottom of which is a flannel cloth, which has been dampened with alcohol of 80 per cent strength. The arrangement should be such that every part of the picture will be exposed to the alcoholic vapor.

THE FAIR OF THE AMERICAN INSTITUTE.

The exhibition building is now filling up quite rapidly, and nearly double the number of articles are in place that was the case at the time of our last visit. There seems to be an improvement in the arrangement of tables and space which admits of a much better display and at the same time economizes much room heretofore wasted in needless passages. Two wooden extensions are in process of construction beside the main building, in one of which will be a Campbell printing press, and in the other a huge saw mill. The excellent and instructive plan of exhibiting an industry by its processes in actual operation, we are pleased to note, is in some cases being carried out. A shoemaking firm enable the visitor to trace the entire manufacture of the shoe from its first cutting from the hides down to the finishing polish. The workmen are seated around the enclosed space, and the shoe passes from hand to hand, each man adding to or perfecting some portion. The extent of the crowd that constantly presses against the railing, eagerly watching the various manipulations, is a convincing proof of the interest taken by the public in such displays. In the same portion of the hall, a number of tailors are at work, cutting out, basting, sewing and pressing men's clothes; and about midway along one of the side aisles, an ivory turner makes billiard balls, chessmen, handles, etc., from the crude material, while another workman engraves monograms and designs on the finished articles. The display of fruit this year is exceptionally large and fine. There are some gigantic grapes and pears from Nebraska, and innumerable plates of apples, of excellent appearance, from various points of the West. The floral exhibit is as yet rather slim, but probably will be augmented when the Fair becomes completely organized. Evidences of improved management are plain; especially in the absence of the vendors of grease compounds and similar nostrums, who made their surroundings hideous with their yells, and provoked the ire, of every exhibitor in their vicinity, during the exhibition of last year.

We resume our brief notices of such inventions as have attracted our attention, from their novelty or especial utility during recent visits. M. T. Boult's

MACHINE FOR CARVING,

paneling, molding and dovetailing in wood, is an excellently constructed and apparently very efficient device. It is four machines combined in one. The dovetail arrangement is a separate attachment connected with the table, which makes both tenons and mortises at once, so that it only remains to fit the portions together. The paneler is a revolving cutter, working upwards on a vertical shaft under the table. The pattern is fastened on the opposite or upper face of the plank while the lower side of the latter is pressed against the cutter. We examined the operation of the machine quite at length, and found much to admire both in the simplicity of its mechanism and the beauty of the work turned out. Young's

DIAMOND SAW

is at work in the machinery department, in the form of a neatly built iron model, one fifth the size of the more cumbrous wooden apparatus. The blade, it will be remembered, cuts through the stone by means of carbons or black diamonds which are securely set along its edge. There is an ingenious feed motion for moving the saw, and another device to lift the latter, consisting of an eccentric on the crank pin communicating with a knuckle joint and levers, so that it is allowed to cut only in drawing. The small machine exhibited, we were told, penetrated brown stone at the rate of 14 inches and marble at 7 inches per hour. A novelty about this invention is its application to the cutting of window moldings. Bevels are made by suitably turning the stone, and rounded edges by gradually moving the latter under the saw. The work exhibited to us was very smoothly cut, and especially noticeable for its clean and sharp angles. The apparatus, the inventor thinks, does the labor, in molding, of from 12 to 14 stonecutters. Lyall's

CORSET LOOM

is a most remarkable combination of the Jacquard card with the well known positive motion loom. The cards are hung in an endless chain in a frame work in the upper part of the machine, above the two rows of beams. These communicate with the harness, by the usual mechanism, so as to lift certain portions of the warp at certain times. Four strips or webs of corset are woven at once. To give a clear idea of the operation of the machine is hardly possible in mere words. If the reader, however, will imagine that half the warp in an ordinary loom, for instance, be pushed out of the way, and that the shuttle travels a dozen or so times through the portion left, then that the whole warp be allowed to come into action and the weaving go on as usual, it will perhaps be understood that there will be a gusset in the cloth formed by the half action, so to speak, of the filling. This, though crudely expressed, is about the operation of the Lyall loom. The Jacquard cards govern the quantity of warp to be kept in action, and this quantity is so graduated as to form the requisite gussets, welts, and gores. The shuttle consists of a box enclosing the bobbin, the thread from which passes around and through extended springs. By this ingenious arrangement the slack loop, which would result from the shuttle not passing through all the warp, in forming gussets as above described, is taken up and the thread kept taut. The winding of the finished web brings in another very ingenious though simple arrangement for taking up the irregular portions. There is an endless rubber belt pressing against the cloth from above. Below the latter is a strip of wood filled with needle point projections. The needles, while the whole warp is being filled, catch the entire web and, by the action of the rubber belt, pass it along. But when, however, only a portion of the width is being woven, the needles hook the inoperative part and hold it while they allow the part which is being increased to pass on.

The entire invention, which we have thus necessarily only faintly outlined, is of great ingenuity and may justly rank as one of the most important of modern improvements in the trade to which it relates.

A WIRE BRUSH MACHINE,

which puts us very much in mind of a pin making apparatus, is at work in the main hall. It makes hair brushes, or in fact brushes for any purpose, out of fine tinned wire instead of bristles. The wire is led from the coil up to the back of a long strip of india rubber, and is moistened with camphene so as to penetrate the same with readiness. On setting the machine in motion, an awl first makes a hole in the band then the wire is brought up, cut by a blade, and dies hold it while a little swedge forms a head upon its end. Then a pusher drives it into the awl hole and through the band, where it remains. The number of pieces in each row is regulated by an ingenious cam device, which causes them to take the elliptical figure peculiar to hair brushes. It only remains to cut the band into suitable lengths and attach it to back and handle to complete the brush.

Near the apparatus just described is an

ENVELOPE MAKING MACHINE.

The paper, previously cut into proper shape, is placed under an angularly shaped plunger, kept covered with gum. This pushes the piece down through a correspondingly shaped slot and at the same time pastes the lower edges. Two arms then swing around and push the paper under another plunger, of different shape, which carries the piece through a square hole of the size the envelope is to be. The edges are next doubled over by swinging metal plates, arranged on the sides of the slot, and the envelope remains in its place until another arrives, when it falls into a suitable receptacle.

There is a peculiar horizontal steam pump, Eickemeyer's, in a corner of the machinery department. At the middle of the piston is a short arm which, by a ball and socket joint, connects with a yoke on the fly wheel shaft. The piston has thus a partial rotation on its axis, and so forms a self-operating valve for both pump and steam cylinder.

A rather queer invention is the

STEAM BOOT BLACKER,

which consists of brushes which rub the sides and top of the boot and another made in shape to conform to the heel. There are attachments for a supply of water, and other brushes for removing mud, etc. The mechanism is quite simple, and agitates the brushes at a rate which might carry dismay to any one who is afflicted with corns, bunions, or tender feet.

IMPROVED BORING MACHINE.

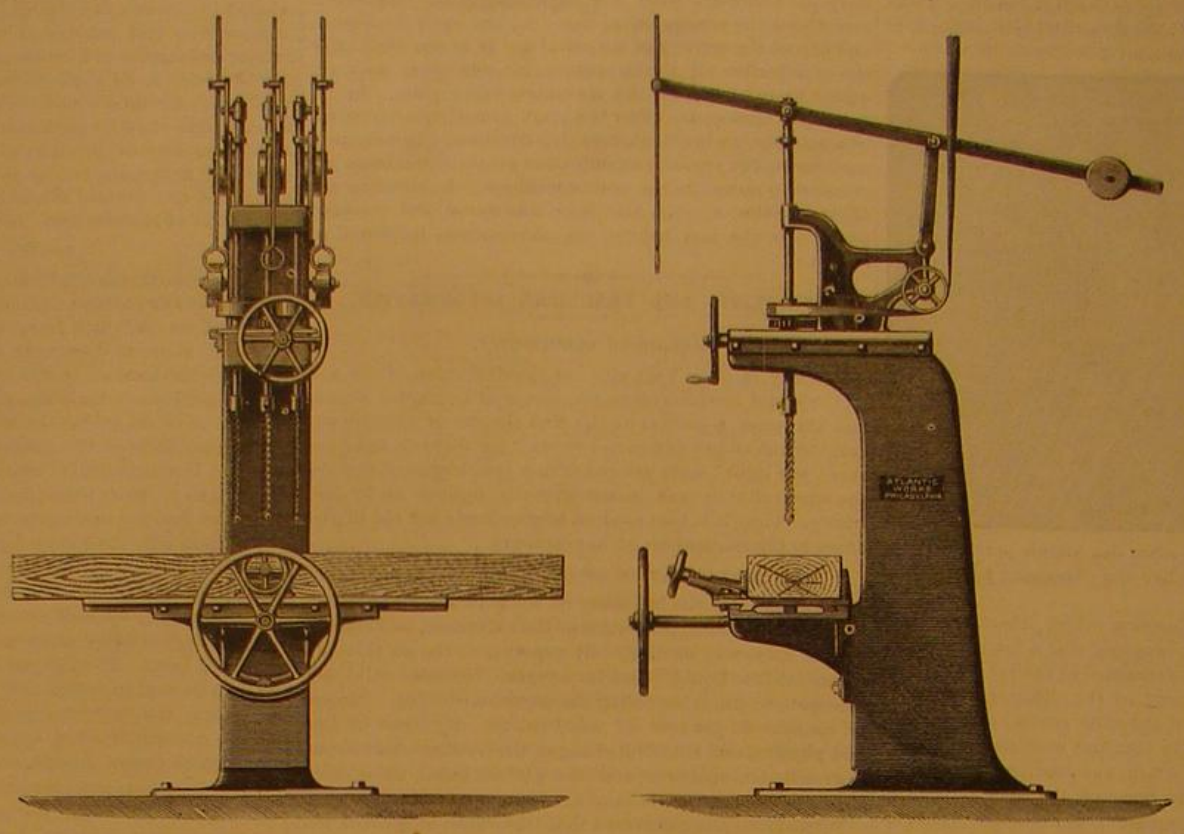
One mechanical difficulty that has presented itself in the construction of boring machines with vertical spindles has been to change the driving motion from the horizontal shafts to the spindles. To this end rough wheels have been used, but these, in addition to that of the limited speed at which they can be driven, are open to the objections of wearing out the bearings and creating noise. The lateral strain upon shafts being as their distances from the center at which the power is applied, it is evident that the strain upon the bearings of boring or drilling spindles, when small wheels are employed, is almost as great as it is upon the teeth of gearing.

Although the operation of wood boring is a light one, so far as the mere cutting is concerned, yet the supporting and adjustment of the timber requires a strong machine. Boring, as a rule, is performed on the heavier class of lumber, such as is joined or framed by means of bolts, instead of tenon and mortices alone, and the appliances for handling the same are therefore necessarily of substantial construction.

We publish herewith engravings of a new machine by Richards, London, and Kelley, of Philadelphia, that combines several improvements, and is claimed to meet most of the objections that we have pointed out.

The spindles, three in number, are driven by one belt that is carried around the pulleys so as to give the greatest tractive power; and no gearing, except a single pair of spur wheels, is used. These wheels are engine cut, and may run at any speed required. The spindles are moved across the lumber by means of the hand wheel seen in front, and have a boring range of 18 inches. The several spindles can be fitted with augers of various sizes, so that all the boring may be performed at one operation when there are not more than three sizes of holes to make in each piece. The table, or carriage, is very strong, arranged with a diagonal clamp and pivoted so that angular holes can be bored. All the movable joints are fitted by scraping, and the whole seems well adapted to the severe use that boring machines receive in our large railway carriage and other woodworking establishments.

We are informed that patents on these improvements will soon be applied for.



WOOD BORING MACHINE.

CHECKER LOZENGE PACKAGE.

There is probably no one of our readers who, while traveling in a railroad car, has not had packages of gum drops or prize candy unceremoniously tossed into his lap and left in his charge during the peregrinations of their somewhat grimy vendor through the train. The advantages of this plan of selling sweetmeats need not here be pointed out; the disadvantages consist in that the purchaser, after he has absorbed the candy, is without further employment than that to be obtained from the perusal of the wrapper or from dismal forebodings of the probable effect of his repast on his teeth and digestive organs.

Fig. 1.

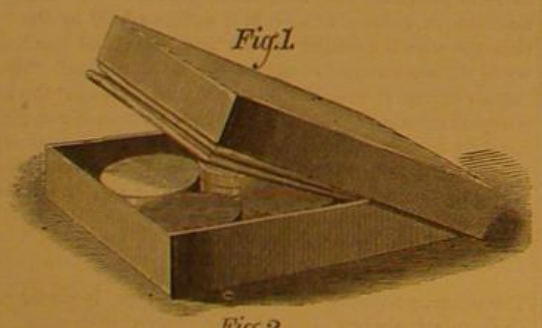
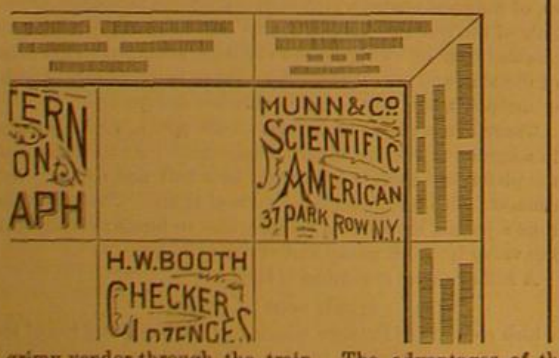


Fig. 2.



The merit of the novel idea which is represented in our engravings will therefore be fully appreciated, particularly as it combines in a single package not only a quantity of candy, but the necessary articles for playing a game of drafts or checkers, thus affording an agreeable means of whiling away the hours of a tedious journey. The box is about the size of the ordinary twenty-five cent packages. Its contents consist of twenty-four lozenges—twelve white and twelve red, of two different flavors—and also of a sheet of paper printed in squares. The divisions of the board, instead of being dead black and white, are formed by printing advertisements in alternate squares, so that the player, while meditating over his moves, has directly under his eyes the announcements of various business houses. The advertisements are either "set up solid" or "displayed," as shown in Fig. 2, and, besides occupying the squares, extend around the edges of the sheet.

The device seems quite novel and should prove a saleable article in confectionery stores as well as to travelers. The candy is, we are assured, pure and free from all deleterious ingredients, and is made by machinery at the rate of two tuns weight per day. The advertising sheet will doubtless commend itself to enterprizing firms as an ingenious mode of bringing their business to public attention.

Patented through the Scientific American Patent Agency, June 18, 1872, by Mr. H. W. Booth, corner of Don and River streets, Toronto, Ontario, Canada, by addressing whom further particulars regarding sale of patent may be obtained.

American Scientific Schools.

We of Young America, like other good children, feel a natural exultation in commendation which comes from father land or mother-country; and thus we Scientific Americans may take pardonable pride in such praise of one of our American schools of science as is contained in the following extract, from the *Chemical News* of August 29, just received:

Programm der Königlichen Rheinisch-Westphälischen Polytechnischen Schule zu Aachen fur den Cursus 1873-74.

Announcement of the Stevens Institute of Technology, a School of Mechanical Engineering founded by Edward A. Stevens. Hoboken, N. J., U. S. A. 1873.

We owe, to the courtesy of the directors of the establishments just alluded, to the opportunity of calling attention to two excellent schools established, the one by the care of the Prussian Government, the other by the munificence of a late eminent citizen of the great Transatlantic Republic.

In the programme of the Polytechnic school at Aachen (Aix-la-Chapelle) we meet with a very clear and succinct review of polytechnic science in all its bearings and its applications, as taught by a staff of some forty teachers, while the headings of the various subjects in which instruction is given amount to about one hundred. The school is now attended by about four hundred pupils, many of whom are natives of non-German countries.

Although an institution due to private munificence, the Stevens Institute of Technology can worthily vie with the now already celebrated School at Aachen. The Stevens Institute is just as much a high polytechnic school as the German one, and to the eminent President of the American school, Dr. H. Morton, high credit is due for the manner in which he has assisted the trustees of this foundation to carry out the will of the late Mr. E. A. Stevens.

Our space does not permit us to enter into a detailed review of the two volumes, the titles of which are recorded above. Both books have a permanent value, and the American contains, aided by woodcuts, a description of some of the most prominent portions of the contents of the museums and collections of apparatus for illustrating lectures on physical, chemical, and engineering sciences. While calling attention to these institutions, we cannot but express our great regret that in this country nothing exists which even approaches either of the two establishments of which the programmes have been courteously sent to us.

SPRAGUE'S COMBINED SASH LOCK, SASH HOLDER, AND WEATHER STRIP.

The chilly evenings and mornings of the present month will be a reminder that cold weather is not far distant, and consequently that it is time to take the necessary precautions for keeping the warm air in as well as the chilly blasts out of our dwellings. With chinks open around the windows, a comfortable house is hardly a possibility, so that we presume there are few who will not avail themselves of some form of the well known "weather strip." The invention which we illustrate in our engraving may, therefore, perhaps prove a welcome device to many, particularly as it is especially adapted to windows which are minus cords, pulleys, or proper locks, a state of affairs frequently the case in country houses.

The arrangement consists of a strip, A, resting alongside the sash, B, Fig. 2, on springs, C, placed to receive it, and secured by screws, D, with their heads against shouldered sockets, so that the movement of the piece, as regards sash and frame, may be regulated. The strip, A, is covered on its face with leather, so that it forms a tight weather strip, and by its elastic movement permits the sash to be held up at any desired point.

A section of this batten, E, forms the locking bolt, and is constantly pushed outward by a spiral spring, F. When opposite the recess in the window frame, as shown in Fig. 1, the action of the spring forces the pivoted section therein, thus firmly locking down the sash. When it is desired to raise the latter, it is only necessary to pull down the hook lever, G, which contracts the spring and withdraws the locking piece. The section, E, is faced and forms a continuation of the weather strip; and by jointing it to the lower end of the piece, A, the device is rendered suitable for the upper sash.

Patented by Mr. E. J. Sprague, July 22, 1873. For further particulars concerning the sale of rights, etc., address the proprietors, Sprague & Miller, P. O. Box No. 17, Youngstown, Mahoning county, Ohio.

Fig. 1. Fig. 2.



THE Brazilian cable expedition is at Madeira, and the line connecting that island with Portugal has been successfully laid.

THE EVAPORATION OF WATER BY PLANTS.

In order to measure with precision the quantity of water necessary to maintain a plant constantly in a proper condition of moisture, it is necessary to determine the enormous amounts of liquid which the vegetable evaporates. The method of obtaining such result is quite imperfect, for since metallic plates are arranged over the plant and pot so as to cover completely the earth, and it is impossible to hinder an evaporation from the surface of the soil, it is manifestly difficult to affirm that all the fluid employed in the watering has traversed the plant.

M. Deherain communicates to *La Nature*, to which journal we are indebted for our illustrations, records of his investigations in the subject, which have extended over several years. In order to collect the water evaporated, he fixes a leaf of the plant in an ordinary test tube by means of a split cork. The tube is held by a support so as to retain the leaf in its normal position (Fig. 1). When the apparatus thus arranged is placed in the sun, dew quickly appears on the interior of the cylinder, and augments rapidly until, at the end of an hour, a quantity of water may be collected, often equal to, and sometimes of twice the weight of, the leaf. In several examples given by the author, we note that of a leaf of wheat, weighing 36·1 grains, yielding, in the above period, 30·1 grains of water, equal to 88·2 per cent of the weight of the leaf. A more striking instance is that of corn leaves gathered after a prolonged drought, giving 229, 187, 179, and 178 per cent of their weight in water, the largest proportions yet determined.

In order to obtain from the leaves such excessive quantities of fluid, it is necessary to expose them to the sun for a time: for if they be submitted merely to diffuse light, evaporation diminishes perceptibly, while it ceases almost entirely in darkness. A wheat leaf exposed to the sun gave, as above noted, 88·2 per cent of its weight of water; in diffuse light this proportion was reduced to 17·7 per cent, and in darkness to 1·1 per cent. These experiments are very simple and easy, and any one interested in the subject can repeat them for himself with little trouble.

It appears difficult, from the above results, to avoid the admission that light has a decisive influence on the phenomenon. In order, however, to render certain the fact that the abundant transpiration in the tube was not due to a warming of the confined air by the sun's rays, during the entire experiment the leaves were kept at a low temperature, either

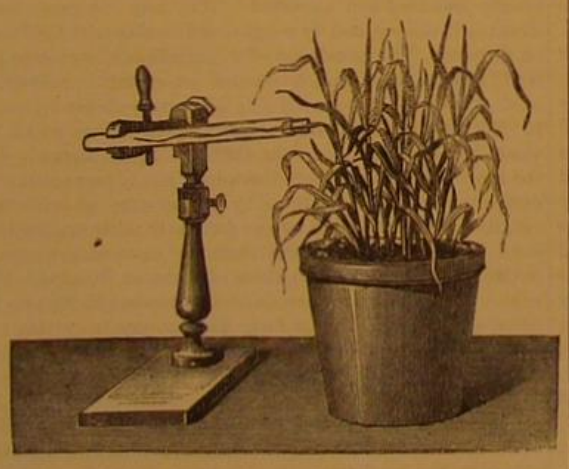


Fig. 1.—Apparatus showing the quantity of water evaporated by leaves.

by placing the tube within another, through which passed a current of water (Fig. 2), or surrounding the inner cylinder with crushed ice, which was constantly renewed. Thus arranged, a wheat leaf, weighing 2·7 grains, gave 2·5 grains of water in the sun and only ·045 grain in darkness. The liquid between the tubes was kept at 59° Fah. At a temperature of 39·2°, gained by the aid of ice, in an hour in the sun, the leaves gave off 108 per cent of water.

It is, then, the luminous heat which determines the evaporation as well as the decomposition of carbonic acid by the leaves; and it is curious to note whether, in pursuing the comparison, we should eventually recognize that the luminous rays, potent in determining the decomposition of the carbonic acid, are equally efficacious in favoring evaporation. In causing the first mentioned effect, the brightest rays, red and yellow, are known to be the most active. This fact may be determined by placing a marsh plant in a weak solution of carbonic acid and then surrounding the vessel with a cylinder containing various colored liquids. It will be found that the green and blue rays, which blacken photographic paper so rapidly, act but feebly, and cause but a very light disengagement of oxygen, while, on the other hand, the red and yellow rays, inoperative on sensitized paper, are singularly energetic in causing the decomposition of carbonic acid. Now, precisely these same rays favor the evaporation of water by leaves, and this is experimentally demonstrated in the apparatus represented in Fig. 3. The tube holding the leaf is placed in a glass, which is filled with a colored solution arranged so as to be easily drawn off and replaced, when necessary, by other liquids. The leaf is then caused to be illuminated by variously tinted lights, and it is found that the efficacy of the rays in determining evaporation ranges in the following order: yellows, reds, blues, and greens. When the outside vessel contains a yellow solution, a quantity of water double that given off by the leaf when submitted to a green light is collected.

Analogous results are obtained by using the solar spectrum obtained through a glass prism. The light (Fig. 4) is reflected by a heliostat to the prism, undergoing separation, and the tubes are arranged in various parts of the refracted

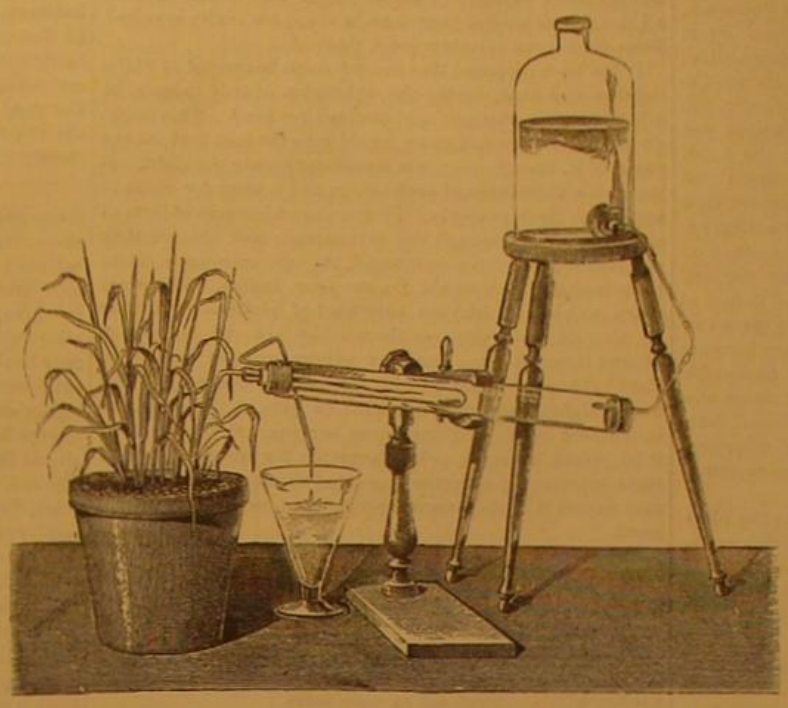


Fig. 2.—APPARATUS SHOWING THAT THE EVAPORATION IS DUE TO LIGHT.

rays. The facts already recorded are plainly discernible.

It may be considered, as determined from the preceding, that the rays efficacious in causing the decomposition of carbonic acid are also those which favor the evaporation of water by leaves, and thus two very important phenomena of vegetable life appear to be connected by a bond, the nature of which is still unknown.

By determining the evaporation of a cultivated surface, we may be able to draw important conclusions on the quantity of water which it should receive in order that the growing plants thereon may prosper. It has been found that in a thinly planted field of corn, where thirty stalks were counted per 10·7 square feet, the weight of the leaves was about 3,732·6 grains. These leaves on a clear day gave off at least 150 per cent of water per hour, or in ten hours 1,500 per cent. The 3,732·6 grains of weight of the latter should therefore give off 55,902 grains of water, or something over one gallon. If, therefore, 10·7 square feet (square meter) yield a quantity equal to some 6·6 pounds, 2·4 acres (hectare) will give about 33 tuns. This is not far from the conclusion reached by Hales, a celebrated English naturalist, nearly a century ago, as he estimated that 20 acres planted with cabbages evaporated 706 cubic feet of water per day, while more extended investigations by Schleiden, the botanist, on fields of grass and clover, gave 21 tuns per similar area.

These figures, however, relate to ordinary and general agriculture, fields, etc.; but if we consider the cultivation of vegetables for the market—kitchen garden culture—we should find, corresponding to the quantities of irrigating water, results infinitely more elevated. It is estimated that the kitchen gardeners of Paris throw, per year, upon the rich soil, water equal to a depth of 12·8 feet. Considering that cultivation continues for 250 days per year, for in winter it almost entirely ceases, it is found that every 2·4 acres receives daily 5,648 cubic feet of water. The result is that, thus treated, the earth yields crude products to the value of from four to six hundred dollars per 2·4 acres instead of from one to one hundred and fifty dollars, as would be the case in extended agriculture.

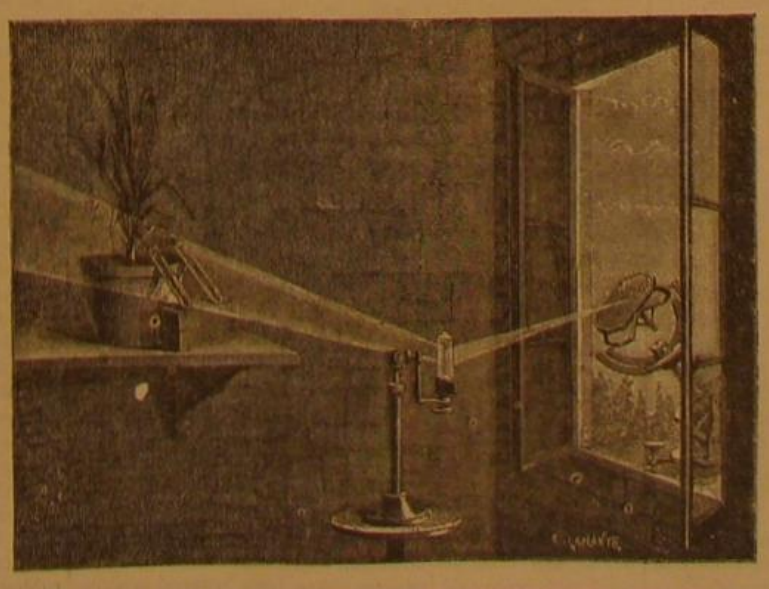


Fig. 4.—APPARATUS FOR DISTINGUISHING THE EFFECTS OF THE RAYS OF THE SOLAR SPECTRUM.

Floors of Mortar in Mexico.

General T. G. Ellis describes, from personal observation, the following method used in Mexico:

"The limestone used was a hard, compact, blue material, in some places sufficiently hard to strike fire on the drills used in running a drift through it for mining purposes. It often contains iron pyrites in small proportion. This was calcined in kilns cut out of a very soft limestone, that likewise is found in that section of country, and which, on account of its whiteness and softness, is called *cal leche*.

After calcination the lime was removed from the kilns, and slaked as soon as cool. Some of it was used within a day or two, and some remained a month or more in barrels. All the work made with it seemed to be equally good.

In making the floors, a layer of broken limestone, three or four inches thick, was first laid evenly over the surface of the ground, the stone being about the usual size for macadamizing roads. Over this a mortar of about two parts of sand to one of lime was carefully and evenly spread to the thickness of 1½ or 2 inches; this was allowed to remain for about twenty-four hour , or until the surface had become quite dry. It would probably take longer in this climate, where the air possesses a greater amount of moisture than in Mexico.

The floor was then thoroughly pounded all over with a tool composed of a block of wood about 1 foot square and 3 inches thick, having a handle rising from the middle, so that a man could stand while using it. The whole surface was beaten down with this ram until it was again as soft and moist as when first laid. This operation of ramming brought the water in the mortar to the surface so as to form a layer of semi-fluid substance on top.

The floor was again allowed to dry, and again beaten over each day for about a week, when the operation brought only a slight amount of moisture to the surface.

Immediately after the last pounding the whole surface was powdered with a thin layer of red ocher, evenly sifted on, and then polished as follows:

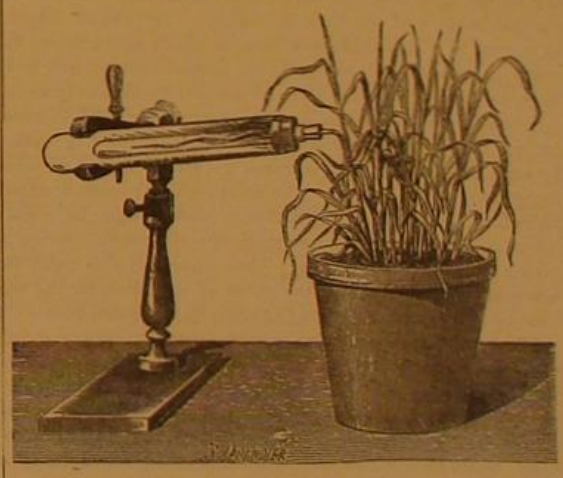


Fig. 3.—Apparatus for distinguishing the effects of variously colored rays.

A smooth, nearly flat, water-worn stone, a little larger than the fist, was selected from the bed of the stream which ran through the place, and with this the whole floor was laboriously gone over, rubbing down, and leaving the surface of the lime as smooth as a piece of polished stone, the red of the ocher rendering it of a rich brown color.

In less than a week the floors made in this way were sufficiently hard to bear the weight of a horse without indentation. Roofs were made in the same manner, without the coloring matter, which was added only to give the floors a better tint than the gray of the mortar. These roofs were perfectly waterproof, and were unaffected by sun or rain.

In the city of Monterey, sidewalks in the principal streets are made in the same manner, and some of them have lasted for years, wearing through like a block of stone.

The great durability and strength of these floors and roofs are entirely owing to the pounding operation above described, as the same materials were tried in the ordinary way without success.

The writer has not had occasion to make use of this process in this climate, but gives a description, hoping that it may be of value to others who may have occasion to lay floors of lime in architectural or engineering works. He has never heard of this method being employed in this country; although it seems singular that it should be used so generally by a neighboring nation, and be wholly unknown to our builders."

Our readers will perceive that this method of

using mortar is analagous to the French mixture known as Coignet's *béton*, which, when thoroughly rammed as above described, forms artificial stone of great strength impervious to water. M. Coignet appears to have been long anticipated by the Mexican builders.

Correspondence.

The Manifestation of Energy in Nature.

To the Editor of the Scientific American:

If we would ignore the assumed existence of the hypothetic ether, and look upon every particle of matter as being the center of a ubiquitous sphere of static energy or influence, natural phenomena could receive a better explanation. From our knowledge of matter we say that it is indestructible; and as every portion manifestly influences in its motion every other, we may say that its energy is practically ubiquitous, and continually exercised for the attainment and maintenance of equilibrium. Faraday supposed the existence of "physical lines of force;" and both Thomson and Maxwell show that this hypothesis gives a more correct view of electro-magnetic action than the usual mathematical expression. As then all that we know of Nature is summed up in matter and energy, we may fairly assume the physical existence of both, while looking upon the essential nature of either as beyond the reach of speculation. By this means we rid ourselves of unwarrantable hypotheses. Space becomes neither a vacuum nor filled with one or more impossible ethers. Electric or magnetic phenomena are not action at a distance, but action along unbroken lines of induced force within a body's sphere of energy, the transversal vibrations of such lines when broken into an advancing wave constituting heat and light.

The constitution of every cosmic system proves the physical existence of energy. Static potency is inversely as the distance from the center of exerted power, as shown by the lever or balance. The centripetal force varies inversely as the square of the distance, the centrifugal as the cube. This makes the revolving force to vary inversely as the distance, when both tendencies are produced from the same center, as in the common illustration of a sling—constraint and outward motion acting along the same connecting line. But the physical connecting line is necessary. Now we find, in every cosmic system, the energy of motion (velocity squared) of every revolving body to be inversely as its distance from the united balancing center.

The solar system, say, represents a certain amount of energy—that of the matter composing it—and is formed in the universal tendency to equilibration, by the matter blending its energies into one common concentric sphere for the mutual balance of the various bodies. The laws of Kepler, in regard to which there has been so much speculation, become inevitable. Equal areas are moved over by each body in equal times. As the force of motion is inversely as the length of radii in the concentric spheres encircled in revolution, the linear length defines the time occupied in motion by each body. The radii squared give the respective areas swept over in revolution. The areas (radii, or times squared) therefore, described by the different bodies, must be to each other as the volumes of energy in the concentric spheres of which they are great circles. The squares of the radii for areas are to each other as the cubes of the same for the volume of energy, which gives the areas to be moved over.

The blending of energies into one common center of balance explains the law of gravitation. For matter must approach until stable equilibrium is attained by the proportional masses, at the necessary distance from the united center of gravity. But by the principle of the conservation of energy, when the bodies have attained balancing distance in free space, the force of approach necessarily becomes transformed into revolutionary motion. Of this deviating force, the Newtonian law renders no account. But the ascription of physical energy to matter, with its universal tendency to equilibrium, not only explains but shows the necessity of the conservation of both centripetal and tangential tendencies.

The theorems of La Grange and La Place are necessitated also by the physical reality. For that definite amount of energy which centered itself for the equilibrated motion of bodies cannot otherwise than conserve what it formed, local action being continuously neutralized by counter strain.

My conclusion, then, is, that matter and energy are physical realities, because they constitute all that we know of Nature. The energy of every particle of matter we look upon as universal because it acts upon all others. The energy of every body is exercised in maintaining or in striving to attain equilibrium with all others, and may act either attractively or repulsively, according to the most powerful enforcement or solicitation; we find that Nature teaches this also. To this variation of action, according to molecular constitution, must be ascribed cometary eccentricities. In apparent defiance to the gravitating law, cases of division and permanent separation of parts have been witnessed. Static potency is inversely as the distance from the center of balance; as we see that a small body will, by a nearer approach to the center of the earth, raise a much larger, if only at a greater distance from the balancing center, although both originally were at the same distance from the earth's center, and the larger body attracting according to its mass. Radiant action, or vibration from the center of a body's sphere of energy, outwards, must vary with the square of the distance, and also tractive potency if acting in all directions. Such variations of potentiality bring about all natural charges amidst all tendencies to equilibrium; and the amount of energy in the universe is measured by its matter. The energy of the atom is no less universal than indestructible.

Philadelphia, Pa. WM. DENOVAN.

The Million Dollar Telescope.

To the Editor of the Scientific American:

Much has been said about this proposed instrument, and several plans given. I have another plan that, if it be not too visionary, will be far less expensive than and fully equal in its results to any other. I have read somewhere, or else I dreamed it, that if a plate of glass be placed over a circular opening and the air exhausted from behind it, the glass is bent back by the pressure of the atmosphere, and it may be made to retain this concavo-convex form. If this be true, why may not the lens be made in this way and filled with bisulphide of carbon? I see no reason why it may not, for all the glasses needed may be made of any convexity required. Some genius can certainly work this out.

It has been proposed that the telescope be erected at Philadelphia, and that, during the exhibition of 1876, people be allowed to look through it at so much per head. This might do to raise money, and many would take the look just for the name of it, though very few would appreciate the sight. It requires a knowledge of such things and a taste for them to appreciate them properly. I have shown persons objects of the lesser world through the microscope; and though they considered themselves cultivated, they no more appreciated those beauties than would Lo, the poor Indian. There are many people, too, who are very fond of pictures; but after all, they do not appreciate them: they lack the knowledge of and taste for art. One may admire, and yet not appreciate. Thus it would be with the great telescope. While many might, from curiosity, want to gaze at the stars, the instrument would be doing mean service. Far better that it be placed at some point favorable for observation, and some experienced observer appointed to use it, and then we may expect it to do something worthy of so great an instrument.

I would willingly forego a look through it, much as I might desire it, that it might be used to better purpose. It is just the thing that I have thought of for years; if I were worth the million, I would have constructed it at my own expense for the benefit of science; but as I am worth less, I will have to stand back and wait awhile. Still, I hope the project will be carried out in some form.

Sans Souci, Ohio. X. PERRY MENTOR.

[Special Correspondence of the Scientific American.]

UP THE AMAZONS.

No. 1.

PARA.—ITS SITUATION, CLIMATE, INDUSTRY, AND COMMERCE.

The largest city on the largest river in the world, and the sole commercial outlet of a region equal to the United States east of the Mississippi but really more fertile: such is Pará.

It is a city of strange contrasts. Founded two hundred and fifty years ago and having an unparalleled position, it has to-day but thirty-five thousand inhabitants, a slow growth, due mainly to revolutions, yellow fever, and absurd legislation. Standing seventy miles from the ocean, it is nevertheless approachable by the largest steamers. It is built on a low tract of land, so that at a distance it appears, like Venice, seated on the sea, with beautiful rocinhas nestling in gardens along the shore, and every variety of craft, from frigate to canoe, on the water; hemmed in between the river Guajará and a perpetual forest that stubbornly disputes every inch of ground; with picturesque avenues of mongubas, graceful palms, and superb bananas in elegant luxuriance: with unpaved streets, neglected plazas, dilapidated houses, sombre churches with grass and shrubs growing on their tiled roofs; with screaming parrots and toothsome vultures, yellow dogs and chattering monkeys; with wealthy Brazilians in spotless white, noisy Portuguese porters, idle soldiers, merry negresses with trays or water jars on their heads, sober Indian women with naked children astride on their hips or rolling in the street; with a mongrel population of amalgamated Portuguese, Indian, and Negro blood—mulattos, Mamelucos, Cafuzos, Curibocos, and Xibaros; everywhere the signs of human indolence and Nature's thrift, of filth and poverty alongside of overpowering beauty and wealth of vegetation, yet altogether leaving a pleasing impression on the mind which can never fade.

Pará (officially called *Belém*—the Portuguese for Bethlehem), is justly celebrated for the almost perfect equilibrium of its climate. The temperature ranges from 73° to 93°, the mean of the year being 81°. The heat is never so oppressive as in New York, being tempered by strong sea breezes and afternoon showers. Were it not for the imported diseases, Pará would be the paradise of invalids. In 1819 the small pox first visited the city, in 1850 came the yellow fever; and in 1855, cholera. The natives suffer most from the first epidemic, and foreigners from the second. At the present time (July), the small pox is at work, not only in Pará, but also in Manáos, a thousand miles up the river. As

AGRICULTURE

is at a low ebb and import duties high, living is dear in comparison with former rates or with what we might expect in a city on the edge of an empire of exhaustless fertility. Luxuries are exorbitant. Hotels charge $2.50, gold, per day. Enterprise runs mainly to small shopkeeping and wholesale trade in rubber and cacao. But there is progress toward a better state of things. We notice many changes since our visit in 1867. The passport system was abolished last year. The State religion is more tolerant (the Jews have a synagogue), and religious holidays, which once seriously interfered with trade and industry, have been reduced in number. Among the new public buildings are the President's Palace and the Grand Opera House. The latter will cost $500,000, and contain a theater accommodating 1,600 persons and a saloon holding 1,200, in every respect out of all proportion to the wealth and size of the city. There are two banks, with a joint capital of $6,000,000. The city is lighted by a London company, the gas costing four dollars per thousand cubic feet. A circular railway now connects Pará and Nazareth, and is well patronized by high and low. The rolling stock consists of five locomotives, fourteen passenger and eight freight cars.

There are very few Germans, French, English, and Americans in Pará; but of Portuguese there are about 5,000, all busily coining money as shopkeepers, artizans, carmen, boatmen, etc. The native Brazilians are exceedingly jealous of them. They complain that these foreigners are monopolizing the trade of the country; but instead of vigorously competing with them, they threaten to drive them back to Portugal. While agriculture, such as it is, is carried on by the Tupuyos or civilized Indians, the mechanical arts are mainly in the hands of the Portuguese. Among the

INDUSTRIAL ESTABLISHMENTS,

there are fifty-nine bakers, forty-three tailors, thirty-six shoemakers, thirty-two carpenters and joiners, twenty barbers (including such as bleed by lancet and leech), nineteen tinners and glaziers, sixteen blacksmiths, thirteen butchers, ten printers, eight sugar refiners, eight soap and tallow chandlers, eight makers of fireworks, four dentists, four bookbinders, four confectioners, three photographers, three saddlers, three tanners, and three potters. No foreigner can practice a profession (as medicine or law), and charge for his services, without a certificate from the University at Rio. Dentistry, being considered a mechanical art, is allowed. There are at present sixteen printing presses at Pará, from which issue fourteen journals—five dailies, three semi-weeklies, and six weeklies; four bookstores; one college (*Lycéo Paraense*) with twelve departments: a normal school, having a course of three years; a library, museum, and literary club.

The great want of the country is laborers of all kinds, but especially field hands. Agriculture has been ruined by the universal rush into "extractive industry," that is, the collection of the natural products, as rubber, nuts, sarsaparilla, etc. The rubber trade absorbs supreme attention; sugar cane is grown for the manufacture of rum, sugar being imported from the southern provinces; and the cultivation of cotton, rice, coffee, and cacao along the Amazons is nearly neglected. Another check to commercial enterprises is the high and irregular tariff. The duty on imports varies from five to eighty per cent. Ordinarily it may be reckoned at forty; but the same goods will enter at different rates, evidently depending on the caprice of the official. Bribery is openly practiced and expected. The duty on ready-made clothing is determined by weight, and on shoes, by the length of the sole. The usual cost of exportation is seventeen per cent; but the loss is much greater on certain products, as cabinet woods. This practically discourages labor by taxing it. Not $400 were collected at the custom house on all the woods exported from Pará in 1868-9. Brazil abounds with the most valuable timber in the world, but is prevented from competing with other nations by this system of self-strangulation. There are but two or three saw mills on the Amazons. A dozen boards of the common wood of the country (cedar or itauba) costs eighteen dollars at Manáos. Fine rubber costs about fourteen dollars an arroba (32 lbs.) up the river, and the loss is about forty-five per cent in getting it to Liverpool or New York, half of which is for freight and the other half for custom charges.

But Pará is destined to enjoy an enviable rank among the commercial centers of the world. She can never have a rival at the mouth of the Amazons, for she occupies the only available spot, the northern channel between Macapá and Chaves being scarcely fit for navigation. Standing at the gateway of a magnificent valley covered with the richest and largest forests on the earth and at the *embouchure* of a river which affords an unparalleled extent of water communication, touching every country on the continent except Chili and Patagonia, Pará must become the

LIVERPOOL OF THE TROPICS.

Her most prominent citizens are men of progress, and the dead weights on trade and labor will soon be removed.

At present the commerce of a country of such vast extent and resources is ridiculously insignificant. As most of the articles of consumption are imported, and many of those produced are exported, the foreign trade is greatly in excess of the internal.

In 1872 the value of exports to England = $2,766,761; to the United States = $2,371,138; to France = $466,788; to Portugal = $247,222; to Germany = $38,438; to Southern Brazil = $171,469.

The greater part of the rubber goes to England and the United States (about 2,500 tuns to each); cacao goes chiefly to France; Brazil nuts, copauba oil, and tonka beans to the United States; straw hats, sarsaparilla, and tobacco to Southern Brazil; piassaba and fish glue to England; cotton, sugar rice, farina, hides and cachaca to Portugal. During last year there entered the port of Pará twenty-four steamers and forty-nine sailing vessels (tunnage 62,393) bearing the stars and stripes; thirty-five English steamers and eighteen sailing vessels (tunnage 41,937); thirty-nine steamers and ten sailing vessels (tunnage 41,845) of the Empire; Portuguese sailing craft, twenty-three; French, nineteen; and from other nations sixteen. The total value of exports from Pará in 1871 was $6,710,561, of which $5,323,135 belong to rubber.

In my next I will treat of the navigation and commercial resources of the Amazons. JAMES ORTON.

LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 13.

BERLIN, September, 1873.

Leaving Vienna late in the evening by express train, the traveller may reach Dresden next morning. The route traverses a pleasant country, but no objects of remarkable interest are seen until, not far from the end of the journey, the little town of Bodenbach is reached. Here our baggage is examined by the customs' officials with equal courtesy and care; we get our breakfast and move on. Here we enter the

SAXON SWITZERLAND,

and as we rapidly ride along the banks of the Elbe, we admire the beautiful mountain scenery on either hand, with high rugged cliffs, bordering the river or confining the narrow lateral valleys with their tangled linings of green foliage, the dark ravines and picturesque basaltic peaks and jutting promontories, the remarkable natural bridge at the Bastei, and the lofty hights of these immense rocks, the *Lilienstein* and the *Königstein*. The latter is crowned with the once impregnable fortress which defied, in earlier times, the attempt of the "Conqueror of Europe" to breach its walls from the hights of Lilienstein. The strange forms assumed by the basalt produce quaint and striking views all along the whole distance; from the crossing of the Elbe at Bodenbach nearly to Dresden, these views form an uninterrupted succession of most beautiful panoramas. The river itself presents objects alike novel and interesting. Here and there, anchored in the stream, are queer *schiffmühle*, large scows or rafts carrying mills for grinding grain, and deriving power from the action of large paddle wheels which are turned by the rapid current. Towage is performed by a steamer which is destitute of paddle wheels, screw propeller or oars. It is a *Kette-dämpf* or chain steamer, which propels itself and draws after it a heavy "tow" by overhauling a strong iron chain which is laid along the bed of the river, and which, coming on board at the bow, passes around a drum amidships and overboard again at stern. So far as expenditure of power is concerned, this is the most economical of methods of propulsion, and the apparent ease with which these vessels are steered and manœuvered is quite surprising. It is somewhat remarkable that this method, which has been long known and practiced in this country, and of which the economy is well understood by all engineers, has been so little used in America, where we have so many locations to which it would be most suitable. The objections to its use in other places would probably be found to be the expense of the chain on long routes, and the fact that the craft is confined to a precise line of travel from which it cannot depart to meet the exigencies of wind or tide, or to avoid other vessels. By this system loss from "slip," which amounts, in ordinary propulsion and towage, to from ten to fifty per cent of the total power expended, is entirely avoided.

Plying on the river are also many little passenger steamers, conveying excursionists to and from the many beautiful watering places and romantic little villages which are scattered along either bank. "Beautiful little boats," the guide books call them, but they look far more quaint and antiquated than beautiful to the traveler who has traversed Long Island Sound, or who has sailed upon the Hudson or upon the Mississippi.

Leaving the river bank, we approach Dresden, crossing a level fertile plain, and are soon landed in this Saxon capital. Dresden has always been a favorite residence both with Americans and with English people, who find here cheap living, good music, a noble gallery of paintings, and good schools for their children. The beautiful suburbs of the town afford pleasant excursions and beautiful drives in summer; and in winter, music, the theater, and skating make the time pass very pleasantly.

At the earliest possible moment we visited the

POLYTECHNIC SCHOOL,

which is one of the oldest and best in Europe, although not very well provided with models and illustrative apparatus in its technical departments. Some of the work done by the students is remarkably fine. One had planned and made the drawings of waterworks for supplying a large town, another had completed the specifications and designs of a peculiar form of steam engine, a third had planned a cotton mill, and a fourth had prepared designs for an ironworks. The amount of time given to the work in the drawing room, is, however, exceptionally great. The student is usually engaged in this work sixteen hours per week, beside which he attends to studies and the lectures given in the several collegiate departments. In some instances, the designs produced by the students exhibited considerable inventive talent; and, in the majority of instances, the plans were well chosen and the details were well proportioned. The young men who, having had the advantages of such instruction, have sufficient energy and love of their profession to enter the workshop, and there learn the no less important details of shop practice, cannot fail to succeed in life, even in Germany, where good opportunities are so much more infrequent than with us.

We found time to visit the

GREAT PICTURE GALLERY

for which Dresden is noted, and there saw the noble works of Correggio and of Rubens, of Rembrandt and Titian, and of dozens of other famous painters of early and of later times, and finally stood, in silent, wondering admiration, before the noblest of them all, Raffaelle's *Madonna di San Sisto*. We passed hastily through the *Grüne Gewolbe* (the green vaults), examining curiously and hurriedly the wealth of art treasures preserved there.

We wandered through the pleasant streets, enjoyed a ride through the lovely *Grosse Garten* and, still more, our visit to the great library, where, among its 800,000 volumes, we found many referring to the early history of our own country. We should have been glad to have spent much more time here, but duty forbade, and we hastened on to Berlin, after taking a day to visit the famous old town and the celebrated

MINING SCHOOL OF FREIBERG,

the *Berg-Academie*. Here we found a good collection of models of mining apparatus and machinery, and a considerable number of newly made duplicates, which, we were pleased to learn, were made for some of our own schools in the United States.

Freiberg is situated in the midst of a mining country, and the exceptional advantages which the school is enabled to offer to students, in consequence of this fact, together with the high character of its professors, have given it a celebrity second probably to none other in the world. A large number of young men from the United States have been educated here. To-day, fortunately, there is no necessity for the American student of mining to leave our country to secure his professional education. The town appears to the stranger curiously antiquated, and the people sometimes almost equally so. The picturesque costume of some of the women, consisting of a red hat and a blue gown, or of a blue head covering and apron with a red petticoat, by its strong contrast of colors, is quite striking and pleasing.

The great city of Berlin has many attractions for the tourist, although it bears no comparison with either London or Paris. Its noble buildings and fine wide streets, its palaces and gardens, and its museums, are exceptionally interesting and pleasing. To us, as to the ordinary visitor, they presented unusual attractions, and the limited time that was allowed for their inspection was enjoyed greatly. But even more interesting than the palaces was the great

LOCOMOTIVE WORKS OF BORSIG,

and the two technical schools—the *Bau-Academie* and the *Gewerbe-Schule*—were not less interesting than the museums.

Borsig's works are among the most important in Germany, as may be seen from the fact that of the 5,455 locomotives reported as belonging to the German railroads in 1870, more than 1,900 were built at this establishment. Only the locomotive works are in Berlin. The iron and steel is made at the large ironworks near the mines, and the boiler shops and forges are at Moabit, a little way from Berlin.

In 1870 the *Borsigsche Anstalt*, in the city, made 158 locomotives. Its capacity is now 170 per year. The *Gesellschaft für Fabrication von Eisenbahnbedarf* in the same year turned out 2,522 railroad cars, valued at three and a half millions of thalers. The ironworks at Moabit in that year worked up 107,609 centners of iron. The locomotive works now employ from 1,500 to 1,800 men, who work eleven hours per day and receive from ten to fourteen thalers—5 to 7 dollars—per week in wages. A restaurant and dining hall have been erected on the premises, and a large number of the workmen avail themselves of the privilege thus offered of taking their meals at the works. The buildings and tools are generally old; but additional buildings are in course of erection, and modern tools are to be placed in them. Ample light, and that usually from above, and good ventilation, the points in which old establishments are invariably defective, are well looked to here; and those most invaluable of all tools in shops doing heavy work, traveling cranes, are not forgotten and are well placed.

A few new tools were already in, and among them was a fine tool, imported from England, for the especial work of trimming up engine frames, which here, as in all European locomotive works, are cut from rolled plates. The machine has four tool posts, feeds in every direction, and the position of the cutting tool may be altered to suit the work. The locomotive frames are cut from plates thirty millimeters—one and two tenths inches—in thickness. Tender frames are of lighter plate, ten millimeters thick. Fire boxes are invariably of copper, and the tubes are of copper at and near the firebox end, the main portion being of iron. Some of the tubes are English, and some are from Düsseldorf.

FORGED WHEELS.

Here, as all over Europe, all wheels are forged. A cast iron wheel, whether for cars or for locomotives, would be looked upon here with equal curiosity and distrust.

We were much interested, at Moabit, in witnessing the process of forging these wheels. Each arm is first forged separately, with its proportional part of hub and rim attached. These several pieces are next welded together to form the rough wheel, and, on each side of the thin hub thus formed by the union of the inner ends of the arms, is then welded an iron ring, making the wheel complete and ready for finishing in the machine shop. This makes an excellent and thoroughly reliable, but an expensive, wheel. Large fires and heavy steam hammers are employed in this work. There are twenty steam hammers in the forge shops. There was but little that was noteworthy in the

BOILER SHOP.

There were no steam riveting machines visible. The riveting was done by hand, but not as is usual in American practice. The rivet holes were punched a quarter inch or more smaller than the intended finished size, and were then drilled out to the full size. The rivets were roughly headed with the common light hammer and were then given their proper form—the snap head—with a die driven by heavy hammers. In some cases the lighter hammer was entirely dispensed with. This makes a good job, and, particularly for heavy plate and large rivets, is probably much superior to the riveting so universally used with us. The conical head is not nearly as strong as the snap head, and it is far more liable to be injured by cold hammering in giving a finish. Where the strain upon the rivet is longitudinal, as where the braces are riveted to the shell, this difference is of great importance.

Like nearly all great establishments, this has grown up from very small beginnings. The first locomotive was turned out in 1841, and to-day the total number has exceeded 3,100. This prosperous growth has apparently been due to the energy, skill, and enterprise of one man, Borsig, its founder, and, in no small degree, to his exceptional interest in the welfare of his workmen, who learned to look upon him as a friend as well as an employer, and who felt a confidence in his regard for them which was never betrayed. Whether this trait in his character was a phase of simple benevolence, or was merely an evidence of his appreciation of the often forgotten axiom that "the real interests of employers and employed are identical," matters little. It probably came of both. The result has been the founding of a great establishment, and the founder has earned a most enviable name. A large wreath-crowned bust of this great man, who is now dead, is mounted at one end of the great dining hall of the locomotive works, and along the walls are suspended pictures of his most remarkable productions. Flags which bear legends, referring to celebrations of important events in the history of the establishment, are suspended above them, reminding the visitor of the display of battle flags in the Tower of London, or of the relics of our own sad civil war. These are trophies of a far more pleasing kind. At the

BAU-ACADEMIE AND THE GEWERBE-SCHULE

there is much to interest those who are engaged in this branch of education, yet not much that can be given here. The former has 650 students and has no room for more. There are 58 instructors. The model rooms contain some unusually fine models of bridges and a large collection of architectural and other models in plaster. The lecture rooms are quite well arranged, but do not compare favorably with those of many colleges in the United States.

The *Gewerbe-Schule* is more a school of engineering, and is one of the best in Europe. The buildings are very large and are quite well arranged; the lecture rooms are unusually well fitted up, and the collection of models and of illustrative apparatus is probably the best in the country. Several workmen are kept at work, in a machine shop attached to the school, making new models; and such students as desire to do so, and at the same time exhibit special talent, are permitted to work in the shop under instruction. The collections are thus continually growing, and the school, under the administration of Professor Reuleaux and his large corps of assistants, is doing a great and a good work.

After making valuable additions to our memoranda, both educational and technical, and paying a hurried visit to a few of the many attractions of Berlin, and after spending a pleasant hour with the distinguished historian and diplomat who so ably represents the United States at the Prussian capital, we reluctantly left our pleasant lodgings *Unter den Linden*, and started westward *viâ* Cologne and the magnificent valley of the Rhine. R. H. T.

Lard as an Unguent.

It is well known that rubbing the body with hog's fat has the effect of reducing the temperature of the skin in scarlet fever. A gentleman of our acquaintance has used the fat portion of smoked ham with beneficial results, and writes to the editor to disseminate the fact for others' benefit. A celebrated German physician recommends to incorporate one or two grammes of carbolic acid into one hundred grammes of lard, and, with this, to rub the whole body, excepting the head, two or three times a day, according to the intensity of inflammation characterizing the case in hand. The effect of this kind of treatment is to produce a pleasant feeling of coolness, to keep the skin softer, and after each application the temperature of the skin falls somewhat. The carbolic acid operates to destroy the germs and spores of the disease.

Packing Oranges and Lemons.

A full grown orange tree yields from 500 to 2,000 fruit annually, and arrives at the bearing state in three or five years, as does the lemon tree; both grow luxuriantly in most soils. The plantations (in the Mediterranean countries) are called gardens, and vary in size, the smallest containing only a small number of trees, and the largest many thousands. The fruit is gathered in baskets similar to peach baskets, lined with canvas, the basket being held by a strap attached and passed around the neck or shoulders. From the garden the fruit goes to the repacking magazine, where it is removed from the boxes, in which it was packed in the gardens, and repacked for shipment by experienced female packers, after having been carefully assorted by women, and wrapped in separate papers by young girls. As many as 500 persons (mostly women and children) are employed by some of the fruit growers in their gardens and magazines, in gathering, sorting, and repacking for shipment, the wages paid them varying from nine to sixteen cents a day. In sorting, every fruit that wants a stem is rejected. The boxes are then securely covered, strapped, and marked with the brand of the grower, when they are ready for shipment. Twenty years ago, this trade was nothing in its commercial characteristics, or the inducements it offered to capitalists. Now it is progressing with giant strides into prominence, and is a considerable source of revenue to the government.

COMBINED HAY RAKE AND TEDDER.

The principal part of this device, an engraving of which is herewith given, is the tedder, which consists of a novel arrangement of a three-throw crank with sliding forks. The latter are actuated in a manner closely imitative of the motion of the arms of a person in handling a pitchfork to toss the hay, for the purpose of admitting a free circulation of the air through the same and thus causing it to be properly cured before removal from the field. The balance of the invention is a very easy and expeditious manner of converting the tedder frame into an improved horse rake



COLVIN'S COMBINED HAY RAKE AND TEDDER.

The oblong frame, which forms the truck, is mounted on wheels and provided with keepers which adapt it for the introduction of a pole or shafts so that the machine may be used with one or two horses, as desired. There is a suitable seat and foot board near each extremity of the axle, A, and inside the main wheels are attached cog wheels, B, which engage with pinions, C. The latter connect with the crank shafts, D. These shafts, as above intimated, are an arrangement of the crank in threefold relation, twice duplicated, and consist of two separate parts, the inner ends of which may meet in a hinged box, H, or be simply inserted in a suitable bearing on the central beam of the frame. E are the fork stems which, six on each shaft, are bent around and embrace the crank rod between shoulders or flanges on the same. Between the parallel parts of the stems, and next to the cranks, are arranged elastic boxes or shifting bearings for the crank connection, so as to relieve the same from sudden strain, and adapt it to the free motion of the forks. The latter are shown in the engraving in two forms; those marked F are spring forks, the tines of which are coiled to form eyes, through which and a hole near the end of the stem, bolts pass. This, with the bows of the tines, being slipped over open slots, also in the stems, secures the parts quickly and firmly together. This fork is well adapted for light grass. For heavier work, however, ordinary forks, G, are dovetailed by short shanks to the stems and secured by headed screw bolts.

Returning to the crank shafts, D, it will be observed that their outer ends are held in hinged boxes, also marked H. Near the extremities are arranged radial pins which, in connection with loose clutches united with the pinions, C bring the latter in gear with the cogged wheels, B. A rod or wire between clutch and pinion is led through keepers to a lever, I, placed conveniently to the foot of the driver, so that, by moving the bar in either way, one or both of the sets of forks may be thrown into or out of action. The collars or flanges, shown on the axle, A, serve as guides to the stems in their sliding movement caused by the cranks.

Our artist shows the tedder in action, and the rake also attached to the machine, but out of use. In order to put the rake in operation the tedder must first be removed, an easy proceeding, as the crank bars are quickly lifted from the hinged boxes, H, and the forked stems slipped off the axle. The hay rake bar, J, fits in permanent bearings, K, placed on each side of and centrally on the frame pieces. The tines or teeth are independent in their motions on the shaft and are held thereon between shoulders. Spring braces, L, bear upon every tine, so that if one be raised th others are not affected. A hand lever, M, connects with the shaft and serves as a convenient means for raising and discharging the rake. In connection with the same appliance is a foot piece, which, when pressed down and brought under a lug, keeps the rake in an elevated position when not in use.

The reader will, before this, have noted that this device is not complicated, and that it furnishes, in one apparatus, two very useful machines. Its width is about that of the ordinary horse rake. From an examination of the model, we should judge it to be a machine well worthy of the attention of agriculturists. It has the merit of being a very neat mechanical device for producing an out-of-the-way motion with an unusually small quantity of gearing, a point of importance when considered in connection with the innumerable cogs, racks, pinions and other devices, which too often encumber agricultural machinery for even the simplest purposes.

The inventor is Mr. R. J. Colvin, of Lancaster, Pa., and the date of the patent is April 22, 1873.

Further particulars may be obtained by addressing the present owner of the invention, Mr. M. T. Boyer, of Parksburgh, Pa.

IMPROVED COMBINED ROLLER AND IRRIGATOR.

The combined roller and irrigator, represented in our illustration, unites, in obvious utility, two sources of success to industrious husbandry—the preparation and proper irrigation of the soil. It is quite simple in construction, so that but a brief description of its parts (as indicated by letters in the illustration) is necessary. A is a hollow drum of wrought or cast iron, so arranged in the frame, B, which is made of hollow tubing, as to revolve on hollow watertight bearings at one or both ends. It also has a gear flange, C, attached to either end, the teeth of which engage with a pinion at D, which, in turn, gives motion to any suitably arranged gearing, to impart proper speed to the pump, E, attached to the frame, B, over one of the bearings of the roller, A. When the machine is drawn over the ground, the roller, rotating, communicates its motion to the pump, which ejects, with any required force, the fluid contents of the cylinder with which it has been previously filled; air is supplied through the opposite bearing to satisfy the vacuum. A lever, actuated by the foot of the operator, and not shown in the engraving, serves to disconnect the pump gearing, when the services of the roller alone are desired.



HOWARD'S COMBINED ROLLER AND IRRIGATOR.

The present engraving illustrates one of the simplest and cheapest forms in which this machine is constructed. It is built of any desired capacity, from the hand garden roller of the horticulturist to the largest and heaviest of machines operated by steam for the rolling and sprinkling of streets. One form of construction confines all the machinery within the drum, pendant from a tubular, shaft in the center of the roller longitudinally. In this arrangement the fluid is forced through the shaft into the frame, which is also tubular as well as the drawing attachments, a hose being attached to any convenient point. In the more expensive forms of construction it is considered an advantage to build the machine entirely of iron, constructing the frame of piping, as well for the additional strength and beauty of form as for the added water space and utility.

By using this machine, it is claimed, liquid manures are made more cheaply and readily available. In the distribution of all fluids by this irrigator, the liquid is thrown high in the air and falls in fine rain or spray over the surface. As a roller it possesses the same advantages as any ordinary land roller, being adjustable in weight, and that weight being in the best position to be most out of the way and most advantageously applied.

Patented June 17, 1873. For further particulars address the inventor, Mr. Dean S. Howard, Drewry's Bluff, Chesterfield county, Va.

Burning Coal Beds.

The so called "burning mountain" at Dudweiler, in the district of Saarbrück, which has been an object of interest to tourists and men of science for more than a century, is now shorn of its attractions; to the former it presents the spectacle of what is, at best, but a smoking mountain; to the latter it is a mere impostor, since, instead of being, as was supposed by earlier scientific observers, a display of volcanic action, or a proof of central fires, it is now clearly established as the result of the spontaneous combustion of a stratum of coal. These smoldering fires, produced by some change which takes place in constituents of the coal may, indeed, burn with more or less intensity for centuries. The thought of such waste is peculiarly distressing at the present time, and the burning mountain of Dudweiler shows only common good feeling by mitigating its destructive proceedings at this crisis. A coal bed at Niederplanitz, near Zwickau, in Saxony, has been burning in a similar manner between 300 and 400 years. The heat given out by this subterranean fire, at a cost which it is distressing to calculate, is not wholly wasted. An ingenious person, since dead, has established a magnificent nursery ground on the burning area, in which, by means of a system of pipes, the supply of caloric is regulated and applied at will. Tropical plants flourish here in the open air with a luxuriance which the best forcing houses and conservatories cannot insure.—*Mining Journal.*

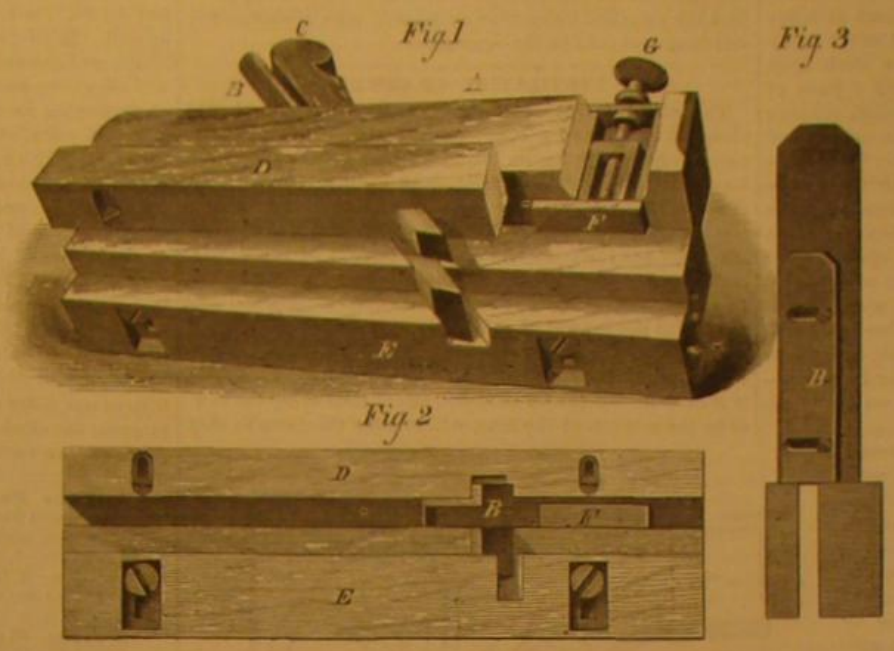
[Passing through the coal region of Pennsylvania, not long ago, we saw smoke issuing from a mountain in the distance, which, we were told, had been burning for more than a quarter of a century; and that a great deal of money had been expended in the attempt to sever the coal vein and conduct water into the seams to extinguish the fire, but without success.—EDS.]

IMPROVED MATCH PLANE.

We illustrate herewith one of those ingenious devices which in a single instrument combines the capabilities of a variety of tools. It consists in a match plane which, by suitable adjustments of its parts, may be set to tongue boards of any thickness.

A is the main stock, B is the iron, and C the key, shown in the side view, Fig. 1. The face of the tool, Fig. 2, is formed in two parts, one of which is an adjustable piece, D, which, fitting into a rabbet of the stock, is made adjustable laterally thereon by screws passing through slots, as shown. By moving this piece out or in, the length of the mouth of the tool is varied so as to correspond with the width of the adjustable iron, B. The latter, Fig. 3, is made in two portions, also connected by screws and slots so that the space between the cutting edges may be made broad or narrow to receive the tongue, which is cut of corresponding size.

E, Fig. 2, is a guide adjustable on the face of the tool by the same means as above described, and F is a gage operated by the thumbscrew, G, for regulating the depth of the cut. Any ordinary plow iron may be used in the grooving tool, and the tonguing tool may be adjusted to suit the groove. With a single pair of implements therefore, it is claimed, the operator is enabled to perform work which ordinarily calls for the use of a multiplicity of devices, thus saving much expense and trouble. Patented through the Scientific American Patent Agency, June 10, 1873, by Mr. James Edwards, of No. 462 Atlantic avenue Brooklyn, N. Y., from whom further particulars regarding sale of patents or State rights may be obtained.



EDWARDS' MATCH PLANE.

THE GLOBE STEAM GAGE.

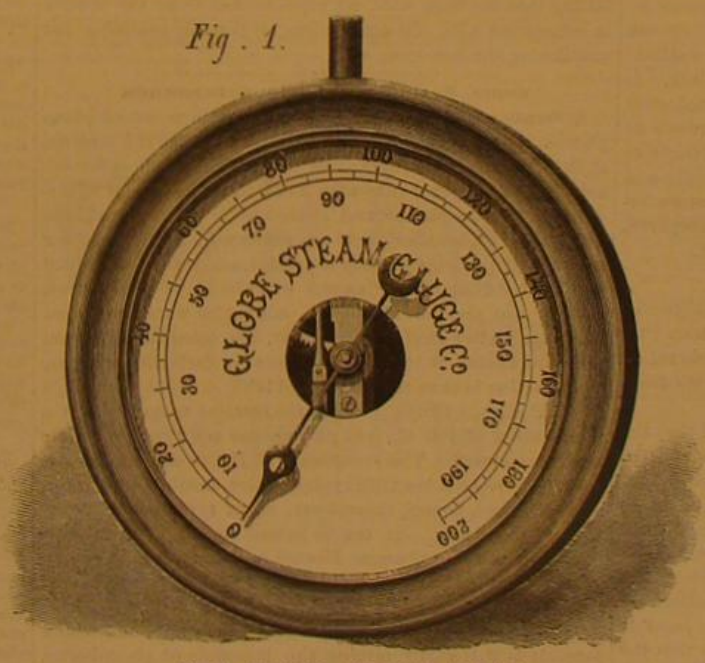
The amount of correspondence concerning boiler explosions, which has been lately published in scientific journals points out the importance of a trustworthy pressure indicator, which can be relied on, at all times, to show any variation in the force within the boiler, and to indicate the same accurately after long continued use.

The invention which we illustrate herewith is a steam gage of quite simple construction, which we are informed has been in use on the Erie railroad for four years past, during which period it has not varied one pound from the test gage with which it was first compared. Various certificates from railroad officials and others, submitted to us by the owners ofthe patent, speak highly in recommendation of the instrument, so that it may be fairly considered as having successfully withstood the test of actual experience.

Fig. 1 gives the appearance of the dial of the apparatus, and Fig. 2 a section showing the essential portions. A is the case, and B a metal spring, the space, C, in rear of which contains water. Steam enters from a pipe at D, and presses the spring inwards into the position of the dotted line. The motion of the spring, by suitable lever and other mechanism, is transmitted to the dial needle which registers the pressure in accordance with the amount the spring is driven inward. The instrument is very sensitive and accurate; and it is claimed that it will withstand a heavy pressure without the spring becoming permanently set, and also that at 140 lbs. pressure the spring is forced out from the center ¼ of an inch. Under a pressure of 700 lbs., to which the apparatus was subjected a short time since, at the manufactory in Waterbury, Conn., the spring was reversed in form and blown out, falling some ten feet distant.

It is further stated that the gage does not get out of order, and that when in use upon a locomotive there is no vibration or trembling of the pointer, no matter how high the speed at which the engine may be running.

For further information, address Messrs. Austin M. Hayward & Son, Susquehanna Depot, Pa.



THE GLOBE STEAM GAGE.

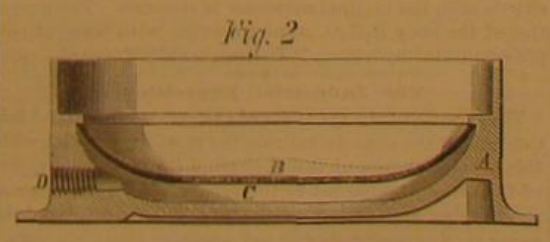
Test for Copper and Tin in Extracts.

The poisonous nature of copper, and, to a less degree, of tin, makes the following method of testing for them in an extract, as described by Hager, both interesting and useful, for either of these metals may have been dissolved from the walls of the vessel in which it was prepared. "The extract is, for this purpose, dissolved in five parts of water, or very dilute spirits, and slightly acidified with a drop or two of hydrochloric acid. A bright strip of zinc is placed in the solution, and, after half an hour, if no impurities are present, the zinc will be found as bright and colorless as when first put in. If, however, copper and tin are present, it will be coated with brown film; if tin alone is present, the film will have a grayish white color. It is washed with water and dried by heating the strip of zinc gently in an alcohol flame, and the copper will be indicated by its well known copper color. Under like conditions the film of tin is a dull grayish white. If copper and tin are both present, and it is desired to determine the quantity of the tin, the film is peeled off with a knife into a test glass and 5 to 8 drops nitric acid added. It is carefully boiled until entirely dissolved, when 75 drops ammonia is added, the solution shaken and allowed to settle. If tin is present, it will separate as amorphous oxide of tin in white flakes." We venture the suggestion that lead can be determined in a similar manner by precipitating on zinc.

Mineral Oils for Iron.

The use of heavy mineral oil as a preservative for iron is strongly recommended by the *London Oil Trade Review*, the substance referred to being, we presume, one of the products of shale distillation, so extensively practiced in Great Britain. Whether a similar product can be obtained from our petroleums is a good subject for research. Our cotemporary says:

The action of the oil is twofold. First, it is detergent when vigorously and freely brushed over an already rusted surface. It seems to loosen the bulk of the rust and it darkens that which remains. Secondly, it acts as a varnish if applied after the cleansing has been effected, or to new and bright work. Its superiority to vegetable or animal oils depends upon the fact that the bulk of the oil evaporates, and it leaves only a very fine film behind. If the oil is light and fully refined, it evaporates so completely as to do but little good in this way; but if tinged or "once run" oil of sufficiently high gravity be used, the resinous or carbonaceous matter which gives the tinge to the oil remains behind and



forms the thin protecting film of varnish. Ordinary varnish leaves far too thick and obvious a film, while the film of the once run oil does its work of protection without displaying itself. As regards the density of the oil required for this purpose, we recommend that which stands between the burning oil and good lubricating oil; it is known, and sometimes sold, as "intermediate oil." We are satisfied that a good trade may be done by anybody who will bring this before the public in a proper manner, and supply the article as required. For domestic purposes, for the cleaning of all kinds of household iron work, for the preservation of such things as mowing machines and other garden tools or exposed iron implements, the brown oil should be sold in small bottles at a cheap rate. For manufacturers of iron work and for ironmongers, to whom it will prove invaluable, it must of course be supplied in larger parcels. At present it can hardly be used at all, on account of the difficulty of obtaining it in retail quantities.

Ruled Test Plates for the Microscope.

In a recent paper read before the Quekett Microscopical Club, London, Mr. William Webb takes the ground that the alleged ruled plates of Nobert and others, purporting to present 200,000 lines to the inch, are illusions, it being a physical impossibility to cut any such number of distinct lines within such limits. He says:

That a micrometer with the lines the one 200-thousandth of an inch apart ruled on glass is an absolute impossibility. That if it be possible to rule lines themselves of the width of the one 200-thousandth of an inch, to make them definable there must be a clearly defined line between them, and a clearly defined line in the same plane of observation. That beyond the first few coarse bands of M. Nobert's tests, there is not, properly so called, a single line. That in the finest bands, except at their extreme sides, there is not half a line. That in the finest bands the only thing certain, except the edges, is the uncertain polarized aerial lines. That the microscopical world has been pursuing a phantom, and adopting a fallacy. That polarization of light in the examination of these and analagous tests is a deceitful servant of the microscopist.

That oblique illumination is another deceiver. That if M. Nobert were to attempt to fill his incisions with black, his finest bands would be merged each into one black line of the breadth of each particular band. That a test must be a known thing which some power will either disperse or fail to define, as in the case of a spectacle vendor, who places before an intending purchaser's eyes words printed in types of different sorts as a known test of visual powers. That there are no tests so reliable as a known measured congeries of contcrted lines, as in microscopic writings, where the transmitted rays are partially shut off by the black, and in which, the rays transmitted being transmitted by direct illumination, their definition is not interfered with; such rays becoming parallel rays, passing out at right angles with the surface of the glass, the unalterable law of natural optics being that the angle of incidence and the angle of reflection are equal.

The Cincinnati Exposition.

The fourth Annual Exposition held in Cincinnati is now in progress, and attracting, on an average, some 12,000 visitors per day. We learn that it is the finest and largest display yet made in the West, and fully in accordance with what might be expected from a city inferior, in point of number and variety of its manufactures, only to New York and Philadelphia. Cincinnati alone furnishes one half the steam engines on exhibition, besides a fair proportion of the agricultural and labor-saving machines. There is also a large display of furniture of fine workmanship, coming from the various establishments of the city. Stoves occupy a prominent place in the list of local products; and from the manufacture, it seems probable that Cincinnati may fairly rival Troy and Pittsburgh. The makers of boots and shoes also carry on an extensive business, employing the most approved machinery and selling goods at the rate of $2,250,000 per year. Miscellaneous goods, and also leather, are exhibited in profusion. Of the latter the city makers, last year, produced $2,473,800 worth. There are from twenty to thirty different kinds of carriages displayed, the workmanship of which compares favorably with that of the best eastern firms. Pork packing is of course represented on a large scale. The figures of the past two years show a marked increase in this important trade. During the winter of 1870–71, there were packed 481,560 hogs, and in the succeeding winter, 630,301.

The Exposition is drawing large numbers of the country people to the city, and the attendance appears to be increasing in spite of the rival attractions of the Louisville Fair.

A CORRECTION.—In our illustrated article upon the improved drill chuck of the Hubbard & Curtiss Manufacturing Company, on page 211, current volume, in giving size for drill of the No. 4 Victor chuck, a typographical error made us say that the device will hold drill shanks from ¾ down to ¼ inch; this should read "from ¾ inch," instead of as above.

DURING last autumn, says the *Journal of the Society of Arts*, there were no less than seventeen companies extracting gold from the auriferous sand of Finland. One of the companies returned a dividend of 70 per cent. The largest nugget weighed 28 pennyweights.

Printing with Aniline Black.

When ammonia is added in excess to a solution of alum, a gelatinous precipitate is formed which consists of the hydrated oxide of aluminum. This hydrate is soluble in acids, acting in that case as a base, but it is also soluble in caustic soda and potash, when it acts as a weak acid and forms salts known as aluminates of soda and potash. The aluminate of soda can be prepared very cheaply, and is advantageously employed, according to Dr. A. Kielmeyer, for coating the cloth placed under the calico and running along with it. In calico printing a portion, of course, of the color or mordant employed passes entirely through the cloth which is being printed; and to prevent it from being deposited on the pressure rollers and returned to a clean part of the cloth upon the second revolution, it is customary to have a piece of thick woolen cloth (a little wider than the calico, running between the calico and roller to take up this excess) and to pass it over one of the heated cylinders; it is thus dried and can be used two or three times before it has to be cleaned. The great expense of these "travellers" and the labor of cleaning them has induced several calico printers to substitute a piece of the unbleached cotton cloth. After being used once it can be bleached and is in no way injured for calico, except in one particular case. A piece of unbleached muslin which has been soiled by aniline black cannot be entirely cleaned by the bleaching process, and, moreover, the fiber is injured. For this reason it has been necessary to adhere to the old method of expensive woolen "travellers" when using aniline black.

Dr. Kielmeyer has, however, made the interesting discovery that aluminate of soda mixed with scorched starch prevents the aniline black from attaching itself to the cotton. The alkalinity of this substance prevents the black from being developed; and at the same time, the solid hydrate of alumina is formed where aniline black and aluminate of soda come in contact, and protects the fiber by preventing the black from coming in contact with it. Attempts to employ the carbonate and acetate of alumina for the same purpose have not succeeded well; for although they check the development of the black, they do not form that insoluble layer which protects the fiber.

In preparing the goods, the unbleached muslin, as soon as it is singed, is passed twice through a cold solution of aluminate of soda of 4 or 5° B. It is left unrolled for two hours that it may become evenly distributed throughout the goods, and then dried on the hot cylinders. The cost of material for preparing a piece 164 feet in length is, in Germany, about 4 cents. For light patterns, like shirtings, it can be used over two or three times, for heavier ones but once; and if the pattern is very heavy, a solution of 10° B. should be employed. Before proceeding to bleach them, they are placed in a muriatic acid solution of 2° B. and washed. After bleaching there will be no trace left of the black. It has also been observed that the black patterns printed over this background do not strike through the goods so much as otherwise, and consequently the fabrics are not weakened so much; but upon the right side they are perfectly bright and full. Even this latter is of no small account when we remember that all aniline black, if never so carefully prepared, has more or less tendency to rot or weaken the fiber.

IMPROVED SHOEMAKER'S PINCHERS.

Mr. William H. Hanna, of Chico, Butte county, California, has recently patented, through the Scientific American Patent Agency, an improved form of shoemaker's pinchers, an engraving of which we herewith present.



It will be observed that the distance between the ends of the jaws and the pivot is considerably shortened, so as to secure greater power of grip. For the same purpose, the lever is extended beyond the extremity of the handle. On the under side of the lever is made a projection, so that the jaws act as a fulcrum against the last and thus preserve as large a range of movement as can be afforded with the ordinary instruments with much longer jaws. The upper lever is placed in about the same plane as the jaws, so that the line of draft coincides with the lever, and the lower handle does not come in contact with the last, as is commonly the case before the leather is sufficiently strained. The teeth abut against the turning face of the jaws so as to bring the bite near to the pivot, thus enabling the upper to be drawn as close as is desirable to the last. It is stated that there is no slipping off of the tool in cases of unusual strain and it is not liable to tear the leather or hurt the hand. Patented July 22, 1873. Further particulars will be found in the advertising columns of our present issue.

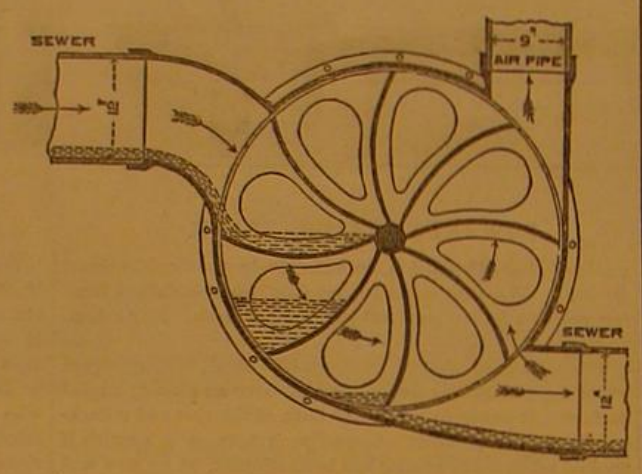
A Check to Railway Enterprises.

Among the bad effects of the recent financial crisis is the cessation of work upon unfinished railways and railway machinery in various parts of the country. Many thousands of laboring men have been suddenly thrown out of employment, and a winter of suffering appears likely to overtake hundreds of worthy families.

As an example of the mischief wrought by this unfortunate state of things, we may mention that the orders for locomotives at the Rogers works, Paterson, N. J., have been canceled and 600 men have been discharged. It is supposed that the principal locomotive shops will soon discharge several thousand men in the aggregate.

VENTILATION OF SEWERS.

The annexed diagram represents one of a series of fans placed in the line of a sewer, with an air pipe from it, supposed to be in connection with the atmosphere above the houses. It is the design of Mr. John Phillips, given in the *Builder*. By causing the sewage to fall into the fans on one side near the top and to escape on the other side at the bottom, they are made to rotate, draw air out of the sewer, and force it up the pipes into the atmosphere. The fans, therefore, are self-acting; and, if properly constructed and fixed, will not get out of order. If, in addition to the usual drain communications, pipes are laid from the open air into the sewer, at points midway or nearly so between the fans, it is evident that the air currents, established along the sewer by the rotation of the fans, will remove the gases as they



emanate from the sewage. Thus the power of the water flowing in the sewers not only carries off the sewage, but, by falling into the fans, with air pipes to and from the sewers in connection with the atmosphere, it is made available for ventilating the sewers as well.

Some New Phosphoric Compounds.

A. Gautier has prepared a singular compound of phosphorus with oxygen and hydrogen, which has the formula P_4HO. If a certain quantity of crystallizable phosphorous acid is sealed up in a tube with 5 or 6 times its weight of terchloride of phosphorus and heated to 79° C., hydrochloric acid and pyrophosphoric acid are produced. A bright yellow colored compound gradually separates, and can be obtained by first distilling off the excess of chloride of phosphorus, cooling the residue to—10° C., adding ice water, and then filtering. After washing on a filter, it is dried in a vacuum and then heated to 140° in a current of carbonic acid gas. The reaction is thus represented: $11PCl_3+27PH_3O_3=4P_4HO+11P_2H_4O_7+33HCl$. When the reaction takes place at a temperature of 170° C., red phosphorus and pyrophosphoric acid are formed. The compound P_4HO is an amorphous body possessing a beautiful yellow color, insoluble in water, alcohol, ether, benzol, chloroform, oil of turpentine, glycerin, and acetic acid. It can be heated to 250° C. in dry carbonic acid without change. Heated in the air, it burns slowly with flame; mixed with chlorate of potash, it is exploded by percussion.

The same chemist has also obtained a compound whose formula is P_2H_2O, by mixing the biniodide of phosphorus, PI_2, rapidly with a large quantity of water. The new body is amorphous, of a pure yellow color, tasteless and odorless, and insoluble in any solvent. It is oxidized very violently by ordinary nitric acid, also by sulphuric acid. Heated in a current of dry carbonic acid to 135° C., it is decomposed, phosphuretted hydrogen being evolved. Ammonia forms with it a brown compound; but on neutralizing with hydrochloric acid, the original substance is restored. The properties of the body P_2H_2O seem to agree with those of solid phosphuretted hydrogen, P_2H, described by Thénard.

The Industrial Expositions.

The reports of the openings of the various industrial fairs throughout the country indicate the strong favor with which this graphic system of demonstrating the material progress of the nation is regarded by the people. From all accounts, the number and variety of the productions displayed has never been exceeded during any previous year; nor does it appear that any single fair has, from the hour of its commencement, failed to attract throngs of interested visitors.

The Chicago Inter-State Exposition, a full description of the immense buildings of which (800 feet long by 200 feet in width), constructed through the generosity and enterprise of the citizens of Chicago, we have already presented, was recently formally opened, and during the first day of the exhibition 20,000 people entered its doors. Regarding the articles displayed, it is yet early to particularize. We learn that every department is complete in a full representation of the important arts and industries to which each relates, so that in our future references to this fair will doubtless be found descriptions of many novel and important inventions.

To the Kansas City and Cincinnati expositions, we have already alluded in detail. Both are succeeding admirably, and exciting no small interest in their respective vicinities. Indiana, in her State Fair now in progress at the Fair Grounds of her capital city, is making an excellent show of the manufactures and industries carried on within her borders. Louisville, Ky., celebrates a second Annual Exposition, and in St. Paul, the Minnesota State Fair was recently opened. In Baltimore, the 26th Annual Exhibition of the Maryland Institute, and in New Orleans, the Louisiana Fair, will afford the manufacturers of the Southern States a means of displaying local productions. Canadian industries will find representation in the Montreal Exposition and in the International Fair soon to be opened in Buffalo, N. Y. The excellent results of the experimental show of 1872, in Newark, N. J., has stimulated its projectors to new efforts, and we are promised an exhibition even superior to the very creditable one of last year. In Albany, we learn that the New York State Fair is attracting 20,000 people per day, and that the display of live stock, especially, has never before been equaled. In our own immediate neighborhood is the Kings County Fair, held in the Rink on Clermont avenue, in Brooklyn, and devoted to the local manufactures and industries of our sister city: while in New York is in successful progress the 42nd Exposition of that patriarch among fairs, the American Institute.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 6 to September 9, 1873, inclusive.

BLAST FURNACE.—T. F. Miner, Albany, N.Y.

ENGINE VALVE.—H. I. Hoyt, Norwalk, Conn.

FLOCK CUTTING MACHINE.—J. Pitts, Melville, Mass., *et al.*

Recent American and Foreign Patents.

Improved Pruning Knife.

Abraham C. Hulse and Joseph S. Crum, Palmyra, Ill.—This invention consists in constructing the parts of a pruning knife in such a manner that it may be quickly and conveniently changed from a shrub to a tree pruner or the reverse.

Improved Chain Clamp.

Charles E. Evard, Leesburgh, Va.—This consists in movable jaws, provided with rectangular recesses across the upper corners and horizontal chain rest, the said jaws when closed leaving an intervening open space large enough for the downward passage of the rivet.

Improved Ventilator.

John Ballou, Boston, Mass.—This is a frame in which a revolving ventilator is arranged so that the draft can be governed and light not be excluded. The device consists of four wings, two of glass and two of wire gauze, amounting to two planes set at right angles to each other. By a quarter revolution, the glass will be thrown into a horizontal position, and the perforated pieces will take its place, thus admitting air while excluding insects.

Improved Farm Gate.

Edward B. Decker, Carrollton, Ill.—This invention is an improvement in in the class of farm gates wherein the lower part may be raised and lowered independently of the upper part. Two lower bars are pivoted at their rear ends to one of the gate standards or cross bars. Their forward ends enter slots in the opposite cross bar. To one of the upper horizontal bars is attached a latch and hook, the latter of which, when the lower bars are raised, catches their forward ends and holds them up.

Improved Milk and Cream Cooler.

Henry C. Baldwin, North Wolcott, Vt.—The outer vessel of this cooler is provided with a spout upon its upper part for pouring in, and with a short pipe in its lower part for drawing off, the water. There is also an opening to allow the waste water to escape when a stream of running water is introduced into the spout. A ring flange is attached to the bottom of the outer vessel to support the inner vessel, so that there may be a water space between the bottoms, and has a number of holes to allow free circulation. To the outer vessel are pivoted hooks to keep the inner vessel in place when the water is poured in. The cover has ventilators to allow the air to circulate freely, the mouths of said ventilators being covered with wire gauze.

Improved Fluting Machine.

Edward M. Deey, New York city.—The first part of the invention consists of an arrangement of devices for adjusting the roller and regulating the pressure, whereby the roller which is raised to facilitate the adjusting of the goods can be raised without contracting the pressure springs. Less power is thus needed than is required to lift it against the springs. The second part consists of guides in connection with the roller to control it against lateral vibration. The third part consists in having the wheel by which motion is imparted to one of the rollers provided with and rigidly attached to a short shaft which couples with the roller, so that the latter can be removed without disturbing the wheel, and without the necessity of sliding the wheel off and on a portion of the roller.

Improved Steam Lubricator.

Reed A. Filkins, Cheshire, Mass.—It is proposed to have a hollow globe holder for the oil, having a hollow standard, with a conical enlargement of the hollow space at the lower end. This end screws into a hollow stand on the steam chest or journal box. A stationary conical plug projects upward from the bottom of the socket into the hollow of the lower end of the standard, so as to regulate the flow of oil by closing the mouth of said standard more or less, as the holder and standard are screwed up or down. The holder has a notched ring around its middle, which is graduated and numbered to show the extent of the opening of the feed at the mouth of the standard, and a spring click engages it to hold the oil holder to any position in which it is set. From the socket below the standard of the holder the oil enters a little chamber, in the middle of which a tube rises around the passage from said chamber into the steam chest to retain a quantity of oil in said chamber. In feeding, the oil will flow from the surface of the body contained in said recess, on the top of the tube, and down the inner surface of it, while the steam rises up in the center of the space. There is a valve which will screw into the proper passage and close it, so that the steam may be shut off at any time to allow of taking off the holder when it may be desired to do so.

Improved Breech Loading Fire Arm.

Daniel Hug, New York city, assignor to himself and William H. Speer, Jersey City, N. J.—This invention consists in a pivoted breech block, having a spring hook connected therewith and a cartridge extractor arranged centrally beneath the barrel, combined, to extract the old cartridges and throw them clear of the gun, as well as support the new one.

Improved Projectile.

James G. Hope, Wichita, Kas.—This invention is more particularly an improvement on the projectile for which letters patent were issued to applicant October 4, 1870; and consists in providing the stem of the projectile with a double set of guide wings, one for preventing its rotation during flight, and the other for causing it to describe a curve of greater or less radius.

Improved Can Soldering Machine.

James F. Spence, Williamsburgh, N.Y.—This invention consists in providing means for feeding cans to a soldering apparatus, and for reversing them so that both heads may be soldered to the body in rapid succession and without the removal of the same from their holder.

Improved Ventilating Window Sash.

Collin Pullinger, Philadelphia, Pa.—This invention relates to convenient modes of ventilating rooms through the windows without bringing to bear upon the persons therein a cold draft of air. The invention consists in a novel arrangement of a small supplementary sash to slide above the top and to the bottom sash.

Improved Rudder for Vessels.

Juan B. Baptista, New York city.—This invention is an improvement in rudders of the hollow class, and consists in forming a balanced rudder of two parallel plates attached to transverse bars, which impart rigidity to said plates, and are in turn secured to the vertical shaft in such a manner as to leave a space between each of said plates and the shaft. The object is to increase the surface acted on by the water.

Improved Fence.

Wilbur S. King, Gonzales county, Texas.—This invention relates to fences adapted to those parts of the country where stock farming is pursued, where timber is scarce, and where the object is to make a fence which will turn hogs as well as cattle and horses, at the same time being cheap, easily put up, and susceptible of quick and ready repair. It consists in posts, rails and stakes, wired together so as to allow the lower parts to be filled with brush.

Furnace for Producing Wrought Iron from Ore.

George E. Harding, New York city.—This invention consists in combining, with a rotary puddling furnace, a gas-producing furnace and a deoxydizing chamber, so that the waste gases may be conveniently applied to deoxydize and carbonize the ore preliminary to its reduction.

Improved Combined Wardrobe, Bedstead, Chair and Table.

Walker Getchell, Bath, Me.—The front of the cabinet has narrow sides, constituting the pendent sides of the table top when detached from the case and arranged for the table. The folding legs are pivoted to it, being let down and fastened by buttons. Part of the top of the cabinet constitutes the back of the chair, and has the seat hinged to it. It also has an upholstered cushion above the seat; and this is so fitted on the back and connected to the seat that, when it swings down against the side of the back to adjust the latter for its place in the cover, it draws the cushion down below the top to uncover the end sufficiently to rest on the top of the sideboard of the cabinet, and when the seat swings up into position it moves the cushion up to hide the back. The sides of the chair are formed of two boards, which nest together so as to be laid on the top of the cabinet and constitute the balance of the cover. The sections of the sides of the case, and boards between the front and the main part, comprise the principal portion of the bed or reclining couch. The wash stand, with a towel rack attached, is mounted on a door, which is hinged to the side where an opening is made in the side of the case into a chamber within, so that the stand swings into the case and is inclosed when the door is shut, and swings out for use when the door is opened. At the side opposite the one having the wash stand, a drawer is arranged for linen and other like goods.

Improved Umbrella.

John McAuliffe, New York city.—The inventor makes clips or laps for fastening to umbrella ribs, to pivot the braces to, by taking little strips of sheet metal, well coated with tin, and folding the ends over back on one side, enough to make the elevation of the folded part about half the thickness of the rib, and so that the space between the said folded part will be just enough to wrap around the brace and inclose it snugly when the folded parts meet on the inside of the rib. A projection is thus formed to which the branched end of the brace can be pivoted. These ends and the folds are united together, and also the lap to the rib, by a drop of solder.

Improved Wheel Plow.

Lionel W. Richardson, Roscoe, Ill.—This invention is a sulky attachment, which may be applied to the beam of an ordinary plow. The axle is bent in peculiar shape. One wheel works on a crank axle, which, by a suitable lever, may be adjusted so that the wheel may run in a furrow or on the surface and the machine still remain horizontal. The plow has a free lateral and vertical movement, easily governed by a lever at the hand of the driver.

Improved Machine for Turning Wagon Axles.

George A. Bolser, Indianapolis, Ind.—This invention consists of a nove arrangement of the tool carrier, pattern, and feed screw, in a machine in which the stick to be turned is stationary and the cutter is revolved around and fed along the stick. The axle, the ends of which are to be turned, is laid on a bench between the posts and centered by suitable means. A large short tube is bolted to the posts in the axis of the machine, so that the axle to be turned projects through it. A pulley revolves on this tube, and carries the face plate, in front of which, at a suitable distance, is another face plate, in four arms, arranged on the sleeve of the tail center and connected to the first face plate by a rod, feed screw, tool supporting rod, and the pattern rod or centers, all of which are arranged at equal distances apart around the axis, and at equal distances therefrom. The pattern is a facsimile of what is to be produced. It extends from the face plate to one of the arms, and is fixed on them so that it can revolve, making one revolution on its axis during each revolution which it makes around the axle. The tool holder consists of a freely moving bar, and it rests on the pattern. The cutter is attached to the bar on the side next to the pattern. The tool bar is moved along slowly in the direction of the axis of the axle to carry the tool from one end to the other of the part to be turned. It is also proposed to utilize this machine for making oval tenons on spokes upon the same plan.

Improved Wood Filling.

Jerome E. Dittenhaver, Chapaleau, Ohio.—This invention relates to a compound for filling wood previous to the application of a paint or varnish, and consists in a preparation which is entirely devoid of color, and will not therefore change the characteristic hue of the wood, which can be applied with an equally favorable result to all varieties, and which permeates so thoroughly the pores and fills so completely the interstices between the fibers that a single coat of varnish or paint will be generally sufficient to produce the designed outside face upon the wood.

Improved Railroad Water Crane.

Henry S. Cubberley and David Mann, Bloomington, Ill.—This invention consists in a frost proof jet, above which is a hollow standard surmounted by a movable bent tube. Within the standard is the valve rod, to the lower part of which is attached the valve. The rod continues on down below the latter and is encircled by a spring which forces the valve up against its seat. On the upper part of the valve rod is a rack, in which works a pinion, connecting by suitable mechanism with a hand wheel outside. By this means the valve is opened or shut.

Improved Harness Maker's Clamp.

Daniel Eighme, Chicago, Ill.—This invention relates to apparatus for holding leather in the operation of sewing it for harness or shoe making or other purposes. The stand is wedge-shaped, and on each of the inclined sides of the wedge there is a rib. There is also a shoulder on each side equal to the thickness of the lower end of the jaws. The inner sides of the jaws are grooved for the ribs and fitted to the inclined sides of the wedge. The jaws are raised by pressing on a lever, and when raised are lowered and are spread apart by a spring. Vertical springs draw the jaws down and hold them in their normal position, which is to tightly clamp the leather. The jaws act as levers, and turn slightly on their fulcrum rods when raised or lowered.

Improved Spring Hinge.

William Hoar, Floyd, Iowa.—This improvement consists in attaching a standard to one leaf of a hinge, and connecting a spring encircled extension thereof with the pintle of the hinge. On opening, the spring is compressed so that the action of the same on the door produces the shutting of the latter, securing also at the same time sufficient resistance against the accidental blowing open by the wind or otherwise.

Improved Portfolio Holder.

Jonas B. Aiken, Franklin, N. H.—This invention relates to portfolio holders which are adapted to be fastened conveniently against the wall of a room and above the wash board. It consists in the mode of combining the two side frames with the bottom support of the portfolio, so that the latter may be held closely locked and protected against unnecessary handling while it may be also held at an oblique angle so as to be easily examined. It also consists in providing the portfolio supports with end guards which prevent withdrawal of the portfolio and are adjustable to those of different sizes.

Stop Mechanism for Doubling and Twisting Machines.

William Cockcroft and Reuben Ackroyd, of Chester, Pa., assignors to themselves and James Massey, of same place.—This invention consists of a stop motion in connection with the feeding or delivering roll of a twisting machine, so contrived that if the threads or yarns break it will stop the delivery, and thus prevent the ends from going from one spindle to another. The tension of the yarn holds the inner weighted end of a lever up above stud pins on the pulley of the delivery roll so long as the yarn remains taut and unbroken, but when the yarn breaks the inner end of the lever will fall and stop the delivery roll by engaging one of the stop pins, and thus prevent the further delivery of the yarn until it is mended.

Improved Machine for Rolling Round Tapered Bars.

Charles F. Brown, Warren, R. I.—The object in the present invention is to facilitate the manufacture of spindles and all articles of tapering form and it consists of two eccentric disks revolving in opposite directions on a central arbor in a suitably constructed frame, so beveled as to roll or straighten a tapering spindle or other article, and in one or more guides through which the article to be tapered is introduced. The eccentric surfaces have the effect of inclined planes upon the spindle, approaching each other in one part of their revolution, and receding from each other in another part, while the spindle simply revolves and receives its form and shape from the pressure imparted by the beveled and eccentric revolving surfaces.

Improved Saw Tooth Gage.

Cyrus E. Grandy, Stafford Springs, Conn.—This invention relates to an ingenious apparatus for temporary attachment to the saw mandrel of a circular saw, to gage the teeth round and as to the set; and consists, first, of improved means for attaching the sweep to the mandrel; second, a templet in combination with the sweep, to insure the parallelism of the sweep with the saw, and an arrangement of the tooth gage supporting arm in the end of the sweep to shift laterally, as required, to adjust the gages to the plane of the saw; third, an arrangement of the gage holding arm to oscillate in the sweep, to adjust the gage to the front face of the teeth; fourth an adjustable gage, with a scale so arranged on the aforesaid arm that the angle of the teeth front may be gaged by it with certainty (it is also arranged so as to gage the teeth round); fifth, an adjustable gage on the aforesaid arm for gaging the set of the teeth; and, sixth, an upsetting swage holder on the said arm.

Improved Compound Metal Working Machine.

George L. Jones, Vanville, Wis.—The object of this invention is to furnish for the use of blacksmiths and wagon manufacturers a combination tool, by which the operations of cutting and punching iron, and the tightening, upsetting, and bending of tyres may be accomplished in a single machine. The frame of the instrument, of oblong shape, is firmly secured to the ground, and provided with strong vertical standards between which is pivoted an eccentric which is operated by a lever. The eccentric operates on the knee joint levers, one of which is hinged at its outer end to a heavy block, moving in a recess of the frame. The block is pivoted with its lower end to frame, and provided with a cutting blade which acts on a similar blade of the frame in the manner of shears. The other knee joint lever is hinged to a sliding carriage which moves in a recess, and to which is secured, in the direction of the longitudinal axis of frame, the puncher, which acts on a perforated steel cutter in a socket. The upper side of carriage is grooved and has a vertical extension plate which carries a strong bar or bolt and a partially grooved eccentric. Other eccentrics and grooved bases are arranged, between which and their corresponding grooved bases, the wagon tyre is clamped and either tightened or upset when off the wheel, as required, by the lever acting on carriage. For bending or rolling the tyre the cylindrical rollers are arranged sidewise of the frame. The outer rollers are adjustable for tyres of different sizes and thicknesses. The notched roller is placed between and above the outer rollers and turned by a crank, giving the bend to the tyre on its passage through them.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business: and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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On the first of September, 1873, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions and advice, *no charge* is made. Write plainly do not use pencil, nor pale ink; be brief.

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Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

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Peck's Patent Drop Press. For circulars, address Milo. Peck & Co., New Haven, Conn.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Notes & Queries

C. A. P. asks: How can I braze a broken cast iron vise?

H. asks: How can I make the best bleaching liquid for washing clothes?

J. W. R. asks: What is a good artificial bait for sunfish? "Grubs are scarce in my locality."

T. W. B. asks: As Professor Wise doubtless ascertained the tensile strength of the material composing his balloon, as well as the pressure to be borne by it (determined by the required weight to be raised), what was the amount of the explosive force?

W. H. B. asks: Is there a substance or combination of substances which is combustible, and easily ignited with a match, either with or without the use of a wick? It must produce as intense a heat as possible, be easily melted, and if poured in that state upon a flat piece of ordinary solder must adhere so firmly as, when hardened, not to become removed by ordinary handling or by transportation, and be reasonably cheap.

Answers to Correspondents

W. P. H's query is incomprehensible.—J. J. H.'s question is a professional one he should consult some good engineer.—J. S. B. should read the description of lead pencil making on p. 84, vol. 27.

F. O. B. asks: Would it not be a good idea to place air pumps on a locomotive engine, so that, in descending a grade, instead of putting on the brakes of a train to arrest the motion, that the air pumps could be used to force air into the boiler, thereby increasing the pressure in the boiler and utilizing the power which is usually wasted in applying the brakes? And could not the steam cylinders themselves be used for that purpose? Answer: Both plans are old.

B. A. K. asks: Will a broad gage locomotive run 200 miles in a shorter time than one built on the narrow gage plan, each being built alike and proportioned to the gage, the broad gage, of course, being much the larger? 2. Does a broad gage locomotive carry more dead weight in proportion to its size than the narrow gage? Answers: 1 and 2. We can see that there might be differences between the performances of the two engines, but one would not necessarily have any advantages over the other.

F. O. C. asks: 1. Who was the first inventor and builder of the locomotive engine, and who laid down the first railroad? 2. Would a leaden tank do for storing muriatic acid in large quantities? 3. What metal is used in place of nickel in plating? Answers: 1. Cugnot, a Frenchman, built the first locomotive, in 1769. The Stockton and Darlington Railroad, in England, was built in 1825. This was the first. 2. It probably would. 3. Read the article on page 307 of our volume XXVII.

E. L. asks: What is the highest degree at which water can be boiled? If I have 15 lbs. of steam in a boiler and build a large fire in order to get it up to 30 lbs., is the water any hotter at 30 lbs. than at 15 lbs.? Answer: The boiling point of water depends upon the pressure to which it is subjected. See article on "Properties of Saturated Steam," on page 81 of our current volume.

G. asks: How can I calculate the horse power of engine? From what book can I learn all about engines and pumps? Answer: We cannot answer the question about horse power without more data. You will find rules given in former answers to correspondents. Probably the best book for you to commence with will be Bourne's "Catechism of the Steam Engine," which can be obtained from D. Van Nostrand. There are many things relating to engines and pumps that cannot be learned from books, and can only be discovered by observation.

C. G. H. asks: When out of sight of land, how will Professors Wise and Donaldson know in what course they are moving? The compass will point out the north; but as the balloon has no stem or stern, they can not tell which way they are going. Answer: Mr. Donaldson informed us that he proposed to obtain the course by dropping something from the balloon, and observing the direction with reference to that.

W. B. asks: If a horizontal pipe, of 6 inches inside diameter, about a foot long, having connected on one side a half or three quarter inch (inside diameter) pipe, standing erect, about 4 feet long: and at the other side simply a prop or bolt, which slides out in proportion to the water pressure from above, and pushes against an object in its immediate front: will there be a horizontal forward pressure, and none backward? 2. If so, how much, by a pipe 4 feet long and half an inch bore, standing erect, with a 6 inch bore of a foot long horizontal pipe? 3. If the water is forcibly driven in, will the force, resulting in the forward pressure, be equal to the force above expended, or greater? Answers: 1. There will be both a forward and backward pressure. The latter pressure can be resisted by a plug in the pipe. 2. The amount of this pressure will be about 49 pounds. 3. If the water is pressed above, the forward pressure will be increased.

W. C. B. asks: 1. What is the limit of the hight to which a siphon will draw water, or what is the highest point at which it can be worked? Will it do any good to let the pump down in the ground 10 feet, and let the pipe run over the top of the hill on the surface of the ground? Answer: From 30 to 32 feet is the greatest hight in practice, and any lift above 28 feet causes great difficulty. If the pump is lowered, the whole pipe must be lowered as well, to get the benefit of the decreased lift.

E. G. F. asks: Is there a book devoted exclusively to stationery and portable engines, their construction, management, etc.? Answer: Yes. See catalogues of some of the leading publishers who advertise in this paper.

A. L. K. says: Is it possible to produce an artificial frost over an area of some square miles? Answer: Not in the present state of science.

S. J. O. asks: Where can I obtain the "Table of Change Wheels for the Screw Cutting Lathe," recently reviewed in your columns? Answer: We are unable to add any information to that already published in our notice of the work.

M. O'R. asks: 1. Where can I find a description of Professor Boyle's experiment or device for correcting the form of lenses, to which experiment or device allusion is made on page 43, current volume. 2. Is there any method or process for depositing nickel on glass, similar or analogous to the process by which silver is deposited on glass? I want to get a bright metallic coat of pure nickel on glass, which may be polished for reflecting purposes. Can it be done, and how? Answer: 1. Professor Boyle arranged a pair of six inch achromatics as a binocular telescope. The novelty of his machine for local retouches consisted in the employment of a lozenge shaped local polisher instead of the usual round one. Robert Browning of London makes silvered glass mirrors, and sends a pamphlet for a shilling. Mr. Clark tried one of his 18 inch specula and found that the diffraction around the three strips of steel supporting the diagonal mirror caused the image of a star to appear with six wings. 2. Professor Draper has completed with his own hands a silvered glass mirror, twenty-eight inches in diameter. It is supported on an india rubber air cushion. Professor Smith recommends nickel-plating cast iron specula, but these require careful annealing. The silver coating tarnishes wherever the air contains compounds of sulphur. In towns, therefore, the silver coating of glass mirrors should be nickel-plated by the battery after polishing.

J. F. S. asks: Would the collection and condensation of the gas or gases arising from hot muriatic acid, after it has done its work in clearing tin scrap, be patentable? Answer: Whether your method is new depends upon how you collect and condense the gas. If you condense by means of an ordinary condenser or worm, or receive the gas into cold water, there is nothing new in it. But this plan of collecting and saving the hydrochloric acid gas might be combined with your process of cleaning tin scraps and be patentable, as might also improved machinery for effecting either result. Improvements for preventing the escape of gas into a room would also be patentable.

C. E. F. asks for directions for preparing cupro-ammonium. Answer: Ammonio-cupric oxide or cupro-ammonium consists of a solution of cupric oxide or black oxide of copper in aqua ammonia. It may be produced by precipitating a solution of a copper salt, as the sulphate, by strong ammonia, and then adding ammonia in excess so as to dissolve the precipitated oxide. In this case, however, it is not pure, as the acid of the copper salt, when the oxide of copper is precipitated, combines with the ammonia, forming an ammonia salt, which remains in solution. To form pure ammonio-cupric oxide, dissolve pure black oxide of copper in the strongest aqua ammonia.

W. R. asks: Is there any kind of air pump that will produce a stronger pressure of air against any object than a good strong wind? If so, how much would such an air pump weigh, and how heavy an engine would it take to run it? Could they both be taken up in a balloon? Would it be practicable thus to drive a balloon against the wind? Answer: Such air pumps are made, but the machinery would be too heavy to be practicable for use in a balloon.

W. B. asks: Why do music boxes squeak after they have been cleaned? The noise is not in the running machinery, but in the steel reeds which the pegs of the roller strike on. Answer: Probably the noise is due to friction between some of the reeds and pegs.

A. asks: Why cannot we do away with sails on lake boats, and run them with windmills, so constructed as to work a screw? Answer: The idea is old and impracticable. By no manner of device can you make the wind drive a boat directly against the wind. You can sail obliquely, and for this purpose the ordinary sails would give you more propelling power, in a more convenient form, than any windmill.

G. V. H. says: My house is stone, with walls 18 inches thick. The roof is tin, with ordinary pine sheathing, and I shall ceil it with pine. What material would be best to put in between the roof and the ceiling to keep the upper story cool in summer and warm in winter? Would sawdust answer the purpose? Answer: Sawdust filling in this case is objectionable: first, on account of its tendency to induce decay of the timber, either rot or dry rot; second, because it will decay itself and find its way through the joints of the boarding, thus filling the rooms with dust and deteriorating the air. The usual course in such cases is to suspend strips at from one to three feet below the roof joists and at about two feet apart, and to put the ceiling upon these, thus depending upon a large air space between the ceiling and the roof, as a non-conductor of heat. The strips are made firm by being braced at short intervals to the joists; and if a plastered ceiling is required, a series of narrow cross strips are nailed to the others at 12 inches apart, to which the lath are secured.

R. B. C. says: In regard to D. B. M.'s answer to inquiries respecting a noon mark, I wish to ask: 1. Why do the observations have to be taken 12 hours apart? 2. How am I to tell when it is noon? Is it when the shadows of the two plumb lines coincide? 3. What kind of an almanac will tell how much the sun is fast or slow? 4. Can you give a rule for calculating the true meridian from the results obtained by the plumb line arrangement? 5. Is there any more reliable apparatus for determining the meridian than by using plumb lines? Answers: 1. No. In 11 hours and 58 minutes, the north star completes half a revolution about the pole. The pole star is on the meridian about seventeen minutes after the plumb line covers both it and Alioth, (*epsilon Ursæ Majoris*) fifth star of the Dipper, beginning with the pointers. The plumb lines may also be ranged with the north star at its greatest eastern or western elongation. Then, if the lines are 100 inches apart, one of them must be moved two and six tenths inches to range with the pole. 2. Look at the almanac for "sun at noon mark," which is the required correction. 3. A "newspaper almanac." 4. The plumb lines are placed in the true meridian, that is, they range due north and south. 5. Yes; by using the solar compass, transit, etc.

G. R. asks: Is there any difference made, in the amount of water discharged by an hydraulic ram, by increasing the size of discharge pipe from one inch to one foot in diameter? The fall to the ram is 10 feet; hight to raise, 60 feet. Of course the size of pipe (1 inch) is already sufficient to allow a discharge of fifty times more water than is elevated by the ram. Does the size of the pipe, by exposing more or less surface to water, offer more or less friction, and thereby vary the amount discharged? Answer: Unless the supply pipe is very long, a diameter of one inch will probably give better results than a diameter of one foot. This is on the supposition that the ram is properly designed for a pipe one inch in diameter.

W. G. A. asks: Would not one bumper on a railroad car do as well as two bumpers? Answer: No. One might but not as well as two.

J. W. H. asks: 1. How can I determine when water is foaming in a steam boiler? 2. What is generally used for cementing grist mill stones, and for fastening smaller sized stones in iron cups? 3. I have a 20 inch corn mill. The top stone is broken in two in the center, and the cement, from exposure to the weather, has rotted. I made a thin solution of plaster of Paris, set the burr or stone, and then poured the solution around the burr in the cup. It is a failure and does not become hard. What shall I do? 3. Can you give me instructions how to temper mill picks? Answers: 1. Violent foaming is sometimes shown in the glass gage. It is generally indicated by trying the gage cocks, and observing whether solid water or a mixture of steam and water issues therefrom. 2. Set the stone in the cup, filling up the back with a cement composed of plaster of Paris. Fill the interstices between the stones with a cement composed of powdered alum and a powder made from small pieces of the millstone. 3. Picks are frequently tempered in brine.

D. B. says: Suppose I have a steam cylinder, with 50 inches area, and 20 lbs. constant pressure, and insert two pistons, admitting steam in center between the pistons, so that they are both forced outwards, would each piston overcome a resistance of 1,000 lbs. (less friction), or the two only 1,000 lbs. collectively? Answer: Each would exert a pressure of 1,000 pounds.

C. M. N. asks how to precipitate sal ammoniac and nitrate of silver. Answer: The latter can be precipitated by hydrochloric acid or any chloride. If in a solution by itself, it will crystallize out on concentrating the solution by evaporation. The two salts cannot exist in the same solution, as the sal ammoniac would precipitate the silver. Sal ammoniac is precipitated by the bichloride of platinum in concentrated solutions. If C. M. N. will give a more precise explanation of what he wants, we may be able to assist him.

W. M. F. asks: 1. What is the use of a storm glass? 2. How is it used? 3. Should the long and narrow bottle be full, or does it make no difference? 4. How can I tell the approach of a storm by the use of the storm glass and thermometer combined? 5. How can I make muriate of ammonia? 6 How can I make malic acid? Answers: 1, 2, 3, 4. It is not necessary that the phial should be full. When the liquid is clear it is a sign of fair weather. If the solid particles rise in the liquid, it signifies rain. Before a storm or very high wind, the liquid will become thick. 5. From the ammoniacal liquors formed in the manufacture of coal gas. 6. It is generally obtained from the berries of the mountain ash. You would do well to consult some standard work on practical chemistry, as we have not space to give details of manufacture in these columns.

G. B. D. asks: 1. What is the most economical speed in feet per minute to run a rotary steam engine, which is constructed on the old plan of hollow shaft and arms, through which the steam passes, exhausting at the curved ends of said arms, always in an opposite direction? 2. What per centage of economy can be realized from the above plan, compared with the best form of reciprocating engine? 3. Would there be any gain of power if the steam, in exhausting from the curved arms, came directly in contact with the inner ratcheted face of another wheel, causing it to revolve in the opposite direction, the two emitting their power by means of one cross and one straight belt, leading to another shaft at suitable distance? 4. What is your opinion in regard to a series of feet being connected to each other by means of links or hinges, their inner faces being provided with rollers, the whole forming an endless traction device, revolving around an endless track and propelled by engines mounted on the frame? Some twenty patents have been allowed to different inventors for certain improvements on this form of traction engine during the last 12 years, and yet there seem to be none in use, either because the whole machine combined is too complicated, or the connections, being constantly exposed to grit and dirt, are not durable. Suppose these revolving feet to be 4 feet x 14 inches each, and they are so connected that one does not leave the ground until the next one relieves it; if we construct a traction engine with two traction wheels 6 feet diameter by 2 feet face, both being secured to one shaft which is driven by engines of the same power as the ones employed to drive the endless traction machine, which of these plans will draw the greatest load at the same speed, and which would be the most practicable for every day use? 5. What is the object in the rubber tire used on road steamers? Is it to give increased traction or is it for the purpose of relieving the body of the machine of the shock or concussion which would occur if the wheels struck a stone or other obstacle? Answers: 1. Generally speaking, the most economical speed for an engine depends upon its mode of construction, system of counterbalancing employed, etc., and no rule can be given that will apply to every case. 2. We have no record of tests that will enable us to answer this question. 3. If applied on the principle of the compound engine, there might be a gain. 4. Traction engines are largely used in England, and their introduction into this country is now fairly accomplished. There are several forms of traction wheels in use which have more adhesion than the engines of the machines can overcome. 5. Mainly for the purpose of gaining adhesion.

N. A. P. says: Two forms of screw propeller are tried on the same vessel, each screw or wheel being of the same diameter, and the pressure of steam in each trial being 60 lbs. It is found that, with wheel A, 4,000 revolutions are required to propel the vessel 1 mile in 8 minutes: while with wheel B, 3,000 revolutions make the 1 mile in 8 minutes. Is there a difference of power actually expended? If so, what? Does the furnace consume more fuel with wheel A on the shaft? If so, how much more? Answer: If we understand your question rightly, wheel B has 25 per cent more efficiency than wheel A, and consequently 25 per cent less fuel is required with this wheel.

A. F. B. says: 1. Is the pressure of steam on every square inch of the flues the same as it is on the shell of the boiler, or has steam the same pressure towards the center as it has from the center of the boiler? 2. Is the law that action and reaction are equal and in opposite directions applicable to the first query? Answers: 1. Steam presses equally in every direction. 2. Yes.

J. G. D. T. asks: 1. Does gunpowder, when ignited within an enclosure (as in a gun barrel, for instance) create pressure by producing air? 2. If so, is there a gradual expansion of its atoms, so as to create a gradual force? Answers: 1. The solid grains of the powder are converted into gases, principally nitrogen and carbonic acid. 2. There is an expansion, commencing with a pressure of nothing and rapidly increasing.

A. M. B. asks: Is it an uncommon occurrence to launch steam vessels with their engines and boilers in? Was not the Dictator launched with her machinery complete? Answer: It is not usual. The Dictator and most of the monitors were launched with their engines and boilers in.

C. E. H. asks: Is there any way of removing coal tar from the bottom of a sail boat, the boat having collected it by laying in a dock near the gas works? Scraping will not answer. Answer: After scraping off as much tar as practicable, try naphtha as a solvent for the remainder. Rub with a sponge or cloth soaked in the naphtha.

P. asks: What is the best cheap preparation for preserving pine shingle roofs, to be applied either before or after laying the shingles? Answer: The article advertised as slate paint may answer your purpose.

J. B. S. E. asks: Is amorphous phosphorus soluble in any of the others? If so, what is the process? If not, what is it soluble in? Will the addition of another substance, not deleterious, make it soluble? Answer: Red or amorphous phosphorus is insoluble in the ordinary solvents of common phosphorus. According to Möhler, red amorphous phosphorus may be rendered colorless and perfectly transparent by fusing it in a concentrated solution of bichromate of potash mixed with sulphuric acid. After this treatment it usually remains liquid after cooling, but solidifies instantly when touched by a solid body.

E. L. says: Suppose four canals, each one mile long and thirty feet wide, to be six feet deep at discharge end, with water below, level with the bottoms. At the entrance ends, the depths are 5, 6, 7 and 8 feet respectively, with full supply of water at these depths, and regular grades between inlet and outlet: How much will each canal discharge in 24 hours? Answer: You can find approximately the velocity of discharge in feet per second, and from this the quantity discharged per second, by the following formula: V = velocity in feet per second, f = total fall in feet, A = cross section of canal in feet, l = length of canal in feet, p = length of wet perimeter in feet. $V = \sqrt{(10{,}000 \times f \times A) \div (l \times p)}$; or the velocity of discharge in feet per second is equal to the square root of the product of 10,000 by the total fall in feet and the area of cross section, divided by the product of the length and wet perimeter.

J. D. W. asks: Does the term steam engine include a boiler, or can an engine be complete without a boiler? I do not refer to portable engines. Answer: A steam engine does not include a boiler unless it is so stated expressly.

P. D. W. asks: What is magilp composed of? Answer: Magilp is a mixture of pale linseed oil and mastic varnish, used by artists as a vehicle for their colors. The proportions vary according to the work. It is thinned with turpentine.

C. M. L. asks: What can I put over silver leaf to keep its color? Answer: Try a varnish composed of pale shellac 8 ozs., rectified spirit, 1 quart; dissolve.

J. W. H. asks: Is it true that, the warmer water is, the more gas it will absorb? I mean any gas that can be absorbed by water. Answer: The general law is that the colder the water, the greater the quantity of the gas taken up and retained by it. Hydrogen is an exception, about the same amount being absorbed at all temperatures of the water.

H. H. M. asks: What is the name of some book that treats of the manufacture of carbolic acid, or how is that article manufactured? Answer: Carbolic acid is made from coal tar. The tar is distilled until anthracene comes over. The resulting oil is rectified collecting separately the oil which distils over between 302° and 392° Fahr. This oil is mixed with saturated potash ley and powdered hydrate of potash, by which it is converted into a white crystallized mass. This substance is dissolved in hot water; the oil which rises to the surface is removed, and the lower alkaline liquid is neutralized with muriatic acid. Impure carbolic acid now rises to the surface as an oil. This can be purified by washing with a little water, digesting over chloride of calcium to dry it, rectifying several times, and finally cooling to 14° Fahr., when pure crystals of carbolic acid separate, from which the remaining fluid portion is poured off. We know of no treatise on the subject.

H. C. L. asks: Will a register placed in a wall six feet from the floor heat a room as quickly and as cheaply as one placed fifteen inches or less from the floor, and why? Answer: Yes: for whether the register is placed near the ceiling or the floor, the warm air will ascend to the former at once, unless some obstruction intervenes. Where a lower hall way connects with an upper one by stairs, and the register is in the lower hall, the warm air will not ascend to the upper one, because of the obstruction of the ceiling and the attraction of aggregation which subsists between the particles of the warm air; but in an ordinary rectangular room such obstruction does not exist. The proper place for a register for warm air, however, is at or near the floor, for convenience in warming the feet, etc., in very cold weather. All rooms intended to be warmed by the ingress of warm air should have a ventilation flue, having a register at the bottom and at the top of the room, to insure a proper inflowing of the warm air, and this flue should be on the opposite side of the room from the warm air flue.

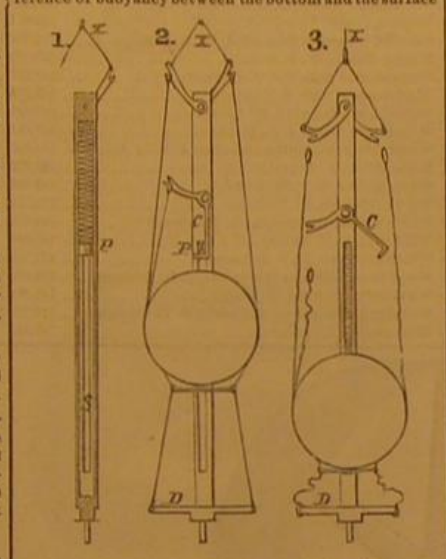
C. A. H. asks: By connecting a 2 inch hose to a 2½ inch, is there anything gained? Is it better than all 2 inch? Answer: The friction of the water will be decreased by this arrangement, and the pressure in the large hose will be the least.

K asks: Is a mining lamp as safe if enclosed in finely perforated brass as in wire cloth? Answer: Yes.

E. C. G. asks: 1. Is there any way of replacing the gilt on a frame, and what is it? 2. How can I galvanize wrought iron? Answers: 1. You could scarcely do this work, if you have had no practical experience in the matter. We would advise you to entrust it to some one who makes a specialty of this kind of business. 2. Dip the iron into muriate of zinc, and afterwards into molten tin.

R. A. P. asks: What is the formula for ascertaining the proper hight and diameter of a marine engine smoke pipe, as used by successful engine builders? Answer: The practice of different builders varies greatly, and the best rule would probably be an empirical one based on data obtained from successful examples. For an approximate rule, the following is a very good one: Allow 200 cubic feet of air for the combustion of one pound of coal per minute; and having assumed a diameter for the chimney, and the number of pounds of coal to be burnt per hour, it will be easy to ascertain the amount of air required per hour, and the consequent velocity in feet per second. Then for a temperature of gas in the chimney, from 450° to 550° Fahrenheit, the hight of the chimney in feet necessary to produce this velocity is equal to one eighteenth of the square of the velocity in feet per second. More accurate methods are given in Professor Rankine's "Treatise on the Steam Engine and Other Prime Movers."

J. S. says, in reply to T. H., who asked if a spar of white pine could be used as a float for deep sea soundings: At the depth he mentions, namely, 5,000 fathoms, I am almost certain his spar, once down, would never rise again, for the following reasons: Dry wood is principally composed of cellulose, the specific gravity of which varies from 1·25 to 1·5; and were it not for the cellular structure of wood, it would not float at all, as is practically shown when it becomes water-logged. At a depth of 5,000 fathoms the pressure would be about 15,000 lbs. to the square inch, or 1,080 tuns to the square foot. I do not think white pine could resist such an enormous pressure. The use of a mixture to generate gas at the bottom of the sea is not impossible, but should say it is highly impracticable. Sea water is about 850 times heavier than atmospheric air; but at a depth of 5,000 fathoms, air would be compressed 1,000 times, and therefore would become heavier than water. Any gas of a greater density than air, such as carbonic acid, is of course out of the question. Hydrogen is the only gas that could be used. 1,000 cubic inches of hydrogen, at 60° Fahr. and barometer 30 inches, weigh 21·379 grains: at the above depth 1000 cubic inches would be compressed to 1 cubic inch. The weight of 1 cubic inch of sea water is 258·264 grains. Consequently 1,000 cubic inches of hydrogen would have a lifting power (at the above depth) of about 237 grains; or to lift 10 lbs., as T. H. wants to do, it would require 170 cubic feet of hydrogen. This scarcely requires comment. T. H. could easily accomplish his object by using as a float a flexible waterproof bag containing some liquid lighter than water, say a hydrocarbon oil of specific gravity 0·7. A cylindrical bag, 6 inches diameter and 2 feet long, thus filled, would have a lifting power in sea water of about 3 lbs. All liquids being nearly alike compressible, the difference of buoyancy between the bottom and the surface



would be very minute. As the deposit at the bottom of the sea is in some places, I believe, of a tenacious nature, T. H.'s sounding rod might possibly stick there, unless his float was inconveniently large. It might be advisable for him to provide for such a contingency by using the apparatus represented by the engraving. Fig. 1 is a tube with a slot, S, on either side, containing a loosely fitting piston, P, with two lugs projecting through the slots, also a strong spiral spring. Fig. 2 shows the spring held compressed by a catch, C. Fig. 3 shows weight and catch disengaged; the lugs of the piston, striking the weight, jerk the tube clear of everything. The disk, D, prevents the possibility of end of tube sinking in the bottom, without disengaging the weight. The float is attached at X.

A. T. A. says, in reply to G., who is troubled with red ants in his sugar: My sugar bucket contains about twenty-five pounds of sugar, and I am frequently troubled with these same red ants; but when so troubled I get three or four large black ants and put them in the bucket; and in less than three hours, not a red ant is to be seen, the black ones eating them up. As a means of preventing ants from getting on to a table, I put a piece of tobacco under each of the feet, and keep the table from contact with anything else.

R. S. H. says, in reply to C. F. B., who says that filing hand saws towards the point leaves more bevel on the front or cutting side of the tooth than on the back side: This is correct. He further says that the difference in the bevel is caused by the taper of the file. In this, I think, he is not correct. The difference of bevel on the two opposite sides of the tooth is caused by the position in which the file is held. If he runs his file level, while the saw is held plumb, he will find the bevel so nearly alike on the two sides that it will be difficult to decide which side has the most, showing that the taper of the file has little or nothing to do with it. Dropping the handle end of the file and elevating the point will and does produce the effect which he lays to the shape of the file. Moreover it produces a deeper cut, and a longer and more pointed tooth, which gives a sharper cutting point, and furnishes more space in which to carry the sawdust.

S. S. says, in reply to F. A. S., who asked for directions for constructing a stove to dry fruit, etc., without changing the color: He should have the dryer made of brick, or, if it is made of iron, have it lined with a porous lining, and never allow the heat to get below 100° as the color changes in proportion to the time it takes to dry the fruit. If he intends to dry large quantities, it should be made with several chambers, that the green fruit may not be put in with that which is partially dry.

A. H. says, in reply to J. C. S., who asked about the dimensions of a belt per horse power: A 1 inch belt at a velocity of 750 feet per minute is a perfectly safe rule to calculate for one horse power. [There seems to be a considerable difference in the figures used for belting, and we shall be glad to hear from any of our readers who have made experiments. A rule by Mr. Rider, lately published, states that a belt one inch wide, and bearing on at least one third of the circumference of the smaller pulley, will transmit a force of 19·25 pounds, at any velocity. Applying this rule to the present case, we find that, with a velocity of 750 feet per minute, the belt would transmit $(19{\cdot}25 \times 750) \div 33{,}000 = 0{\cdot}431$ horse power.—EDS.]

T. M. G. says, in answer to a querist who asked if broken files can be mended: I have to say that my father once imported a lot of files, many of which arrived broken. He tinned them on the clean broken ends and "sweated" them together. In order to test the strength of the joint so made, one was struck across something, and the file broke within an inch of the joint.

D. R. says, in reply to a correspondent who asked how to harden jewellers' rollers: Put them in a cast iron box with carbon made from ivory chips, and keep the box at a dull red heat for 4 or 6 hours; then dip the rolls in water, or salt and water. They must be handled quickly from the box to the water, as the air spoils the surface.

A. S. G. replies to R. B.'s query as to passing trains as follows: Engine A can run on to the siding with eight cars, leaving the other eight on main track. Engine B then runs past, pushing the eight cars before it, after which A regains its place on the main track, getting out of the way while B puts the eight cars on to the siding, runs by them, and pulls them again on to the main track. The trains have now passed, and nothing remains but for A to pick up its cars, and go on its way. No problem of this kind is insoluble, as long as the siding can hold at least one car with its engine. [Answers similarly correct have been received from F. D. C., E. L. W., T. M. W., G. E. K., H. R. R., H. C. B., S. B. E., F. V. F., J. J. M., J. T., L. B. E. L., F. A. W., O. B. A. S., E. R., and J. N. P.—EDS.]

B. B. says, in reply to R. B.'s query as to trains passing each other: Two trains cannot pass each other under the circumstances described.

J. S. B. & Co. say, in answer to H. H. who asked for a cement for a leaky cast iron furnace: Clean borings or turnings of cast iron 1 lb., sal ammoniac, 2 ozs., flowers of sulphur, 1 oz. Mix them well together and keep dry. When required for use, take of the mixture 1 part, clean borings 20 parts: mix thoroughly and add a sufficient quantity of water. A little grindstone dust added improves the cement.

A. D. N. replies to A. P., who is troubled with water in his boiler: I guess you have no drain cocks to your cylinder or steam pipes, and that the water which troubles you is condensed steam collected in your engine while cooling off. Any engine is harder to start after cooling, partly because of the water of condensation and partly because the engine is cold. [A. P. says that when he uses a small quantity of water in his boiler, he does not have the trouble; hence it does not probably occur from condensation in the cylinders only.—EDS.]

D. B. says (in answer to A. B. F. who asks: 1. Does sulphur when burned for bleaching purposes do equally well whether the flame is blue or red with a sparkling blaze? 2. Does the burning in the two different ways produce same kind of gas? 3. What will prevent cotton or linen fabrics from becoming mildewed?) 1. The flame of sulphur is blue; the red blaze must be produced by some impurity. 2. The blue, of course, gives rise to the bleaching property. 3. Mildew can be prevented by the use of powdered sulphur.

G. W. W. says, in reply to E., who asked how to utilize several hundred horse power running to waste at a distance of 3 miles: Put a water wheel at the fall, and attach air pumps, lay a pipe from the pumps to the factory, of suitable size, then connect to your engine the same as with steam. Start your pumps and compress the air in your pipes, and with it run your engine, without steam, fuel or boiler. You will have no danger from fire or explosion. A safety valve can be placed on your main pipe to carry off surplus pressure. Power can be let all along the line of pipe, and it can be conveyed any distance.

J. H. W. says, in reply to A. K., who asked for a recipe for invisible ink: The following recipe is a good one: No. 1. 1 dram sulphate of copper or of iron, 1 oz. water; put into a bottle. No. 2. 1 dram prussiate of potash, 1 oz. water; put into another bottle. Write with No. 1, using a gold or quill pen. When dry, apply No. 2 with a feather, or lay a wet cloth saturated with the fluid on the writing, when it will be perfectly visible. The writing will be of a dark blue color. This is called invisible ink.

J. H. W. says, in answer to W. B., who asked how to remove ink spots: Use cyanuret of potash or oxalic acid. After the removal of the spots, wash well with water; and if the color of the cloth is taken out, apply ammonia, when it will be instantly restored.

C. H. A. says, in answer to G., who asked how to get ants out of sugar: Every ant in it will, sooner or later, go home with a load, and then return for more. Hence, if the vessel containing sugar or other substance infested by ants be removed from the place where it stood to another, the ants in it will take their loads and depart. Those returning will be like an Irish friend of mine, who, seeking a foot bridge which had once been laid across a stream, exclaimed: "Here it is, an' 'tis gone, sure!" The very last ant will leave in the course of a few hours, but it may be necessary to move the package several times, to prevent those which have found their way home from returning with their friends. I have tried this repeatedly and it has never failed.

G. W. F. says: E., in a recent question, says: "I have several hundred horse power running to waste," etc. It seems to me to be a problem, well worthy of the most serious consideration, how to make the most of water power, particularly where it exists, as your querist states, to the extent of several hundred horse power. The most perfect key to this matter, conceivable, seems to be that mentioned in your last issue as practiced in Belgium, namely, the transmission of power by means of compressed air. The letting of excess power to run anybody's factory readily suggests itself, or even its application for the manufacture of ice.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

R. J. says: 1. I send a specimen which completely puzzles me. Recently I had given to me several very rich specimens of gold ore. I extracted the gold by pouring on it 1½ parts of hydrochloric acid to one part of nitric. My object in putting in a larger quantity of hydrochloric than nitric was to precipitate the silver which was in the ore. I left them together until all effervescence ceased; I then had an orange colored liquid, which I evaporated until it got gummy; this I put into a crucible and heated to a white heat, and the specimen herewith was the result. 2. What is the best work on chemistry? Answers: 1. We are afraid that you have been deceived in the appearance of the ore which you imagined contained so much gold. The residue sent us consists largely of the red oxide of iron; and from your account, there is little doubt that you have been trying to extract gold from the bright yellow sulphide of iron, or iron pyrites. The effervescence was caused by the decomposition of the nitric acid, nitrous fumes being evolved. The sulphur was oxidized by the nitric acid into sulphuric acid, which combined with the iron oxide to form sulphate of iron, some sulphur being separated. It was this sulphur which caused the liquid to become gummy when evaporated and heated. The hydrochloric acid, in the presence of the oxidizing nitric, played a minor part. The solution finally contained sulphate of iron, free sulphur, free hydrochloric acid and perhaps some chloride of iron. The white heat, to which the solution (evaporated to dryness) was finally submitted, decomposed the sulphate of iron, driving off the acids or decomposing them, and there was finally left the red oxide of iron. There may have been some grains of metallic gold, however, as there generally is in iron pyrites, though seldom enough to pay for extraction. The gold can be extracted by the following method: The pyrites is roasted as thoroughly as possible to drive off the sulphur. It is then reduced to powder and agitated with mercury. The mercury combines with the gold present, forming an amalgam of mercury and gold. This amalgam is then submitted to the action of heat, by which the mercury is driven off and the gold recovered in the metallic state. The mercurial vapor is of course condensed, and the metal used for another operation. 2. Bloxam's is highly recommended.

E. B. G.—The stone you send is a hard fine grained limestone, and looks as if it might be available for lithographic purposes, but the specimen is too small for us to judge accurately of its value. A good lithographic stone is of a yellowish gray color, and uniform throughout; free from veins, fibers and spots; a steel point makes an impression on it with difficulty, and the splinters broken off by the hammer have a concholdal fracture.

E. L. W.—Your specimen is rich in lead, and is probably a lead ocher; but it is too small for complete analysis.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Crank Pins. By W. A. S.
On a Balloon Experiment. By D.
On Pressure and Space. By J. A.
On Air and Steam Engines. By F. A. W.
On Perpetual Motion. By J. W. S.
On Traction Engines. By H. M. S.
On the Art of Inventing. By J. E. E.
On Street Pavements. By W. H. B.

Also enquiries from the following:

E. G. de W. & Co.—J. S. B.—D. M.—C. W.—J. J. H.—C. & N.—G. C. F. S.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Correspondents in different parts of the country ask: Where can I obtain pipe clay for making lead pencils? Who owns the patent rights for the various artificial stones? Who makes the best candle machine? Does the vapor stove, using crude petroleum, work well practically? Who recently invented a process for tempering and preserving the elasticity of steel and brass springs? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

September 9, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, burglar, H. P. Hood	142,630
Alarm, till, C. & W. H. Tucker (r)	5,568
Axle box, W. A. Clark	142,556
Bed bottom, P. Anderson	142,549
Bee hive, A. J. Sternberg	142,718
Blind slat fastener, G. W. Brooks	142,674
Blind stiles, etc., boring, L. Worcester (r)	5,566
Boiler and condenser, B. T. Babbitt	142,663
Boiler and condenser, B. T. Babbitt	142,664
Boiler feed heater, etc., J. Armstrong (r)	5,569
Boot and shoe stretcher, J. Lyons	142,710
Boots, machinery for lasting, Trask & Wheeler	142,657
Bottle casing, J. Dugan	142,695
Bracelet, J. S. Palmer (r)	5,571
Buckle, W. Parsons	142,721
Button, J. Durand	142,686
Can for holding paint, etc., G. H. Chinnock	142,642
Can for oils, etc., G. H. Chinnock	142,643
Car axle box, W. W. Whitaker	142,732
Car brake, W. Wartmer	142,628
Car brake, railway, W. D. Pope	142,649
Car brake, railway, G. Westinghouse, Jr	142,600
Car brake, self-acting coal, J. D. Leonard	142,572
Car coupling, R. H. Dowling	142,682
Car coupling, P. Kendrick	142,654
Car coupling, T. & J. W. Melkle	142,713
Car coupling, C. L. Miller	142,715
Car coupling, J. Waite	142,730
Car heater, railroad, Scripture & Stackman	142,727
Car, pneumatic railway, H. G. Yates	142,605
Car truck, changeable gage, W. W. Whitaker	142,731
Car wheel, Sax & Kear	142,587
Carpet, J. Dornan	142,681
Carriage spring, G. W. Harlan	142,627
Caster, salt and pepper, J. Bird	142,670
Casting, core apple for, J. B. Aston	142,662
Casting, core barrel for, W. Smith	14,746
Chair frame, G. Gardner	142,625
Chair seat or back, G. Gardner	142,624
Chair, connecting cradle, J. Reeves	142,583
Chuck, centering, G. H. Miller	142,642
Cigar mold, N. DuBrul	142,683
Cisterns, cut off for, G. W. Howell	142,569
Clamp, F. M. Holmes	142,697
Clothes dryer, A. S. Miller	142,714
Clothes reel, D. L. Huff	142,651
Clutch, friction, J. J. Grant	142,564
Coal delivering sack, W. S. Shackleton	142,741
Coal hod, H. B. Safford	142,734
Coal mining machine, F. M. W. Price	142,582
Composition mastic, A. Thiele	142,733
Condenser, marine, B. T. Babbitt	142,665

Crusher and harrow clod, Young & Worthan	142,755
Cutter head, E. Benjamin	142,689
Derrick, J. E. Serrell	142,740
Dredger, J. F. Morse	142,577
Drill and planter, seed, W. F. West	142,709
Drill jackpost, etc., Eastman & Morris	142,619
Electric regulator, T. A. Edison	142,658
Elevator, E. Boyden	142,595
Elevator, hay, C. H. Kirkpatrick	142,695
Engine, reciprocating, A. Staley	142,747
Engine, rotary, J. E. Crisp	142,559
Engine, rotary, F. J. Hollenweger	142,669
Engine, steam, R. T. P. Allen	142,660
Engine heater, steam fire, W. F. Shaw	142,589
Envelope machine feed box, E. Allen	142,606
Evaporating liquids, J. J. Johnston (r)	5,570
Fence post socket, G. W. & J. B. Durant	142,697
Fire arm, breech loading, W. C. Hicks (r)	5,564
Fire extinguisher, F. Latta	142,677
Flask, powder, M. Clik	142,614
Floor for refrigerators, etc., Smith & Schmid	142,745
Furnace, malleable iron, D. R. Nash	142,716
Furnace, oxide of zinc, J. G. Lang	142,571
Gage, splitting, T. Rice	142,584
Glass molds, treating, J. Lydiatt	142,573
Hammer lifter, drop, C. Peck	142,722
Hammer for planishing iron, W. D. Wood	142,734
Harrow, R. L. Taylor	142,593
Harvester rake, J. Irvine	142,632
Harvester rake, J. L. Owens	142,644
Hatchway, self-closing, A. B. See	142,588
Hay, sling for loading, G. W. Long	142,698
Heater for steam fire engines, W. F. Shaw	142,589
Hinge for blinds, lock, T. Cincas, Jr	142,679
Horseshoe, A. W. Smith	142,590
Horseshoe, sectional, J. D. Abbott	142,547
Horseshoe nails, D. Turbayne	142,597
Horseshoe nail die, A. H. Caryl	142,678
Indicator, distant heat, J. A. Read	142,727
Jack, lifting, I. A. Crippen	142,680
Jeweler's show case, Martin & Studer	142,575
Journal packing rack, W. H. Humphrey	142,698
Kettle and pan scraper, E. J. Whitman	142,602
Knife, drawing, E. Parker	142,720
Lamp, L. Berns	142,609
Lamp, F. Rhind	142,730
Lamp, street, J. S. Hagerty	142,693
Lard and tallow, drying, A. Smith	142,743
Last block fastener, L. S. Wright	142,603
Lever for drawing timber, J. N. Eames	142,618
Lock, permutation, P. W. Hall	142,696
Loom picking mechanism, W. Stearns	142,592
Mandrel, tube welding, H. K. Flagler	142,622
Mechanical movement, W. Oliver	142,578
Metal working machine, compound, H. B. Sevey	142,588
Mill, boring, F. E. Hahn	142,694
Molds, blackwashing, J. B. Aston	142,661
Molding machines, cutter head for, J. Alloways	142,548
Needle case, Marchant & Hart	142,699
Needle sharpening device, Barnum *et al*	142,553
Nut lock, K. H. Loomis	142,709
Ore concentrator, J. A. Peer	142,646
Ore washer, J. A. Peer	142,647
Organ, reed, L. K. Fuller	142,690
Packing machine, A. Ralph	142,651
Packing, metallic piston, J. Massey	142,640
Paper pulp, wood, T. B. Armitage	142,550
Pavement composition, S. J. Whiting	142,601
Paving composition, A. Thiele	142,594
Pile or fagot, J. Barker	142,666
Pision, C. B. Allen	142,659
Pitman, J. H. Carothers	142,611
Pitmen with shafts, connecting, R. Cleaveland	142,616
Planing machine cutterhead, E. G. Richards	142,731
Planter, corn, E. C. Brown	142,675
Planter, corn, N. C. Lamb	142,706
Planter, corn, G. W. Starrett	142,686
Platform, dumping, F. Peteler	142,724
Plow and cultivator, shovel, A. Smith	142,655
Press, hay or cotton, D. A. Nelson	142,718
Printing press, J. G. Peterson	142,648
Printing press ink, E. Allen	142,607
Propeller, chain, E. P. Russell	142,653
Pump, rotary, C. P. Holmes	142,696
Pump, hand lever, O. T. Earle	142,562
Purifier, middlings, L. S. Reynolds	142,729
Purifier, flour and middlings, E. N. Lacroix	142,705
Railroad cattle guard, Tunison *et al*	142,596
Railroad rail, J. B. Johnston	142,701
Rail, fastening for, B. W. Buchheit	142,610
Rail, joint for hollow, R. S. Sanborn	142,654
Railroad, street, J. R. Beckett	142,668
Railroad switch, D. E. Brockett	142,672
Railroad switch stand, R. A. Rash	142,725
Rake, revolving horse, G. Penisten, Sr	142,581
Refrigerator, oyster, etc., J. C. Jones	142,703
Rivet, J. E. Wootten, (r)	5,567
Roof, metallic, I. S. Mettler	142,641
Sad irons, etc., varnishing, W. J. Reagan	142,728
Sandpapering machine, H. L. Hapgood	142,626
Sash balance, L. S. Wright	142,604
Sash fastener, L. L. Bates	142,667
Saw filing and setting machine, N. G. Ross	142,585
Saw table, circular, H. C. Rosin	142,733
Saws, gage for gang, N. C. Moody	142,643
Sawing machine, E. Inman	142,699
Sawing machine, spoke, J. L. Thralls	142,749
Screw blanks, machine for threading, E. Croft	142,560
Separator, grain, J. W. Breese	142,672
Sewer basin for street corners, J. R. Boschen	142,671
Sewing machine caster, E. R. Clark	142,615
Sewing machine hemmer, J. D. V. Eldredge	142,689
Sewing machine table lock, J. B. Logan	142,780
Sewing machine treadle, M. H. Knapp	142,704
Sewing machines, motor for, R. H. Atwell	142,551
Shoes, manufacture of, C. W. Green	142,691, 142,692
Shook hooder, J. I. Berry	142,552
Shutter, fireproof, A. Gottlieb	142,563
Shuttle box mechanism, J. Schrack	142,736
Skirts, etc., ornamenting felt, J. W. Blackham	142,554
Sled brake, P. Gable	142,628
Spray jet, adjustable, A. Nickerson	142,719
Square, try, W. H. Cooper	142,557
Stamp, fountain hand, F. J. Coutant	142,617
Staples, machine for making, W. Malick	142,574
Stove, heating, Little & Nation	142,707
Stove pipe for vessels, J. Hall	142,567
Stove, reservoir cooking, D. H. Natton	142,717
Stove oven attachment, Craine *et al*	142,558
Straw cutter, R. A. Rash	142,726
Table, extension, J. M. Sackman	142,586
Table, ironing, A. J. Palmberg	142,645
Tallow, etc., cooling, A. Smith	142,744
Thrashing power, traveling, R. W. Faris	142,621
Tile machine, C. J. Merrill	142,576
Tobacco ridger, J. R. Whittemore	142,733
Tool handle, W. B. Hill	142,576
Trap, stench, J. Semple	142,739
Trunks, etc., strap fastening for, W. Grinsted	142,565
Type, arranging, D. B. Ray	142,652
Tyre setter, J. Palica (r)	5,565
Tyre tightener, M. E. Jacobs	142,633
Valve, main stop, C. W. Isbell	142,700
Valve, steam, H. F. Jones	142,702
Vegetable cutter, G. W. Parker	142,580
Veneers, cutting, J. A. Squires	142,591
Ventilating building, L. B. Valk	142,598
Vessels, center board for, J. Call	142,677
Vessels, relieving grounded, W. R. Highton	142,737
Wagon brake, W. F. Osborn	142,579
Wagons, end gate for, F. Grundy	142,566
Washing machine, S. Budlong	142,676
Washing machine, C. W. Sherer	142,742
Watch case latch, J. C. Dueber	142,684
Water cooler and filter, combined, W. J. English	142,620
Water filter, J. Pearson	142,722
Water meter, T. T. Prosser	142,650
Water strainer, F. W. Mase	142,711
Water wheel, turbine, A. A. Herriman	142,628
Wind mill, O. B. Knapp	142,636
Window screen, J. F. Scherpe	142,735
Wood rails, machine for dressing, H. G. Angle	142,608
Wool drying frame, E. Duffee	142,561
Wrecking apparatus, McGroder & Tiedemann	142,712
Wrench, W. J. Innis	142,570

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,454.—RAILWAY SWITCH.—W. Wharton, Jr. Nov. 26.
26,481.—PLATFORM SCALE.—T. Fairbanks. December 2.
26,486.—PIPE MOLDING.—J. Ferth *et al*. December 3.
26,513.—NAIL PLATE FEEDER.—J. Newell. December 3.

EXTENSIONS GRANTED.

15,961.—NUT MAKING MACHINE.—W. E. Ward.
25,434.—COTTON SCRAPER.—J. H. Mitchell.
25,895.—BOOT HEEL.—S. Dodge, *Jr., et al*.
25,442.—PORTABLE FURNACE, ETC.—D. R. Prindle.
25,473.—SCALE.—A. Turnbull.

DISCLAIMER.

24,442.—PORTABLE FURNACE, ETC.—D. R. Prindle.

DESIGNS PATENTED.

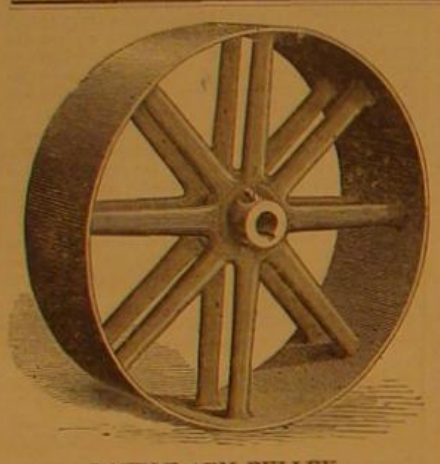
6,874.—SAD IRON HANDLE.—J. Hargrave, Cincinnati, Ohio.
6,875.—CHAIRS.—G. M. Harwood, Troy, N. Y., *et al*.
6,876.—LAMP STAND.—W. H. Perkins, Meriden, Conn.
6,877.—FIRE PLACE STOVE.—S. B. Sexton, Baltimore, Md.
6,878, 6,879.—INKSTANDS.—B. Brower, New York city.
6,880.—RUCHE HOLDER.—D. Kisch, New York city.
6,881.—MONUMENT.—M. Van B. Mitchell, Zanesville, Ohio.

TRADE MARKS REGISTERED.

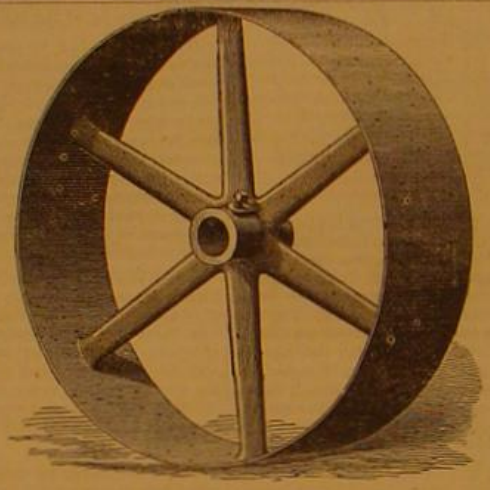
1,442.—LICORICE PASTE.—D. V. Arguimbau, Brooklyn, N. Y.
1,443.—WHISKY.—Derby & Day, St. Louis, Mo.
1,444.—WATCH CASE.—J. C. Dueber, Cincinnati, Ohio.
1,445.—HAT.—J. S. Fayerweather & Co., Danbury, Conn.
1,446.—MEDICINE.—Fenton Manuf. Co., Cleveland, Ohio.
1,447.—SEEDS.—D. M. Ferry & Co., Detroit, Mich.
1,448.—WHISKY.—W. M. Filess & Co., New York city.
1,449.—HOSIERY.—Smyth & Co., Ballybriggan, Ireland.
1,450.—GOLD RINGS.—Dueber Watch Case Co., Cinn., O.

SCHEDULE OF PATENT FEES:

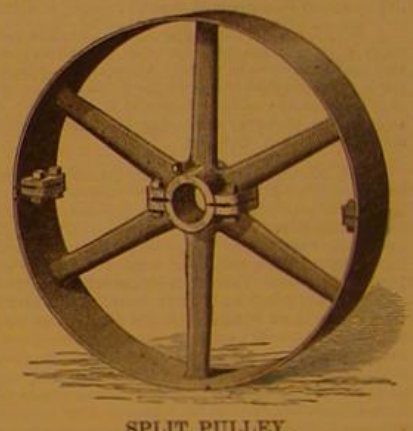
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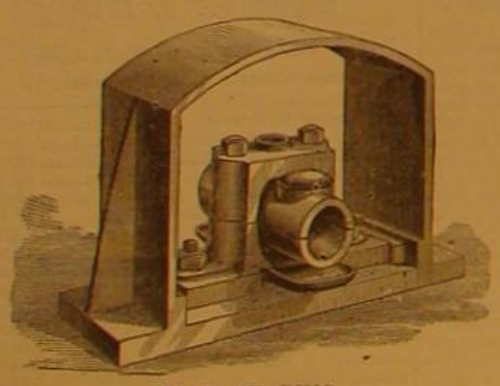
DOUBLE ARM PULLEY.



PLAIN PULLEY.



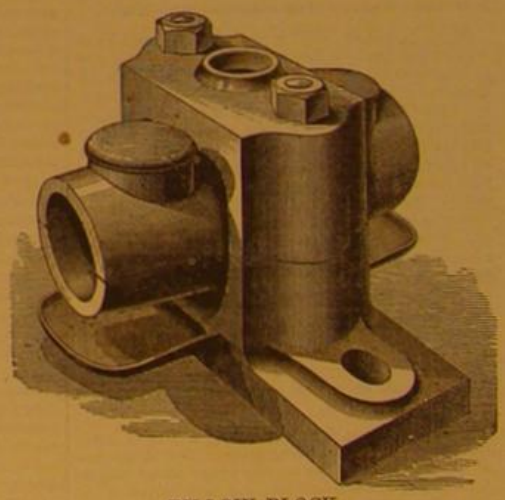
SPLIT PULLEY.



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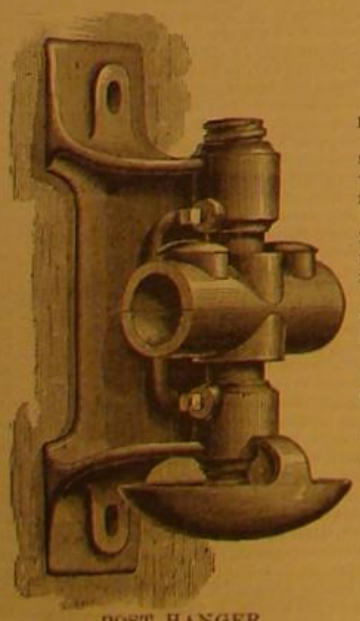
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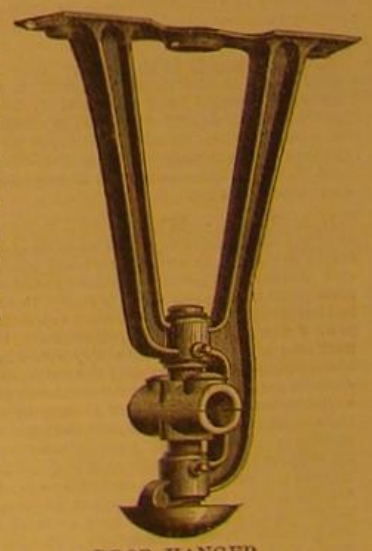
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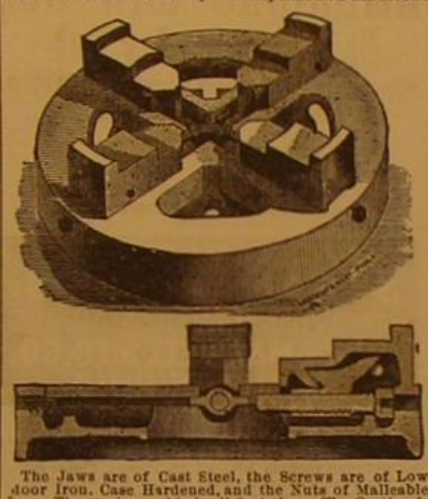
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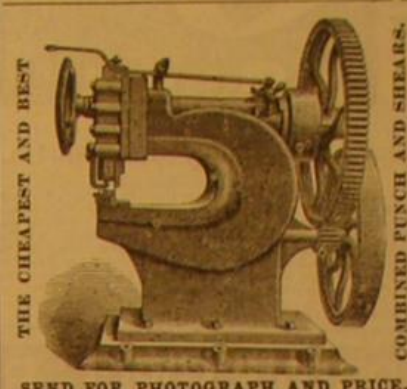
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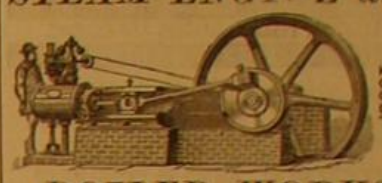
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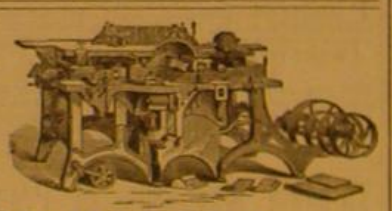
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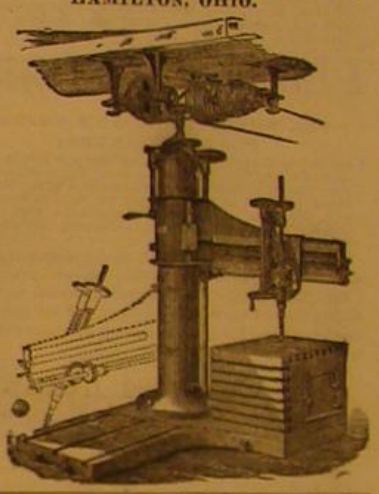
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HILL SIDE RAILWAY.

We illustrate in the accompanying engravings a novel form of lowering railway, applicable, as will readily be perceived, to almost any case in which it is required to transport loads down high and precipitous declivities. It consists, briefly, in two self-balancing carriages, provided with reservoirs for the reception of fluid or granulated material (as shot), running upon suitable tracks. Other stationary receptacles are arranged upon the latter so as to supply the carriage reservoirs at suitable times with a quantity of the water or other movable weight, the particular object of which will be explained as we proceed. In Fig. 1, a general perspective view of the entire apparatus is given; in describing the details reference is made to Figs. 2 and 3, which are respectively a representation of the bottom of one of the carriages and a plan view of the tracks and fixed receptacles.



DU BOIS' HILL SIDE OR LOWERING RAILWAY.

The cars, A A, are connected together by means of a long rope, B, which passes up and around the grooved wheel, C. The latter corresponds in diameter to the distance between the centers of the tracks, and revolves in a plane parallel to their surface, transversely and longitudinally; in brief, the rope leaves the periphery of the wheel in the same line whatever may be the position of the cars along the length of the rails. The cars, as we have above stated, are self-balancing, that is, the weight of one exactly counterbalances that of the other, and in order to move them it is only necessary that a sufficient force should be exerted to overcome their inertia and the friction of the mechanism. Beneath the platform of each vehicle is arranged a tank, D, Fig. 3, which is provided with an opening and spring valve, at E, and a receiving spout at F. On its lower portion, and between the rails, is a reservoir, G, connecting with a wide receiver, H, by means of a tube, I. The receiver, H, is placed, as shown, near the upper end of the track, and its sides extend out under the rails. The reservoir, G, has in its bottom two spouts and sliding covers or valves, which are actuated by the handles extending above at J.

Fig. 2

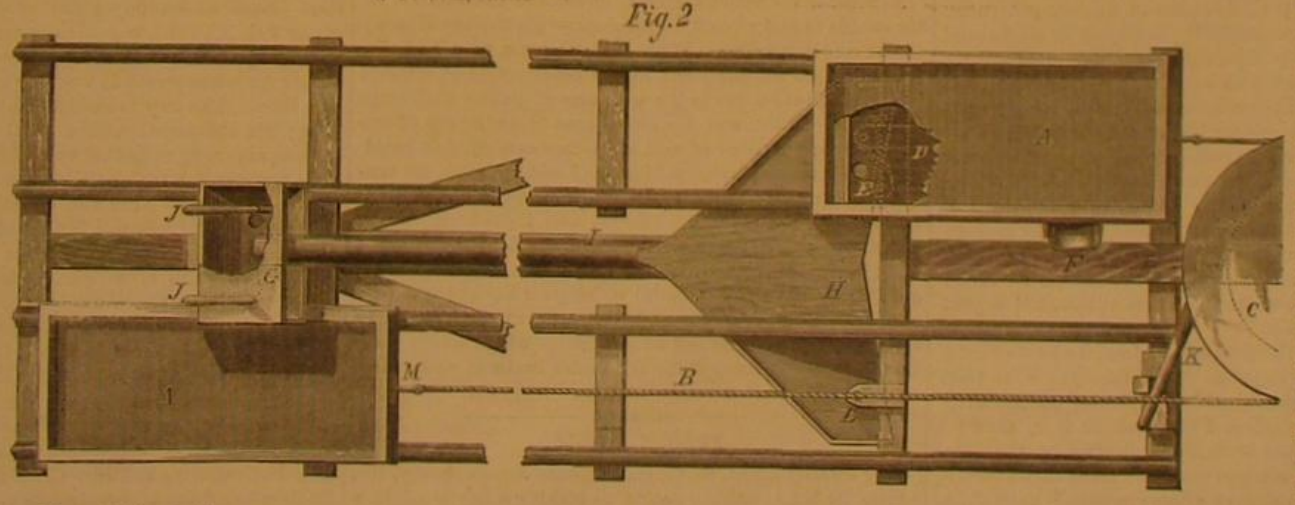
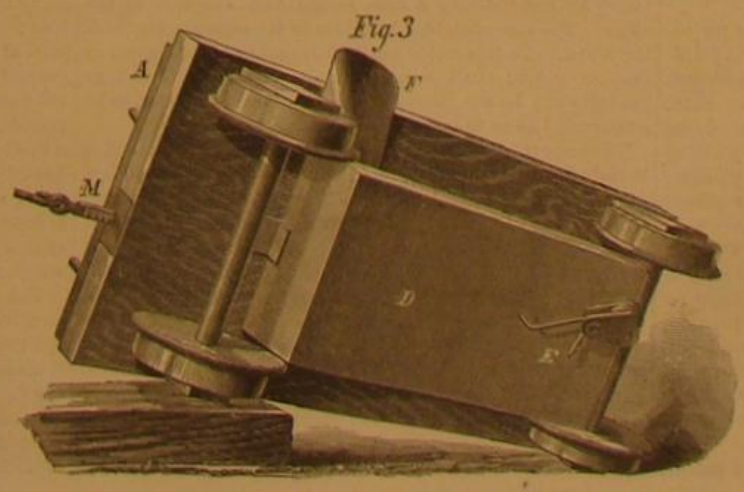


Fig. 3



To understand the operation of the apparatus, let it be supposed that coal, for example, is to be transported from the top of the mountain. The car at the upper end of the track is loaded and started down, its descent being regulated by the brake, K, on the wheel, C. Of course, by the rope, B, the second car is thus drawn upwards. As soon as car No. 1 is at the bottom, car No. 2 reaches the top. Car No. 1 is now unloaded. It is evident, however, that as the coal is removed the weight of car No. 2, which is being filled above, will gradually counterbalance that of car No. 1, and hence begin its downward motion, probably before either filling or emptying is completed. To avoid this, the reservoir, G, is previously filled with water or shot, and one of its bottom spouts, by handle, J, being opened, its contents are allowed to enter the tank beneath the car by the spout, F. This additional weight partially compensates for that of the coal removed, so that the upper car does not overbalance the lower and now empty car until the full load is in a place when there is a slight though sufficient difference in weight in favor of the loaded car, to cause it to start down the decline. Just before the empty carriage, which is of course thus drawn up, reaches the top of the track, an arm on its valve, E, strikes a projection, L, between the rails and underneath the car. The spout which valve, E, when shut, closes is thus thrown open, and consequently the contents of the tank empty into the receiver, H. From the latter the shot or water instantly descend the tube, I, refill the reservoir, G, to be again drawn out, as above described, into the car now at the bottom. The eyes for connecting the rope, B, to the cars, are attached to a rod M passing under the latter, and arranged in connection with a spiral or other spring. By this means the rod being suitably graduated, a balance is formed which indicates the weight of the load upon the car.

The principle involved in this novel invention is capable of a wide and general application, and from its use a material saving is effected in the cost of handling heavy articles which require to be lowered from one point to another. It may, by suitable modification, be arranged in buildings, the carriages ascending and descending vertically. If fluid be employed in preference to shot, alcohol or other spirits would be substituted in winter to prevent freezing, a proceeding involving very little expense as there is very little waste of the liquid used. In reference to special instances where it is considered that the device may be advantageously employed, the inventor enumerates the following: "In all elevated sand or gravel banks and brickyards; in stone quarries such as are along the Hudson river and Eastern coast; in ice houses, especially such as are situated on Rockland Lake, N. Y.; in cement quarries or mills, as those of the Newark Company, at Ron

dout, N. Y.; in coal mines, as exist upon the hills near Pittsburgh; in warehouses on high banks, as are found near Wheeling, Va., and Vicksburgh, Miss., and for moving lumber, as at St. Anthony." It requires but one person to attend to the lowering of the heaviest bodies. The apparatus may also be employed as an elevator, for the ascending platform can be weighted with such articles as it is desired to raise, instead of the usual counterbalancing weight, an advantage which applies to all cases in which the device may be used.

Patented March 18, 1873. For further information address the inventor, Mr. Charles Du Bois, Fishkill-on-the-Hudson, N. Y.

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Contents:

(Illustrated articles are marked with an asterisk.)

Amazons, up the—Letter from Professor Orton*..... 244
American Institute, Fair of the... 241
Animal trap, improved*..... 242
Answers to correspondents..... 250
Artificial butter in New York, manufacture of*..... 241, 246, 247
Bees as architects..... 245
Brussels—Letter from Professor Thurston..... 248
Business and personal..... 250
Car brake, improved*..... 242
Chloride of iron obtained by dialysis..... 242
Chlorophyll, preparation of pure. 247
Electro-dynamic experiment, note on a..... 245
Ether, on the manufacture of.... 245
Fecundation of flowers by insects* 243
Fossil man of Mentone, the*..... 243
Hewes, Joseph L..... 241
Hill side or lowering railway*.... 249
Inventing, the art of..... 241
Inventions patented in England by Americans..... 249
Iron, enameled..... 245
Landseer, sir Edwin..... 241
Light, new plan for obtaining a powerful..... 247
Locomotive, the fireless..... 246
Nitrous oxide, the solidification of..... 248
Notes and queries..... 250
Panic over, the..... 240
Patent planing machine litigation 240
Patents, official list of..... 253
Patents, recent American and foreign..... 249
Platinum and palladium on the hydrocarbons, action of..... 242
Puddle walls..... 240
Scientific and practical information..... 241
Silver from cyanide baths, recovery of..... 249
Sounding instrument, deep sea*.. 245

PATENT PLANING MACHINE LITIGATION.

Among the most memorable litigations that ever took place in this country in connection with patents, were those pertaining to the Woodworth Planing Machine, originally patented by William Woodworth, December 27, 1828, for the term of fourteen years, and twice extended by Congress, for fourteen additional years. The monopoly became so burdensome and oppressive that the legislatures of various States passed resolutions imploring Congress to grant no further extensions, and it finally expired in 1856, after an existence of twenty-eight years.

Woodworth's device was an improvement on Hill's machine, which was defective in that it did not reduce the boards to a uniform thickness. Woodworth arranged the cutting cylinder above the bed; and in connection therewith used yielding pressure rollers to hold the boards in proper position. He thus obtained a new and important result, to wit, the production of planed lumber of uniform thickness. This gave him the almost exclusive monopoly of mechanical planing, from which he or his assignees realized great wealth. Many attempts were made to break down his patents, but they usually failed. A great variety of devices were brought forward, designed to evade the claim of Woodworth to the yielding pressure roller. In some of these the pressure was applied upon the edges of the board by weights; in others by springs upon the face of the board; in others by iron bars resting upon the boards and pressed down by springs. But the courts held that all these devices were infringements, producing substantially the same results as Woodworth's rollers and were therefore not substantial departures from his contrivance.

When the Woodworth monopoly expired, the lumber interests received a great impetus. Manufacturers were freed from the great tax, and the number of planing machines rapidly increased. The dealers little thought that, after the lapse of seventeen years from the expiration of the great original monopoly, an attempt would be made under color of law to saddle another and even greater monopoly upon them. But we are sorry to say that this was the fact.

In 1848 Joseph P. Woodbury applied for a patent for an improvement in planing machines, in which he used a yielding pressure bar instead of Woodworth's yielding pressure roller. Lock Woodworth's roller so that it will not turn, and we have, substantially, Woodbury's pressure bar. Long prior to 1848, the courts had decided that the use of yielding pressure bars were infringements on Woodworth's yielding pressure rollers; and therefore, while Woodbury's patent might have been new and patentable, he could not have used his device, had the patent then been allowed. But the Patent Office decided that there was not sufficient novelty in Woodbury's device to support a patent, and accordingly rejected his claim. The applicant then withdrew his petition, and received back his money. As he could not obtain a patent, everybody who made planing machines had a free right to use his device, and they did so. Woodbury's invention is now to be found employed on almost every planing and molding machine in the land.

In 1870, Woodbury renewed his application for a patent, but was again rejected. The Patent Office decided that its former decisions were correct. In January, 1873, the applicant again renewed his petition, and again the Patent Office decided to sustain its previous decisions and rejected the case. On the 29th of April, 1873, the Patent Office again revived the matter, and decided that all its previous decisions were good for nothing, unreliable, and consisted of a tissue of blunders. So the patent was allowed, and the Woodbury party now flaunt the document in the faces of the lumber planers and molders, demanding payment of a heavy royalty under threat of instant stoppage of their mills.

The lumber merchants and manufacturers throughout the country, are naturally alarmed and indignant to find themselves overwhelmed, as it were, by this decision of a floundering Patent Office, by which a merciless grab is now attempted upon their earnings, and they have combined for a common defense by legal means. They believe the patent to have been wrongfully granted, and will fight it in the courts to the bitter end. The union comprises all of the most enterprising lumber manufacturers in the country, and they are preparing for their defense in the most systematic style. The most prominent legal talent has been employed. The stakes on both sides are immense.

The dealers have agreed, in case Woodbury's claims are sustained by the courts, that they will remove his device from their machines and substitute another, unless he modifies his demand, which is one cent royalty on every hundred feet of lumber or molding of any sort, and which, if paid by all dealers will, it is estimated, amount to the sum of one million dollars per annum. Whether Woodbury's claims will be sustained in the courts is of course uncertain. Some new judicial view of such cases may be announced, or evidence adduced that will nullify the patent. But otherwise, we should expect that the patent would be sustained, because in other cases, heretofore published by us, the courts have, under similar circumstances, invariably sustained the patentee. It may be justly alleged in his behalf that, if he were really the original and first discoverer of this device, the Patent Office committed a serious error in depriving him, for so many weary years, of the rightful fruits of his invention. That the device is one of great public importance, and therefore worthy of a patent, is proven by the remarkable fact that it is used on about every planing machine in the world.

While this is true, it is nevertheless equally certain that the tax which the patentee requires, and which he may at any time increase, will be for many years to come a grievous burden upon the public.

THE PANIC OVER.

The temporary nature of the financial crisis is proved by the fact that, during the short period intervening since our last issue, the excitement has nearly all subsided, and a better feeling of confidence is rapidly becoming restored in monetary circles. Although, as we have already observed, it seems hardly possible for the usual fall business transactions not to feel in some degree the after effects of so close a stringency of the money market, still we do not consider that any serious or extended injury to trade resulting therefrom need be at all apprehended. An example of its merely passing interference is well illustrated in the case of one of the oldest and largest dry goods firms in this city, which, although suspending one day, were enabled to resume payments on the next.

As regards the manufacturing interests of the country, we are unable to find ground for the sinister predictions of many of our contemporaries. With the exception of a probable check to rapid advancement in the construction of some of the new railroads, due to the weakness of public confidence in their securities, and the consequent throwing out of employment of a number of men heretofore employed in building or in manufacturing rolling stock and supplies, we cannot perceive any diminution in the prosecution of our great industries. Factories, foundries, and indeed all similar establishments, so far as we can learn, are flourishing, and a brisk business seems to be the general rule. Moderation, good management, and hopeful waiting for the storm to pass over have been the means of averting or, at most, confining to a few the evil results of a disaster which might have made itself felt throughout the entire business community of the country.

PUDDLE WALLS.

Our correspondent, S. W. G., of Elsah, Jersey county, Ill., writes for information relative to making a fish pond in a valley by constructing a dam across from one side to the other. The essential idea in a dam is its capacity for holding water. To this end it must be of sufficient substance, so that its weight shall secure it from being overturned or pushed away by the pressure of the water. It must also be constructed so as to be watertight.

To secure this last requirement the most effective method is to include within the dam a puddle wall. The correct method of puddling, so simple in itself, is not always practiced. The popular ideas in regard to this important part of the work are erroneous. By many persons it is supposed that the best material for the purpose is clay. This is an error. Pure clay is, in some respects, the worst. Again, it is supposed that the work must be compacted by a rammer. Ramming is not effective in compacting it. There are still other erroneous notions entertained on the subject, but we will perhaps best expose the objectionable methods by simply stating the correct one. If the puddle is to extend across a valley, commence by removing from the surface, where the wall is to stand, all rubbish, brush, grass, roots and other perishable material, as well as all surface soil down to the solid natural gravel or ground. In doing this, excavate a trench equal in width to the thickness of the wall. Make the bottom of the trench level across the bottom of the valley, and extend it into and up each side hill in level benches or steps, so that at all points the wall shall have under it a level surface to stand upon.

Next, the material. This should be a gravelly loam, taken from a bank where alternate layers of gravel and loam, or clay, are found. Screen from it by a rake all stones larger than an egg. Spread it to an even depth of four inches in the lowest trench. Sprinkle water over the whole surface by a hose or buckets until the material is soaking wet, when another layer of dry material four inches deep is to be spread over the first one. A convenient method of regulating the depth is by setting up at frequent intervals stakes projecting eight inches above the bottom of the trench with notches cut four inches from the top. In placing the first layer, the workman is guided by the notches. The second layer is to be carefully graded to the top of the stakes. Now place a plank, equal in length to the width of the trench, across it near one end. Standing at one end of this plank with a shovel, hold it upright, the back from you. In this position push the shovel to the bottom of the trench by aid of the foot on top of the blade, and then push the handle horizontally from you with force. Withdrawing the shovel, move along the plank the width of the shovel; and placing its point in a line with the position it before held, again press it to the bottom of the trench and horizontally from you. Continue this operation until you have moved along the entire length of the plank. In doing this, you have formed a wedge-shaped opening across the trench. In returning along the plank, slice off, in the same manner, about an inch in thickness from the edge of the opening nearest you, pushing it compactly upon the material previously packed. Continue this process, cutting slice after slice, until the edge of the plank is reached. Turning the plank over gives room for more work. Follow this operation until the whole of the material is cut and compacted. In making these cuttings, the water which was put upon the lower layer of four inches is squeezed up through the whole of the upper layer, and the whole thickness of material is rendered of the consistency of putty. The next morning the puddle will be found sufficiently hard to walk upon freely. Then repeat the entire process of spreading the two separate layers of four inches each, watering the first layer and cutting and compacting as before. By this method, double layer upon double layer is to be laid until the top of the wall is reached Some parts of the operation may appear unimportant and thus be neglected, but many who have so thought and acted have found to their sorrow, after the completion of the work, the necessity of adhering strictly to what experience has shown, in some of our largest engineering works, to be the true method of making puddle walls.

The thickness of a wall should be in proportion to its hight and length. For small ponds, a wall four feet broad at top and gradually widened downwards at a rate of one and one half inches per foot of hight on each side, or three inches on both sides, will be of ample strength. The puddle wall must be covered from the air on all sides by the filling and stone work used to form the dam.

THE FIRELESS LOCOMOTIVE.

The locomotive engine, run by steam generated from hot water forced into it from a stationary boiler previous to the start (described on pages 290 of our Vol. XXV. and 118 of our Vol. XXVII.), is gradually fulfilling the anticipations of its projectors, and promises to lead us to a practical substitute for horse power in working city railroads and suburban lines. The improvements, however, leave much to be done; but the imperfections of the present machine are such as are easily remedied by a skillful constructor.

On October 3, a trial of a fireless locomotive took place between East New York and Canarsie. The dimensions of the engine are as follows: Boiler, 10 feet long by 46 inches diameter; two cylinders, 8 inches diameter by 12 inches stroke; two pairs of wheels, 30 inches diameter, coupled; ordinary slide valves, working without expansion, the engine being provided with double eccentrics and links for reversing. The exhaust is blown into two condensers, one for each engine, fitted with 36 five eighth inch tubes for promoting condensation, and air pumps for creating partial vacuum. For the engine, such as it was, apologies were made by Mr. G. L. Laughland, the President of the Fireless Engine Company, and Mr. C. H. Haswell, the Consulting Engineer, and due allowance was made by the visitors for its many obvious imperfections. Its performances were as follows: It left East New York at 2.52 P.M., with the steam gage at 180 pounds, and ran the 3½ miles to Canarsie (down grades) in 12m. 45s. At the end of the trip, the gage showed 108 pounds. During a 9 minutes stoppage, it fell to 104 pounds, and the run back (up grades), in 17 minutes, reduced it to 45 pounds. No fire was used on the locomotive, the entire trip having been made by the steam rising from the hot water with which the locomotive was charged at the start. It drew one car with 120 passengers. The net weight of the engine was 4 tuns 3 cwt.; the car itself was estimated to weigh 7½ tuns empty, and with its load 12½ tuns.

The experiment was a successful demonstration of the possibility of running a locomotive by the proposed means; but the poor construction of this particular machine renders it necessary to defer any calculations as to the economy of the device We understand from Mr. Schieffler, of the Grant Locomotive Works, Paterson, N. J., that an engine to be worked on this plan is to be designed and constructed at that establishment.

THE ART OF INVENTING.

Many persons suppose that the capability of inventing is wholly a natural gift, but such is not the case. It is just as much an acquired art as any other profession. In order to insure success as an inventor, it is necessary for the student to go through a school of inventive studies and to confine his productions to a particular class. If a mechanical inventor he must understand mechanical movements and powers, as well as metals and timber and how to work them. He must study the relation between causes and results, he must acquire a knowledge of drafting, and must learn what has been accomplished in his particular line.

It is true that some wonderful inventions have been made by persons entirely unacquainted with the particular branch in which they were working, but such instances are rare. The more extended the knowledge which the artisan possesses, the more likely is he to make a valuable improvement. But constant and unceasing study is entirely unnecessary; in fact it tires out the mind, which, like the fatigued body, must have rest before it can successfully pursue its laborious journey. If, therefore, the mind becomes weary and confused, it is better to drop the subject for a time and take it up again.

Nearly twenty years ago, in the city of Boston, a friend of ours, still living, invited us to accompany him to see a model of an invention. We went with him, and a very enthusiastic young man showed us a beautifully made model, mostly of finished brass, of a ship with a revolving mast geared into the paddle wheels in order to propel his ship against the wind. He said that he took the idea from a feed mill, run by wind, near Charlestown bridge. "But," said our friend, "that feed mill is on *terra firma;* but where will your ship be going when afloat? With the wind blowing against the revolving sails, you will have to cast anchor in order to keep it from blowing backwards." He had never studied cause and effect; and he told us that he had spent six months and nearly $2,000 in trying to accomplish an impossibility. Years of precious time and thousands of dollars are annually lost in a similar manner. Many hundreds of men have labored at models and expected to make fortunes by running an overshot or breast wheel in a dead pond by causing it to pump up its own water, and by similar impossibilities.

The educated inventor will never run into such wild cat schemes. But as he becomes more and more acquainted with the arts and sciences, he will find that every step forward must be directed to a practical result; and at last, when his life's work is done, he will see that all he has gathered will be only a drop from the ocean of Science, which lies still spread before mankind for other minds than his to continue to explore.

MANUFACTURE OF ARTIFICIAL BUTTER IN NEW YORK.

We have had occasion in former numbers of our paper to describe the new processes of making butter from substances other than milk. It is to France that we are indebted for the practical inauguration of this new industry, which has now been transplanted to this country and is in full operation in this city. We devote a considerable space in the present number to the illustration of the devices and method of working, as practiced here, in which our readers, we have no doubt, will be much interested. Similar factories will be established in other cities and the manufacture promises to become extensive.

SCIENTIFIC AND PRACTICAL INFORMATION.

CARBOLIC ACID.

Carbolic acid is now so generally employed as a disinfecting agent that a *resumé* of the various forms in which it is made, in the largest establishment carrying on its manufacture in England (Calvert's), may prove of interest. 1. Solid carbolic acid of three different qualities, the point of solidification of which varies from 81° to 108° Fah. 2. Liquid acid of two different qualities, constituted almost entirely of cresylic acid. According to Mr. Calvert, the disinfecting properties of the latter substance are the same as those of carbolic acid. 3. Soaps in which the proportion of carbolic acid varies from 5 to 20 per cent, according to the uses to which they are to be applied. 4. Disinfecting powder, composed of silex and 15 per cent cresylic acid. The silex is obtained from alum factories, where kaolin is treated with sulphuric acid. The disinfecting acids become thoroughly incorporated with it, forming a dry and pulverulent substance.

THE PASSAGE OF GASES THROUGH VEGETABLE COLLOIDAL MEMBRANE.

The experiments of M. Barthélemy lead to the conclusion that the natural colloidal surfaces of vegetables have, for carbonic acid, an admissive power which is from thirteen to fifteen times more considerable than that for nitrogen, and from six to seven times greater than that for oxygen. These experiments, proving the dialysis of carbonic acid through the cuticle of leaves, are of the same nature as the investigations of Dutrochet on membranes and aqueous solutions to determine the endosmose by the cellules. In a word, cuticular respiration appears sufficiently proved by the presence of this membrane on all the organs.

THE FAIR OF THE AMERICAN INSTITUTE.

There have been some alterations in the awards to be given by the American Institute during the present exhibition which, it seems, will enable the judges to discriminate more closely as to the relative merits of articles entered for competition. Last year, the grand medal, a distinction requiring originality and an extraordinary degree of excellence and utility in the invention for which it might be given, and the medal of special award, for the best of a class, general excellence, etc., constituted the list; now, however, another medal has been added, so that the three, respectively of gold, silver, and bronze, with of course the inferior honor of a favorable report, will render the task of thus signifying the value of a device one of much greater simplicity. It is frequently the case that committees feel that an article deserves distinction and yet not so high an honor as another device of far greater utility, while neither may merit the highest award; and similarly, when there are several inventions all of one class and yet each possessing important peculiarities, it is equally difficult, with but a single award to bestow, to determine to which exhibitor it justly belongs. In such instances, the matter is usually compromised by recommending the granting of the same distinction to a number, with the obvious result of causing general dissatisfaction on the part of those who consider their devices merit some special honor, and engendering the ill feeling and dissensions caused by each individual claiming to have received the highest award. Another medal, though it may not entirely obviate this trouble, will perhaps render it an easier matter to stamp at once the best of a class, and yet grant to others of the same category a fair distinction, thus at least raising the standard and enhancing the value of the premiums.

Since our last visit, we note many additions to the display, but, with that tardiness which now seems to be the rule, many intending exhibitors have not yet appeared or, having entered, have not got their articles in proper shape. The fair has now been open nearly a month, and it seems to us high time that its contents should be finally arranged.

The collection of

MACHINISTS' TOOLS

presents some specimens of excellent workmanship and several novel improvements worthy of mention. Among others, we notice a planer from Messrs. Hewes & Phillips, which has a worm wheel outside of the table connecting with the latter by a rack and pinion. A lathe by the same firm has a novel arrangement of back gearing which renders its construction of much more compact form. Van Haagen & Co., exhibit a friction planer which operates excellently and without any perceptible noise. Underneath the table and in the direction of its length is arranged a rack with teeth running longitudinally; into this mesh the projections on a friction wheel of the usual form, somewhat similar to the variety employed on ordinary friction hoisters. Connecting with the pinion is a shaft communicating with bevel friction gearing and a clutch outside, by means of which the motion of the table is changed. It might be supposed at first sight that the gearing under the table would slip under a heavy strain, but it seems that such is by no means the case. A rotary shaper, displayed by the above firm merits mention as a new machine capable of a large number of uses particularly in boring, planing, and keyway cutting, etc. An attachment to this, and in fact to any machine having either revolving or stationary spindles, is a new expansion boring tool, which consists of a slotted hub in which is screwed a shank for attachment to the spindle, and in the cavity [in] which is pivoted the end of an arm. The inner extremity of the latter is a worm wheel, the worm acting in which passes through the hub and is turned from outside. When the worm rotates, the arm is set to any desired angle, and there are arrangements for firmly holding it in place. Its outer extremity carries the boring tool.

There are several

ROCK DRILLS

on exhibition, but the Ingersoll is, just at present, the only one in actual operation. This machine has a novel improvement for holding the drill bar, which forms an automatic connection. Three tapered gibs, half round so as to fit the bar, are arranged to fit over and enclose its upper end. The collar drops over the gibs, thus wedging them against the bar firmly, grasping and retaining the same and allowing work to immediately commence at the next down stroke.

STONE PULVERIZING

is an operation of some interest carried on by the Zetetic Pulverizer. This machine consists of a stout winged wheel revolving at high speed in a heavy vertical circular box. Stone in moderate sized lumps is fed in through a hopper, and by centrifugal force dashed around within the box, emerging into an enclosed room in a state of almost impalpable dust.

White, Clark & Co. exhibit a means of elevating water to any hight by a combination of their centrifugal pumps. Two small machines are used, one mounted horizontally on a vertical tube, and another similarly arranged at a distance above the former on a prolongation of the same pipe. The shaft passes straight down through the latter. The lower pump draws water through the lower part of the tube, and its discharge is led by a bent pipe to the upper portion, to be acted upon by the pump above. The two portions of the pipe are separated by a stuffing box, through which the shaft passes. Burden's

VACUUM PUMP

is exhibited in several different sizes, and from its odd form and appearance attracts considerable attention. Each machine consists of a number of iron vessels in the shape of bell glasses, a description of one of which will answer for all. The mouth of the receptacle, which is placed in a trough, is closed by a grating, above which is a large valve lifting inwards. Steam enters from above, on the valve being lifted, and filling the vessel condenses, thus drawing in first a small stream of water from a valve about midway up the side, which promotes further condensation. The vacuum formed finally lifts the large lower valve, and the vessel fills completely. Then two other escape valves, opening outward near the bottom, open, and the water is accelerated in the discharge by the steam entering as before.

Ryder's grate bar is an invention of novelty, and consists in every alternate bar of the grate being made corrugated on top, and movable, in a longitudinal direction, by means of mechanism connecting with a handle outside. It is claimed that the fires can be thus kept clean with great facility and little trouble. The device, we understand, is to be practically tested under one of the boilers.

A novel feeding mechanism for sewing machines is exhibited in the main hall, by means of which almost any kind of ornamental stitching used for belts, harness, shoes, etc., can be admirably made. As displayed, it is simply a cam attached to the shaft of the feed wheel, so that the latter is carried sidewise at various times so as to produce a certain pattern by moving the cloth under the needle. A different cam is required for each variety of stitch. Near this machine is an

APPARATUS FOR SEWING ON BUTTONS,

which, if it could only be arranged for every purpose, would be an inestimable boon to the unmarried male population of the country. The present device is adapted for shoe buttons—small round affairs with projecting eyes—and uses the ordinary button just as it is supplied to the trade. The thread leads under the work, and the needle comes down through the eyes of the buttons, which slide down one at a time from a small inclined trough. A barb at the end of the needle catches the thread, carries it up through the leather, and makes any number of chain stitches, changing from eye to outside. As soon as the button is firmly fastened, a loop of the thread, which projects through on the upper side of the leather, is slipped over it. The next button can be secured at any distance from the first, the thread leading along the under side of the material.

R. M. Hoe & Co. exhibit a remarkably fine assortment of saws, besides knives for cutting rubber and cork. The Meriden Britannia Company also deserve a word of praise for an exceptionally good display of silver ware in novel and beautiful designs.

Sir Edwin Landseer.

Sir Edwin Landseer, the celebrated English painter, is dead. It is hardly necessary for us to particularize the works which have rendered his name famous, as no modern paintings are more generally familiar. As a delineator of animal life, Landseer had no superior; and although critics complain that he marred the effect of his pictures by semi-humanizing his brutes, still it may with truth be asserted that such an appeal to a popular taste served in the main to highten the admiration of the world for his efforts, even while a more austere judgment condemned and lamented it as mere vagary of humor.

Springing from a family of artists, Landseer began his labors at a very early age, and exhibited his pictures in public when he had reached but fourteen years. Of late, however, his powers became impaired, and for many years past nothing has left his easel worthy of the great reputation which he had achieved. As a sculptor, a branch of art in which he was induced to try his skill almost by popular acclamation, he produced but one important work, namely, the couchant lions on the Nelson monument, in Trafalgar Square, London, which, however, it is generally admitted, afford no particular evidence of his genius or ability.

His chief forte lay in the representation of horses, dogs and game, of all of which he was unaffectedly fond, and painted with a wonderful fidelity to nature. Most of his works have been engraved, and copies are sold in most of our picture stores. Landseer was born in 1802 and was knighted in recognition of his merits in 1850.

Joseph L. Hewes.

We notice, with much regret, the death of Mr. Joseph L. Hewes, a prominent manufacturer and inventor, resident in Newark, N. J. Left an orphan at fifteen, Mr. Hewes was taken under the guardianship of Seth Boyden, who, after giving him the benefit of an excellent education, entered him as an apprentice in his shops. From this period the subject of our sketch evinced great aptitude for invention, as well as no small mechanical skill, and, after several years of labor for others, in 1846 started in the business of manufacturing machinists' tools and engines in York. At the beginning of the war, Mr. Hewes rendered very valuable assistance in improving and remodeling arms, and it is stated that, through his timely aid, the first eight thousand of New Jersey volunteers were at once equipped for service. He had seven new inventions put in operation last year, and it is believed that the strain upon his energies in making some new machinery at the Industrial Exposition produced his fatal illness.

A JUST AWARD.—The self-acting lubricating devices of Messrs. Nathan & Dreyfus, of No. 108 Liberty street in this city, are, we notice, among the exhibits from the United States to which the highest prize, under the rules of competition, was awarded at the Vienna Exposition. This is a well merited recognition of valuable inventions which have excellently withstood the test of experience.

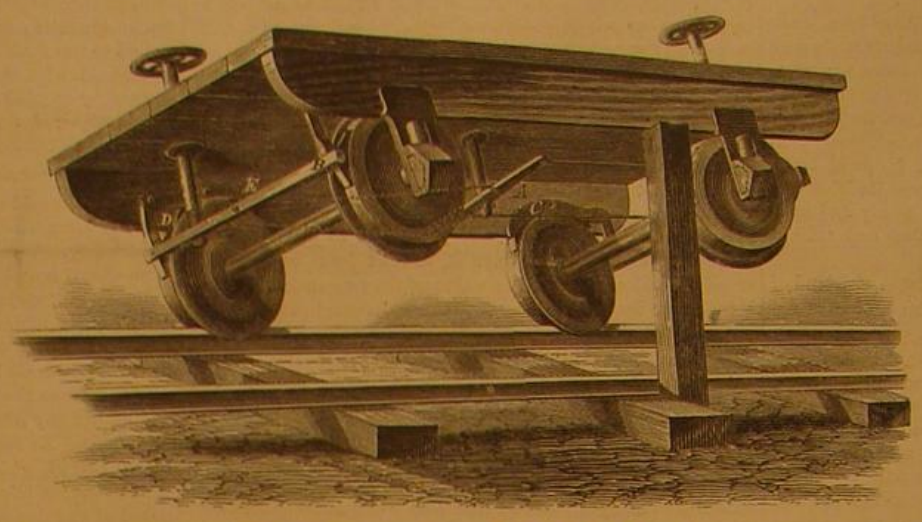
PROGRESS OF THE HOOSAC TUNNEL DURING SEPTEMBER, 1873.—Headings advanced westward, 184 feet; eastward, 132. Total during month, 316 feet. Whole length opened, westward, 14,577 feet; eastward, 9,902 feet. Aggregate opened to October 1, 24,479 feet. Length remaining to be opened, 552 feet. The whole length of the tunnel, is 25,031 feet.

IMPROVED CAR BRAKE.

The invention herewith illustrated consists of a brake so constructed and attached to a railway car as to exert a much greater pressure upon the wheel than is ordinarily obtained. This result is claimed to be effected by a system of levers and auxiliary brakes, causing the rotary motion of the wheel itself to contribute to the pressure upon its periphery.

The shafts of the brake wheels are connected by suitable means with a pivoted lever arranged under the car at A, and the latter, in turn, communicates with the brakes, B. These are arranged on an arm which is pivoted to a horizontal lever, C, which is also pivoted at its center to the framework of the platform, and carries two brakes, D and E. If the car wheels revolve from right to left, their peripheries, acting upon brakes, B, pressed closely against them, tend to draw such brakes downward, thereby tilting the lever, C, and causing one of the pieces thereon, in this case D, to bind firmly against the wheels. If, however, the latter turn in the opposite direction, the brakes, B, are somewhat lifted, depressing the lever, C, so as to cause the piece, E, to act as an auxiliary brake. It is claimed that, by this means, the power of the brake is doubled; and in cases where steam is employed, it will give the same power with one half the strain upon the braking apparatus.

For further particulars address the inventor, Mr. George W. Crowe, 125 West 5th street, Cincinnati, Ohio.



CROWE'S IMPROVED CAR BRAKE.

IMPROVED ANIMAL TRAP.

The invention illustrated herewith is a device for catching and destroying mice, rats, squirrels, and other small animals.

The trap is actuated by clockwork, and once wound up is self-setting. When sprung, a sharp toothed bar is rapidly rotated, striking the animal, killing it, and throwing it out of the box.

The case is made with an opening of a size proportionate to the hight of the animal to be trapped. The vertical shaft, A, is connected with a coiled spring and toothed wheel, part of the latter being shown at B. When the shaft is turned by the key, it coils up the spring without revolving wheel B: but when the spring is allowed to unwind, the said wheel is rapidly rotated. This motion by the cog teeth is transmitted to a similar wheel, C, the shaft of which extends above the case and terminates in a notched disk, D. Just beneath the wheel, C, and at E, is the toothed bar for destroying the animal.

F is a horizontal shaft, having at its forward end an upwardly projecting arm, G, which is caught and held perpendicular by the spring catch, H. At the middle of the same shaft is an arm, I, which passes down through a slot in the case, in such a position that a stop on the wheel, C, may take against it, and the motion of mechanism be thus arrested. At the inner end of shaft, F, is a cam or arm, J, which is so arranged in connection with a projection, K (dotted lines), on the wheel, that said projection strikes it, thus turning the shaft, F, thereby raising the arm, G, so as to be again caught by the spring, H, and also lowering the arm, I, so that the wheel may be arrested, as already explained.

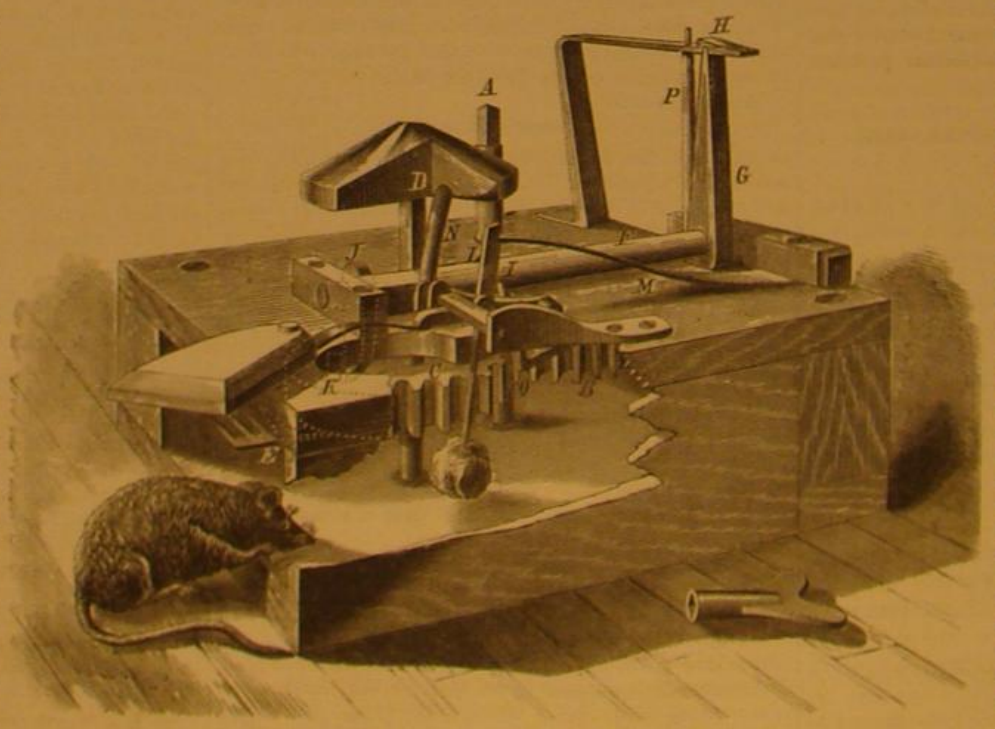
The shank of the bait hook, which is so placed that the animal cannot pass through the case without coming within the sweep of bar, E, passes up through a slot and connects with a flattened rock shaft which rests, as shown, upon the horizontal arm of the bent lever, L, the latter being pivoted at its angle to the top of the case. The vertical arm of the lever has a notch into which is caught the extremity of a spring, M, when the trap is set. Beneath the end of this spring is a bent lever, N, also pivoted at its angle, and having a vertical arm, to accommodate which the notch is made in the disk, D. There is still another bent lever, O, only a part of which is seen, as it extends under the top of the case. This has a projection directly under the end of the spring, M, and connects with the perpendicular rod, P, so that when pushed down by the spring, M, it raises the catch, H, clear of the arm, G, and allows the shaft, K, to turn.

The illustration represents the trap as set. When the bait hook is agitated it turns the rock shaft so that the edge bears down the horizontal part of the lever, L, clearing the spring, M, from the notch. The spring, of course, comes down with some force on the projecting upper end of the lever, O, thereby, as above described, releasing the arm, G, of the shaft, F. This releases the wheel, C, allowing it to be rotated by the wheel, B, acted upon by the coiled spring. By this means the toothed bar, M, is revolved with considerable force, killing the animal and tossing it clear of the box.

The disk, D, of course revolving with the wheel, C, the side of its notch strikes against the vertical arm of the lever, N, thereby raising the other arm, now directly under the spring, M, so as to elevate the end of the latter once more into the notch on the lever, L, and, at the same time, allows the lever, O, to be withdrawn from the catch, H, by a small spring. As the wheel, C, revolves the projection, K, strikes the cam, J, which throws the arm, G, into the catch, H, and lowers the arm, I, to catch and stop the wheel. At the same time the outer end of the lever, N, rises into the notch on disk, D, and its inner end drops away from the spring, M, so that the trap is thus reset.

The device is quite ingenious and very sudden in operation. We should imagine that it would speedily clear a cellar or other infested locality of troublesome vermin.

Patented through the Scientific American Patent Agency, November 12, 1872. For further particulars regarding sale of rights, etc., address the inventor, Mr. George Barr, Clatskanie, Columbia county, Oregon.



BARR'S ANIMAL TRAP.

Action of Platinum and Palladium on the Hydrocarbons.

The recent experiments of M. Coquillon on the above subject take as a point of departure the fact that a platinum wire, rolled in spiral form and heated to redness, remains incandescent in presence of vapors of alcohol or ether, and forms different products of which the principal are aldehyde and acetic acid. All mono-atomic alcohols, as well as their ethers, act in analogous manner, and produce, in this incomplete combustion, aldehyde and the acid corresponding to the alcohol; while all the hydrocarbons, volatile oils, aniline etc , participate in this property and maintain the incandescence of the platinum spiral. The fixed oils and sulphureted essences, such as the essence of garlic or mustard, are without this effect.

Palladium has this property of remaining incandescent in hydrocarbureted vapors in even a greater degree than platinum; and with toluol, it similarly produces hydride of benzoyl. When it is plunged in an incandescent state into proto-carbureted hydrogen, it continues in the same condition without requiring to be brought to redness by the battery. With bicarbureted hydrogen, while the platinum wire gives frequent explosions, palladium causes none. It extinguishes itself when the gaseous mixture is no longer suitable. Another curious peculiarity is that its surface becomes rough and wrinkled, and the spirals break, after a few days' experimenting. The weight is also sensibly diminished.

Chloride of Iron Obtained by Dialysis.

It is now many years since the late Professor Graham discovered that when a solution contained both crystalizable and uncrystalizable, or colloid, substances, the former would pass much more rapidly through an animal membrane that the latter. For performing this experiment, a hoop of hard rubber has a piece of parchment paper stretched over it, and the apparatus, which resembles a sieve, is allowed to float upon the surface of water. The mixed solution is poured into the apparatus, and in a few days the greater part of the crystalizable body will be found in the water, while the uncrystalizable one will remain on the membrane. Professor Graham gave to this process of separation the name of "dialysis," and to the apparatus that of "dialyzer," which names have been generally adopted in all languages.

Since the discovery of dialysis, it has found many uses. It has been used with great advantage in analytical chemistry, for separating crystaloid and colloid bodies, especially organic ones. Its greatest value has been in analyzing the contents of the stomach, when it is desired to show that poison has been taken. The presence of a poison in the slimy contents of the stomach would otherwise be difficult to prove. Recently it has, also, been employed in the arts, and Dr. Reimann describes in his *Färberzeitung* its use in the dye house for preparing iron salts: From mixed solutions of salts and gum, the salts can be separated while the gum remains behind. But not only so; when a salt alone is placed in the dialyzer, the crystalizable portion of the salt, which is usually the acid, passes through the membrane first, the base remaining on the dialyzer. Now there are a series of salts which require a proportionally large quantity of acid to keep them in solution. Notable among these are the sesquioxides, especially that of iron. The very acid salt of iron is extensively employed in dyeing silk as an iron mordant for heavy black. An iron mordant which is very acid and which generally contains an excess of nitric acid, as well as some nitrous acid, acts destructively upon the fiber, so that very heavily weighted black silk loses a greater part of its strength, and sometimes can be pulled apart. To avoid this disadvantage, the iron may be used in the form of dialyzed oxide of iron. In preparing such a solution, oxide of iron dissolved in muriatic acid (perchloride of iron) is placed in a dialyzer. After some time it will be found that the acid is mostly gone off, while a solution of the oxide of iron remains in the dialyser. Such a solution gives up its oxide of iron very readily to the immersed fiber, which is thoroughly mordanted, while it cannot be attacked, since there is no acid, at least no excess of it, present. Such a solution is far more active than the ordinary iron mordant, because the iron in it has a great tendency to deposit itself upon the fiber, while that in the acid mordant, being held by the acid, shows less of this tendency. It seems, too, from what has been learned, that the mordanting of fibers in a solution of salt is really a phenomenon of dialysis. The fibers may be regarded as a conglomerate of membranes, and hence it is natural that the silk, for instance, should take out the iron from a solution of its salt, and allow the acid to disseminate itself through the bath. This tendency of the fiber to take up the iron is assisted by previous dialysis of the solution.

For technical purposes, especially for weighting silk, it is necessary to take away all the acid from the oxide solution. Here it is sufficient to obtain a solution containing but little acid and an excess of oxide of iron.

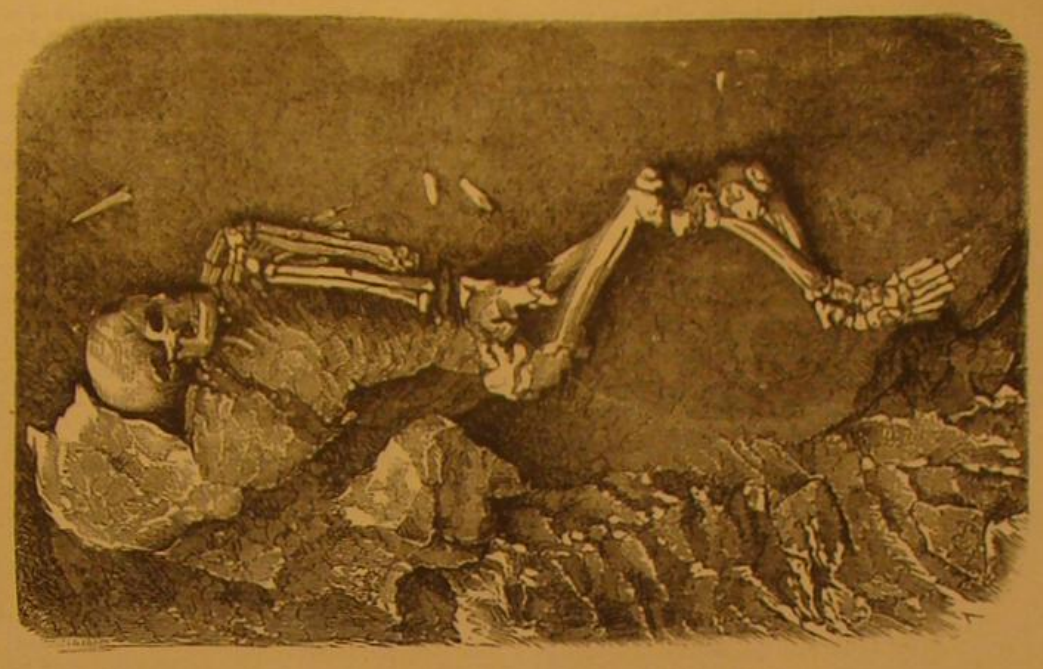
Fr. Oltmanns, an apothecary in Hanover, has for years prepared dialyzed oxide of iron for medical purposes, and recently has also made it for use in dyeing. The dialyzed oxide of iron made by him contains 6 to 7 per cent of pure sesquioxide of iron in solution; a quantity which, because of the ease with which it acts on the fiber, is more than sufficient for most purposes. For weighting silk, and for many similar purposes in the dye house, especially for all cases where it is desirable to load the fiber heavily with the oxide of iron in mordanting, without attacking it, dialysed iron is invaluable.

THE building of dikes at the mouth of the Seine has been the means of causing high water to appear at Havre 36 minutes sooner during the spring and 14 minutes during the neap tides.

THE FOSSIL MAN OF MENTONE.

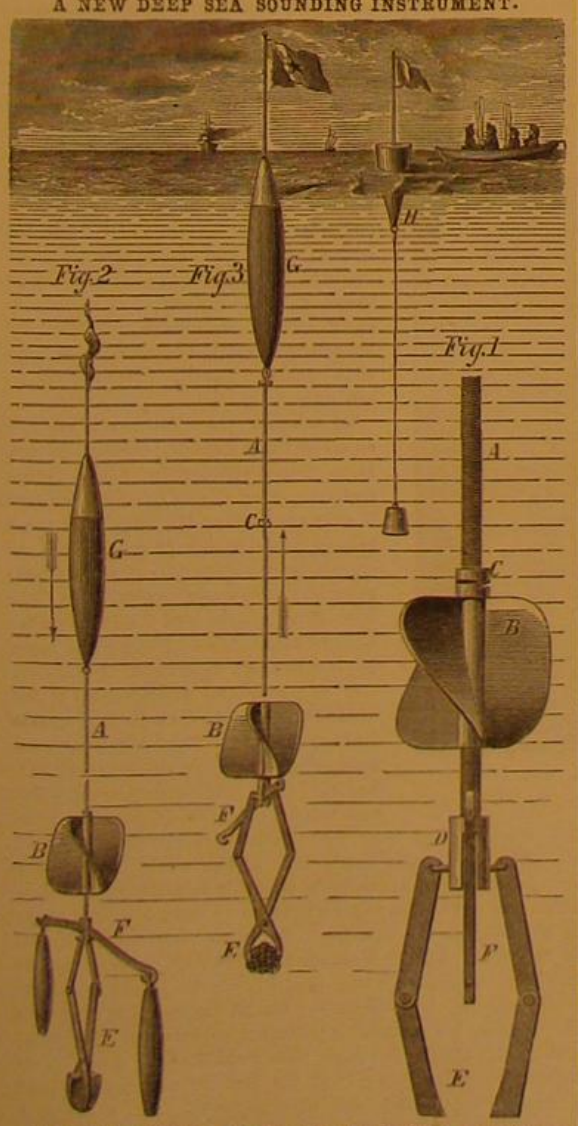
The discovery of a human skeleton in one of the grottoes of Mentone, a village on the south coast of France, near Nice, has produced for some time past no small excitement in the scientific world. The cave in which it reposed is hollowed in the garumnian limestone immediately below the nummulitic tertiary deposit so well developed in the vicinity. Some large imbedded rocks, probably post-eocene, gave rise to the natural excavation.

It appears, from the recent investigations of M. Rivière, that, at the upper portions of the caverns examined, remains of instruments and tools were found, belonging to the prehistoric epoch which immediately preceded, in the west of Europe, the appearance of metals. Below the surface, beds abound, remains of human industry indicating a civilization even more primitive than the antiquity assigned them by the superposed masses. In this locality was discovered, at a depth of 21 feet, the famous human skeleton depicted in our engraving. The earth was evidently in virgin condition, and hence the remains clearly belonged to the geological and palæontological age of its surrounding deposit. While, however, the fauna discovered in connection with the human relics indicate a very ancient palæontological epoch, the bone and stone instruments, and especially the necklace found on the skeleton, seem to point to a more recent period. The presence of cave bears and hyenas, the *rhinoceros tichorinus*, and *bos primogenius*, evidently relate to the most ancient quarternary epoch, the age of the bear; while, on the other hand, the abundance of remains of deer of various species and of small hight (chamois especially), the fact of the multiplicity of bone tools, needles, chisels, and a *baton* of command, together with the peculiar necklace which closely resembles that found on the fossil man of Cra-Magno, lead to the conclusion that the series of objects belongs to an age posterior to that of the bear, namely, to that of the reindeer. It is believed, however, says Dr. Garrigou, in *La Nature*, that the original owner of the skeleton existed during the latter age, and was buried in a cave formerly inhabited by men of the preceding epoch.



THE FOSSIL MAN OF MENTONE.

A NEW DEEP SEA SOUNDING INSTRUMENT.



It would be difficult, we imagine, to devise a more simple and inexpensive apparatus for deep sea sounding than that represented in the accompanying illustration. There is no intricate mechanism, no series of wheels or dials requiring careful adjustment, and not even a line; nothing, in fact, essentially more than a piece of metal wire, screw-threaded from end to end, and a fan working thereon rotated by the motion of the machine. The screw is cut to a certain pitch, so that the descent of the apparatus must be through a fathom of water to cause the fan to make one revolution. The further the instrument travels down, the higher the fan will climb up the rod. As soon as bottom is reached, and the machine begins its ascent, the fan (of course acted upon in a different direction) runs down the screw, but a messenger on the latter, pushed up by the fan, remains at and indicates the highest limit attained. It is only then necessary to pick up the apparatus when it comes to the surface and observe the distance that the messenger has been carried up, and the depth in fathoms is infallibly told.

Compared with the intricate systems for sounding carried by such vessels as the Challenger, and in other marine exploring expeditions, the present device is a marvel of simplicity and cheapness. It can be made on board, with the tools ordinarily found in the engineer's department of a steamer, or, at most, with one special instrument for cutting the screw thread upon the wire. The remainder of the apparatus is a block of wood or other light material for a lifting buoy, the grapplers which bring up specimens of the bottom, and a watch buoy. By noting the time of descent, together with the bearing and distance of the watch buoy from the point at which the machine rises to the surface, the bearing will show the difference of direction between surface and submarine currents, and the distance, the velocity. Thus, in the single instrument, is afforded a means of determining depth, character of bottom, and set and rapidity of currents.

The credit of this very ingenious invention is due to Captain Truman Hotchkiss, of Stratford, Conn., a gentleman of large maritime experience, to whom we are indebted for the substance of the detailed description which follows.

From Fig. 1 the particulars of the device will be understood. A is the screw threaded rod, made of brass or steel, and B is the fan, boxed and tapped to travel thereon. C is the messenger, traveling on the screw and fitting the upper end of the fan by a coupling so as to be moved by the fan only up the screw. At D is a socket screwed to the lower end of the rod, A, which carries the grapnel, E, the latter hanging to the bent end of a bolt which passes through the socket. This bolt also serves as a pivot for an unevenly balanced lever, F, Fig. 2, which passes through a slot at right angles to the plane of the grapnel. The upper end of rod, A, hooks in an eye on the bottom of the lifting buoy, G. H is the watch buoy, provided with anchor and flag.

Fig. 2 shows the machine descending and also the mode of adjusting it. It will be observed that the arms of the lever, F, differ considerably in size, and that they are provided with hooked ends, the curve on the arm on the right turning downward, and that on the left arm in the opposite direction. By this means the two weights represented are supported, one weight, the heavier, extending down to about the level of the bottom of the grapnel. The latter of course remains closed, as is evident from its form. The fan and messenger are then carried down to the bottom of the rod; and thus adjusted, the machine is let go, the watch buoy being previously carried to the place of descent. The time is then noted and a careful watch kept for the return of the apparatus. In descending, the rotating fan climbs up the screw, carrying the messenger with it; and the weights, overcoming the lifting power of the buoy, continue dragging the machine down until bottom is reached. At that moment the lower weight is lifted from its hook and drops clear, the smaller weight overbalances the lever and also falls off, and the jaws of the grapnel, opening against the resisting soil, grab a portion of the bottom. The lifting buoy now easily carries up the apparatus freed from the weights; and soon reaching the surface (Fig. 3), is easily recognized by the flag which it carries, blowing out clear.

The machine is then recovered, and the position of the messenger noted, as already described. As there are thirty-eight turns of the screw thread per inch of rod, it is only necessary to measure the distance in inches between the messenger and socket, D (*minus* the length of the fan), and to multiply the result by thirty-eight, when the depth in fathoms is at once known.

The machine may be made of any desired size; and in cases where the grapnel is likely to catch in seaweed or other obstruction, the power of the lifting buoy can be easily increased to tear away the hold.

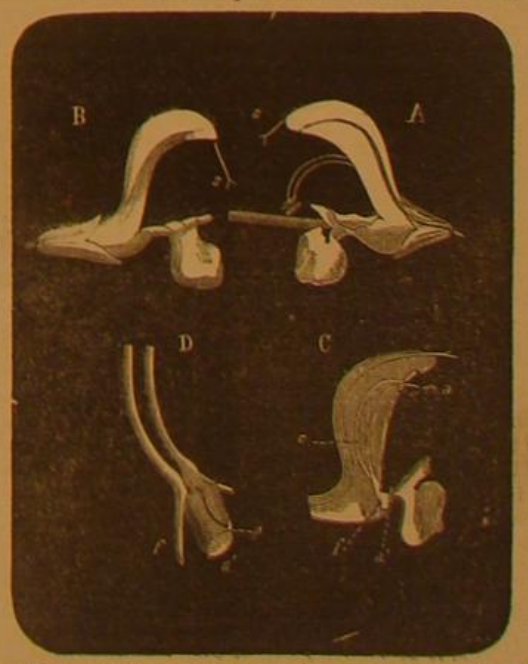
THE FECUNDATION OF FLOWERS BY INSECTS.

Among the numerous discoveries with which vegetable physiology has of late been enriched, none is more interesting or more curious than the part taken by insects in the development of flowers. The fact seems hardly credible, moreover, that, after all the theories which have been invented to explain the passage of the pollen to the stigma of the same flower (to explain which even the intervention of water, which is highly destructible to the pollen of terrestrial plants has been mentioned as possible), in the majority of cases the floral organs are so disposed as to absolutely prevent this contact, and that the pollen needs to be deposited on the stigma of a sister flower or even on a blossom belonging to a separate stalk.

Generally, when the pollen of a flower, through some means, accomplishes its self-fecundation, the result is a deleterious action upon the stigma, and the plant remains barren, as, for example, in many species of the genus *oncidium*. The aquatic plants, of which the pollen is transported by water, are few in number, while the pollen and stigma exhibit a peculiar disposition. With others (*coniferæ*, *gramineæ*), in some cases the wind carries the pollen, but the flowers are insignificant, destitute of nectar and of odor, and their pollen is in such great abundance that it has given rise to a fable, in certain countries, of a rain of sulphur.

Our attention, at present, however, will be directed to the flowers the pollen of which is carried by insects involuntarily from one blossom to another. Such flowers seem to appeal to the insect to enter their open leaves by exhibiting the brightest colors, and most beautiful and varied forms, besides secreting quantities of the nectar upon which their visitor subsists. Nothing can be more wonderful than the thousands of different shapes of corolla, of stamens, and of pistils; and yet all are arranged so as not only to cover the insect, in spite of himself, with pollen, but, at the same time, to separate completely the pollen and stigma of the same flower. Often the mechanical disposition of the various parts of the blossom and their play at the moment of the entrance of the intruder is extremely complicated, as Darwin has demonstrated in the case of many of the *orchidaceæ*; but there are other flowers of which the construction is easily understood and which are equally ingenious and surprising. One of the simplest is the sage (*salvia pratensis*) a very common plant of the *labiatæ*, or mint family, characterized by the existence of two stamens instead of four, portions of the flowers of which our illustration (extracted from the pages of *La Nature*) represents.

The corolla, A B, is deeply divided into two lips; the upper, which corresponds to two divisions of the corolla, turns backward in the form of an arch, and incloses the style and the anthers. The lower lip is divided into three lobes, of



which the middle one is large and concave; while those on the sides are smaller and roll from within outwards. The tube of the corolla is somewhat crooked at the base, and this crook or depression contains the secreted nectar. Of the peculiar form of the stamens, a clear idea will be gained

from Figs. C and D. In C the corolla has been cut longitudinally so as to leave the stamens intact. In Fig. D, a portion of the stamens is shown separately. The anthers have a long connective astride the filaments. The latter are very short, and are inserted in the sides of the tube of the corolla, *f*, in Fig. C and D. One anther, *a*, is developed regularly; the other, *a'*, is transformed into a flattened appendix, nearly rectangular, slightly curved, and convex outside. These two organs are so placed together as to form a kind of spoon, which very exactly closes the tube of the corolla. They even adhere quite strongly by their anterior points. The connective, which is almost unapparent on the inferior side, is elongated on the upper portion into a delicate arched filament which carries at its extremity the only pollen-enclosing cell of the anther.

If it be attempted to push a needle or bit of stick into the tube of the corolla, the little spoon, *a'*, will just be encountered. By a light effort, the connectives are turned around the filaments, when the fertile anthers, concealed under the superior lip, project themselves forward and deposit their pollen upon the intruding instrument. On withdrawing the latter, the elasticity of the filaments carries the anthers back under the upper lip. Up to the time when the pollen is ripe, the style, which is also concealed at the bottom of the upper lip, does not arrive at complete development and the bifidal stigma, *s*, hardly extends beyond the corolla, Fig. A. In the advanced flower, deprived of its pollen, the style elongates downwards and carries the stigma at the level of the entrance of the tube (see *s*, Fig. B).

It is now easy to follow the action of the flower, when a bee, for instance, visits it. The insect alights upon the lower lip of the corolla, and, to reach the hidden nectar, tries to penetrate the tube. But this it cannot do without, as already shown, pushing before it the short branches of the two levers formed by the connectives. At the same time the arched upper parts advance and embrace the body of the bee, applying the open anthers to its abdomen so that the insect emerges covered with the fine pollen. As long as it seeks the nectar of flowers of the same age as that just left and of which the styles are still very short, the stigmas can receive but little pollen; but when the bee attempts to enter an older blossom than B, the elongated stigma grazes along its back, rubs off the pollen, and thus becomes fecundated. Since the pollen of the *salvia* is deposited on the back of the insect, it is evident that little can be given to a flower of another species the construction of which requires the placing of the substance upon the head or trunk. While whatever may be the flowers which the bee visits before entering another *salvia*, the pollen with which it is charged is not rubbed off or wasted as it remains intact until a proper blossom is entered.

UP THE AMAZONS.

No. 2.

VOLUME OF THE GREAT RIVER AND ITS TRIBUTARIES.

The Amazons is the most voluminous of rivers. At the narrows of Obydos, six hundred miles from the sea, half a million cubic feet of water pass any given point every second. Born in Lake Lauricocha, among the Andes of Peru, the main trunk runs northerly for five hundred miles in a continuous series of rapids; and then, from the frontier of Ecuador, it flows easterly, twenty-five hundred miles across the great equatorial plain of the continent. The average current of the Great River in its passage through Brazil is three miles an hour. At Tabotinga, two thousand miles from its mouth, the width is a mile and a half, with a depth of eleven fathoms; at the entrance of the Madeira, it is three miles wide, and below Santaren, it is ten. The tributaries are in keeping with this colossal trunk. In fact, the Amazons is a great river system, rather than one river. It has twelve affluents over a thousand miles long, the largest, the Madeira, equaling the Arkansas, entering the Amazons nine hundred miles from its mouth.

Besides these and a host of minor tributaries, there is a wonderful network of natural canals alongside of the main river and joining the tributaries, called *igarapés*, *paranás*, and *furos*. These bypaths are of immense advantage for intercommunication. They are characteristic of the country, and are so numerous that Amazonia is truly a cluster of islands. Altogether, this vast inland fresh water sea drains a territory of two million square miles, reaching from the Andes to the Atlantic and throwing out its arms to the Orinoco and Paraguay. On the Lower Amazons, the annual rise reaches its maximum about the middle of June, and its minimum in December, the difference of level being about fifty feet.

EXTENT OF NAVIGATION.

No other river runs in so deep a channel to so great a distance. No other river can furnish over six thousand miles of continuous navigation for large vessels. For two thousand miles from its mouth, the main stream has not less than seven fathoms of water; and not a fall interrupts navigation for twenty-five hundred miles. The Pongo de Manériche is the western limit to navigation on the Amazons proper. While the current is ever east, there is a constant trade wind westward, so that navigation up or down has always something in its favor. In August and September, a strong breeze sweeps up the lower part of the main trunk, so that schooners often go from Pará to Obydos in ten days, or one third of the ordinary time.

As to the tributaries: the first in order, the Tocantins, could furnish a natural highway to the rich province of Minas Geraes, were it not for rapids one hundred and fifty miles from its mouth. This interruption will some day be circumvented by a railroad. Above the falls, a steamer can go six hundred miles. The Xingú is navigable nearly one hundred miles. From Santarem, steamers ascend the broad Tapajós about sixty leagues, to the rapids of Itaitúba; and passing these, traders go by canal to Diamantino and Cuyabá on the confines of Paraguay. From Itaitúba, there is communication *viâ* Manes with the Madeira. Near Obydos enters the Trombétas, navigable one hundred miles. And just beyond Serpa, the great Madeira pours its flood of waters. This majestic tributary is about two thousand miles long, one branch rising near Lake Titicaca, a second starting within fifteen miles of the source of the Paraguay, and a third washing down the gold and diamonds of the Sierras. It has a three mile current, and at its mouth is two miles wide and sixty-six feet deep. It is navigable to San Antonio, a distance variously estimated from five to seven hundred miles. Here begins a series of rapids, nineteen in number, having a total fall of thirty-eight fathoms; above which a steamer can ascend to Santa Cruz, in the heart of Bolivia. Colonel Church, who sounded the Marmoré for six hundred miles above the rapids in October (the dry season), found nowhere in midchannel less than fifteen feet of water, an average current of two miles an hour, and a width varying from six to twelve hundred feet. A railway around the formidable rapids which separate Bolivia from the Lower Madeira is now in process of construction by the Madeira and Marmoré Railroad Company. The track extends from San Antonio to Guajarámirim, a distance of one hundred and eighty miles, and by the terms of the contract the road is to be finished in April in 1874. This is one of the most important enterprizes on foot; but great difficulties have been encountered, as the scarcity of laborers, the attacks of Indians, and the prevalence of epidemics. The company, however, in spite of all obstacles, declare that this great connecting link must and shall be built. As soon as completed, the National Bolivian Navigation Company will be ready to put a fleet of steamers and barges on the Marmoré and Guaporé. Both Brazil and Bolivia are interested in this railway, and have conceded to the company over one million acres of territory along the line. The affluents of the Madeira water a region as large as the basin of the Nile and nearly as rich. The valley of the Beni above is famous for its gold, Peruvian bark, coffee, and cacao, which now have to climb the mountains of La Paz and cross to the Pacific.

One hundred miles west of the Madeira enters the Rio Negro, which is navigable to San Gabriel; but at present steamers go only to Santa Isabel, or five hundred and forty-six miles. It is a deep though sluggish river, the depth at Manáos at high water being forty-four fathoms. Steamers, therefore, do not usually cast anchor, but fasten to buoys. The Rio Branco branch can also be navigated by small steamers for sixty leagues. Above the rapids of San Gabriel, the Negro is connected by the Cassiquian with the Orinoco; and hence the commerce of this part of the river is naturally in the hands of Venezuelans.



MOUTH OF THE AMAZONS

Next in order is the Purús, one of the most promising tributaries of the Amazons. Recently opened to the world by the daring Chandless, this hitherto mysterious river, possessed by the untameable Chunchos, has suddenly become one of the most attractive and valuable streams in the world. Rising in the richest part of the Andes and entering the Amazons only forty-five leagues above the city of Manáos, it is navigable for steamers, the greater part of the year, for over twelve hundred miles. At the distance of eight hundred miles from its mouth, the depth is never less than twelve feet. It is nearly, if not fully, equal to the Madeira in size, but is exceedingly winding in its course. Parallel to the Purús is the almost equally important Juruá. It is navigable, for steamers drawing three or four feet of water, for fifteen hundred miles. Like the Purús, it is a very crooked river, and has a two and a half mile current. Five hundred miles from its mouth, it has a depth of two fathoms at low water.

The Jutahi and Japurá are first class tributaries; the latter is navigable for ten days by steamer, when falls are reached where there is a lofty table-topped mountain. The Icá has no rapids and is navigable into New Granada. It is a healthy river, and is of considerable commercial value. The Jávari is navigable for an unknown distance, and is called the "Golden Dream of the Peruvians," who think it is the eastern outlet of their country. The Napo could be ascended by a flat bottom steamer five hundred miles; it is the natural highway eastward for Ecuador. The noble Ucayáli has been navigated by a steamer of five hundred tuns for six hundred miles in the dry season; and a small steamer has ascended over seven hundred miles, or within two hundred miles from ancient Cuzco, and three hundred from Lima. There is twenty feet of water at Sarayacu. The Ucayáli will undoubtedly connect Lima with the Amazons. Finally, the Huallága has an average depth of three fathoms for a hundred miles; but canoe navigation begins at Tingo Maria, one hundred and twenty miles from Huánaco. Such are the vast capabilities of this gigantic river, fitly called the Mediterranean of the New World.

THE NATURAL WEALTH

of the country is in proportion. No spot on the globe contains so much vegetable matter as the Valley of the Amazons. Within it we may draw a circle of eleven hundred miles in diameter which shall include an evergreen, unbroken forest of grand and beautiful and valuable trees, in endless variety. In truth, it is this very excessive exuberance which offers the chief obstacle to settlement. We know next to nothing of the interior; but the margins of the main trunk and especially of the tributaries abound with precious woods, drugs, dye stuffs, edible fruits, and other useful products. Among the most important of these for exportation are: Moira, pinima, moira piránga, moira coatiára, itaúba, palo di sangre, massarandúba, sapucáya, jacaranda, cedar, and cumarú; salsaparilla, vanilla, cupaíba; cinchóna and guaraná; cacao, coffee, tonka beans, nuts, farina, tapioca, cotton, rice, tobacco, and sugar; rubber, piassába, pita, and copal, and a host of others unknown to commerce.

SAILING CRAFT AND STEAMERS.

The present traffic in the riches of this inexhaustible region is far behind the world's expectations; but it has wonderfully increased since the introduction of steamers in 1853. It is impossible to ascertain the number of sailing vessels on the river; but the variety is extraordinary, for the Indian is a carpenter and shipwright by intuition. Thus we see: First, the *canoe* proper, or "dug out." Second, the *montaría*, a small boat made of five planks, or a canoe increased by two narrow boards for the sides and small triangular pieces for stem and stern. The paddle serves for both steering and propelling. Third, the *montaría-possante*, a large montaria with oars. Fourth, the *igarité*, a large canoe or montaria with two masts, rudder, keel, and palm leaf awning or cabin near the stern. Fifth, the *galiota*, an igarité with wooden covering. Sixth, the *cobérta*, a large galiota with one or two wooden cabins. Seventh, the *cigilêngas*, a large igarité, short and broad, flat bottom with keel fore and aft, first made at Viges. Eighth, the *batelao*, a barge with square sails but no deck, to carry cattle; sometimes propelled by long oars. Ninth, the *barco*, a batelao with deck. Tenth, The *escuna* or schooner.

Of steamers there are now thirty-five afloat on the Amazons, varying in tunnage from seventeen to eight hundred and sixty-four. The aggregate tunnage is over ten thousand. Twenty of these belong to three companies, which receive a large subsidy from the Government and have a total capital of $3,600,000. The oldest and most powerful line ("*Companhia de Navagação a vapor de Amazonas*") is owned in London, but is under the management of the distinguished and energetic Sr. Pimeuta Bueno, of Pará. This company is endeavoring to swallow up the other two having just purchased the Paraense line and nearly completed negotiations for the Fluvial, and thus monopolize the carrying trade on the river. Officially made free to the world in 1867, the navigation of the Amazons is virtually restricted to the Brazilian flag. Foreign vessels may go up the main river as far as Manaos; up the Tapajos to Santarem; and up the Madeira to Borba. On the Maranon the Peruvian government has two large steamers, doing monthly service, besides several small ones for the tributaries; and an English firm at Iquitos has recently inaugurated a private line between that point and Pará. Goods for Peru pass Pará free of duty. Two regular steamers leave Pará for Manaos and intermediate points, on the 2d and 18th of each month, and a monthly steamer plies between Manaos and Loreto, on the Brazilian frontier, connecting with the Peruvian Morona for Yurimaguas on the Huallága. The other steamers run from Pará and Manaos to numerous villages along the main river and the tributaries. The navigation of these tributaries, but

ust commenced, is most important, for they are the real sources of the characteristic products of the country; the region bordering the main trunk yields scarcely anything. On the Tocantins a steamer goes once a month to Cametá; once a month (during high water) to Baiao and to the first falls. Almost the only trade on this river is in Brazil nuts. The Xingu has one occasional steamer going just above Souzil for rubber, of which the annual product is five or six thousand arrobas. The Tapajos has a monthly steamer as far as Itaituba (175 miles) leaving Santarem the 28th, and bringing down rubber, salsaparilla, tobacco, farina, cacao, coffee, copaiba, pepper, nuts, pirarucú, pitch, hides, lumber and limestone. The annual amount of the Topajos cacao is is 100,000 arrobas, rubber the same, pirarucú 50,000 arrobas, salsaparilla 1,000 arrobas, nuts 40,000 bushels, hides 20,000. A steamer leaves Manaos for San Antonio, on the Madeira, the 27th of each month, and oftener when there is a cargo.

PRESENT AND PROSPECTIVE COMMERCE.

At present the trade on this chief tributary is inconsiderable, its value, in 1872, amounting to only $279,312. The exports consist of rubber (about 25,000 arrobas), hides, tallow, quina, copaiba, cacao, nuts, fish, tobacco (of superior quality for pipes), and salsaparilla. But the moment the railway around the falls is finished, a magnificent country will roll its wealth down the Madeira. Above the falls are the cities of Exaltocion, Trinidad, Santa Cruz, Oruro, Cochabamba and La Paz; there is the Bene valley, famous for its gold, silver, tin, copper, lead and mercury mines; and from the banks of the Marmorá will be exported, as soon as an outlet can be made, cinchona bark, rubber, coffee, cacao, salsaparilla, tobacco, farina, cotton, llama and alpaca wool, cattle and hides. At present, cattle can be bought there at $7 a head; cinchona, $45 a quintal; cacao, $1.50 an arroba; sugar, $1 an arroba.

On the Rio Negro a steamer makes six trips a year as far as Santa Isabel (546 miles) for piassába and salsaparilla. The value of the trade on this tributary, in 1872, was $62,586; it is now on the increase. The rich cacao and coffee, once raised in this region, is no longer cultivated; and no one can be found to cut the celebrated moira pinima—the most beautiful wood in the world. Not a stick can be found for sale in the city of Manaos; while everybody confesses that there is an abundance of it up the Negro, especially on its branch, the Branco, near the boundary line of Guiana. A regular monthly steamer (and often an extra one) goes up the Purús, one thousand miles to Hyutanahau, bringing down rubber, copaiba, salsaparilla, nuts, turtle oil and fish. The commerce on this river is rapidly increasing. Its value in 1872 was $627,602. There are more inhabitants along the banks of the Purús than on any other tributary.* There is a monthly steamer, likewise, on the Juruá, ascending to Marary (five hundred miles), and the trade is similar to that on the Purús. The Peruvian steamers, plying between Lonto and Yurimagnos, takes up dry goods and hardware in exchange for Moyabamba hats and salsaparilla. Her rate down stream is eighteen miles an hour and from ten to twelve up, while the Brazilian steamers descend at the rate of twelve or fifteen miles an hour, but make only eight up stream.

Such is this great fluvial highway, as thus far developed. Unless checked by blind legislation, the commerce of the Amazons, leavened by Anglo-Saxon capital and Anglo-Saxon enterprise, is destined to assume proportions commensurate with the magnitude of the river. JAMES ORTON.

*The latest intelligence contradicts the report of Mr. Piper's massacre, and announces that he has found gold in abundance.

NOTE ON AN ELECTRO-DYNAMIC EXPERIMENT.

BY MM. GASTON PLANTE AND ALF. MAUDET-BERQUET.

In charging a secondary couple of leaden plates with the magneto-electric machine of Gramme, we have observed a phenomenon which affords quite a curious example of the reciprocal transformation of mechanical power into electricity, and of electricity into mechanical power.

The machine of Gramme possessing, as is well known, the remarkable property of furnishing currents influenced in the same direction, the secondary couple is charged by the aid of this machine as if under the influence of a voltaic pile, and enables us to obtain, at the end of a few moments, by a successive chemical action accumulated upon a large surface, temporary effects of an intensity superior to those which the machine produces in a continuous manner. It is easy to verify this, either by the incandescence of a thread of platinum, or by any other physical action. But if, instead of thus discharging the secondary couple, it is left in communication with the machine, and if we cease to make it revolve, if we even stop it entirely, by opposing a sufficient resistance, it will immediately be observed to put itself in motion again under the influence of the secondary couple which it has just charged, not in a contrary direction, but in the same direction as the motion with which it was animated, while charging the secondary couple.

The velocity is less, it is true, than that which is given to it in order to develope electricity, but it is still sufficiently great, and the rotation may be prolonged two or three minutes, that is, during the time employed by the secondary couple to discharge itself. The dynamo electric machine operates in this case as an electro-magnetic motive power, and the secondary couple gives back to it, under the same form, the power which it has stored up. Electricity serves only, as it were, as the intermediate machinery in this communication and restoration of motion.

If we measure the forces called into play, we can plainly ascertain that this restoration is not complete on account of the loss inevitable in every transformation. But as the measure of the product of the secondary couple, effected by one of us in a previous experiment conducted after another method, has demonstrated that this couple was a good receiver of the electric force, it is probable that one would find here, all the circumstances being the same, only a trifling waste in the transformation.

The direction of the rotatory motion communicated to the machine by the discharge of the secondary couple is, we have said, the same as that in which the machine was turned in charging the couple. Now if the machine in turning in a certain direction has charged this couple, it is difficult to conceive, at first view, that under the influence of the discharge of the couple it turns still in the same direction; for it must then tend to recharge the secondary couple, so that the latter would be discharged and charged at the same time.

Nothing seems more paradoxical. Nevertheless the fact is easily proved, and is very simply explained in the following manner: If we consider in the first place the direction of the current furnished by the machine, that of the current given back by the secondary couple (which is the reverse of the preceding), and if we take into account the actions resulting, we confess that, according to the laws of induction and of electro-dynamics, the rotating ought indeed to act in the direction indicated by experience. If we observe, on the other hand, that the secondary couple, once charged, has a temporary intensity superior to that of the machine, that is, that it can furnish in a given time, by means of the accumulation which takes place, a quantity of electricity superior to that which the machine would produce during the same time, we understand that it could overcome or surmount the feebler intensity which the machine tends to develope by its rotation even under the influence of the discharge of the secondary couple.

The motion then takes place by virtue of a difference of intensity between the current furnished by the secondary couple and that which the machine would tend to develope by the simple fact of its rotation. Thus is explained, according to us, this apparent paradox of electro-dynamics. We will add that the experiment can be easily repeated, with the smallest as with the largest models of Gramme's machine.

On the Manufacture of Ether.

O. Süffenguth states that the best method of making large quantities of ether is by the continuous process. A retort, containing a mixture of nine parts sulphuric acid of 66° B. and five parts 90 per cent alcohol, is heated to 284° Fah. and alcohol allowed to flow in continuously to keep the mixture at a constant level. Heretofore a direct fire has been applied under the copper or iron retort; but owing to the inflammability and volatility of the ether, this is evidently dangerous; and moreover, the direct fire soon destroys the retort, or at least dissolves the leaden lining. This is now entirely avoided by the use of superheated, high pressure steam for heating the retort. Even though this method is rather more expensive, it prevents igniting and exploding the ether vapor, which quite compensates for the cost. Another advantage is the ease with which a constant temperature is maintained by regulating the pressure, so that the operation is no longer dependent upon the care and experience of the workmen.

Various materials have been used for the retort or still; sometimes copper alone, sometimes copper lined with lead, and also iron lined with lead. Experience has proved that the last named is not only the cheapest but will last the longest. If the operation is carefully conducted, 66 per cent of ether of a specific gravity of 0·730 will be obtained. Half a pound of sulphuric acid makes 100 pounds of ether, and the apparatus is so constructed that it can be refilled without interrupting the operation. Great attention to the regulation of the temperature and to the flowing in of the alcohol are the principal conditions for obtaining a large yield.

The crude ether thus obtained is freed from the acid dissolved in it and washed, after which it is rectified in a suitable apparatus. Attempts have been made to rectify it in the process of its manufacture, by conducting the ether vapor into a vessel with double walls, the space between the walls being filled with water at a temperature of 35° C. (95° Fah.) Here the water and alcohol are condensed, while the ether passes up into a second vessel filled with pieces of quick lime of the size of a man's fist, which take up the sulphurous acid. It is now warmed and enters from beneath into a cylinder holding a leaden basket of dried wood charcoal, or alternate layers of charcoal and pieces of coke soaked in a solution of soda and well dried. From here it is conducted through a cooler into the receiver. This continuous rectification is more difficult and requires greater attention on the part of the workmen than where the purification is a separate operation, first on account of the continual regulation of the temperature in the different parts of the apparatus, and secondly because the lime sometimes stops up the tube or is carried off in the vapor. The operation never goes on regularly nor is the product always pure. It seems to be better, in practice, to keep separate the two operations of making and of purifying the ether.

Bees as Architects.

Now we exercise a patient observation on Nature, analyzing, investigating, calculating, and combining our facts, and say coolly with Professor Haughton, "bees construct the largest amount of cell with the smallest amount of material;" or with Quatrefages, "their instinct is certainly the most developed of all living creatures with the exception of ants." "The hexagons and rhomboids of bee architecture show the proper proportions, between the length and breadth of the cell, which will save most wax, as is found by the closest mathematical investigation," says another great authority. Man is obliged to use all sorts of engines for measurement—angles, rules, plumb lines—to produce his buildings, and guide his hand; the bee executes her work immediately from her mind, without instruments or tools of any kind. "She has successfully solved a problem in higher mathematics, which the discovery of the differential calculus, a century and a half ago, alone enables us to solves at all without the greatest difficulty." "The inclination of the planes of the cell is always just, so that, if the surfaces on which she works are unequal, still the axis running through its inequalities is in the true direction, and the junction of the two axes forms the angle 60° as accurately as if there were none." The manner in which she adapts her work to the requirements of the moment and the place is marvelous. A center comb burdened with honey was seen by Huber and others to have broken away from its place, and to be leaning against the next so as to prevent the passage of the bees. As it was October, and the bees could get no fresh material, they immediately gnawed away wax from the older structure, with which they made two horizontal bridges to keep the comb in its place, and then fastened it above and at the sides, with all sorts of irregular pillars, joists, and buttresses; after which they removed so much of the lower cells and honey, which blocked the way, as to leave the necessary thoroughfares to different parts of the hive, showing design, sagacity, and resource. Huber mentions how they will find out a mistake in their work, and remedy it. Certain pieces of wood had been fastened by him inside a glass hive, to receive the foundation of combs. These had been placed too close to allow of the customary passages. The bees at first built on, not perceiving the defect, but soon changed their lines so as to give the proper distance, though they were obliged to curve the combs out of all usual form. Huber then tried the experiment another way. He glazed the floor as well as the roof of the hive. The bees cannot make their work adhere to glass, and they began to built horizontally from side to side; he interposed other plates of glass in different directions, and they curved their combs into the strangest shapes, in order to make them reach the wooden supports. He says that this proceeding denoted more than instinct, as glass was not a substance against which bees could be warned by Nature, and that they changed the direction of the work before reaching the glass, at the distance precisely suitable for making the necessary turns—enlarging the cells on the outer side greatly, and on the inner side diminishing them proportionately. As different insects were working on the different sides, there must have been some means of communicating the proportion to be observed; while the bottom being common to both sets of cells, the difficulty of thus regularly varying their dimensions must have been great indeed. The diameter of the cells also varies according to the grubs to be bred in them. Those for males have the same six sides, with three lozenges at bottom, as those for workers, and the angles are the same; but the diameter of the first is 3½ lines—that for the workers only 2 ⅔. When changing from one size, to another, they will make several rows of cells intermediate in size, gradually increasing or diminishing, as required. When there is a great abundance of honey, they will increase both the diameter and the depth of their cells, which are found sometimes as much as an inch and a half in depth.—*Good Words.*

Enameled Iron.

M. Peligot has made a report, to the Society for the Encouragement of Industry, on the enameled wrought and cast iron work introduced by M. Paris about twenty-five years ago, and for which the Society have awarded him two medals. According to the report in question, the enamel used is a true transparent glass which allows the color of the iron to show through, very tenacious, having the same power of dilatation as iron, and capable of resisting powerful acids. The ordinary white enameled ware of Paris generally contains lead, and often in large proportions, and is liable to be attacked by even very weak acids. M. Paris' ware has been employed for many purposes: cast iron vases for gardens decorated in imitation of old Rouen ware have been exposed to all weathers without suffering any injury; a chimney in enameled plate iron was set up at the Mazas prison in 1849; the doors of the gold assay furnace in the laboratory of the Paris mint are of the same, and have borne the effect of nitrous vapors since 1850; in 1866 this enameled iron was selected for street names and house number plates, in several districts of Paris, and the report states that, while other manufacturers make enameled ware of the same appearance as that of M. Paris, the latter has shown its superiority in resisting the effects of time.

Specimens of new applications, lately introduced by M. Paris, were presented to the Society, and included chairs, tables, and stools for gardens, enameled on sheet iron and mounted on castings; and stands for dishes, decanters, etc., made in imitation of ancient earthenware, but presenting the superior advantage of bearing heat well.

ACTION OF NITRIC ACID ON CHROMATE OF LEAD.—On treating chromate of lead with about double its weight of nitric acid, a solution of chromic acid is obtained, according to M. E. Duvillier, containing but two per cent of oxide of lead. It is considered that the nitric acid decomposes the chromate of lead into chromic acid and nitrate of lead, which precipitates itself on boiling in presence of the excess of nitric acid employed.

MANUFACTURE OF ARTIFICIAL BUTTER IN NEW YORK.

Milk is a mechanical mixture of butter, casein, and water, the latter holding in solution sugar of milk, or lactin, and several salts. The butter is held suspended in the milk by the caseous or cheesy matter, and the whey, with which it is intimately blended. Milk is thus a true emulsion, resulting from a mixture of these three ingredients, and owes its opacity and white color to the diffusion through it of the butyraceous oil. The particles of butter in milk consist of very minute globules $\frac{1}{1000}$ inch in diameter, suspended in the surrounding serous fluid.

FIG. 1.



MANUFACTURE OF ARTIFICIAL BUTTER.—THE HASHING MACHINE.

When milk is allowed to stand for some time, the lighter particles of butter rise to the surface, constituting, with a certain quantity of the other ingredients, cream, leaving the casein, from which cheese is made, and the whey below. All the particles of butter, however, are not eliminated by this means. Still the remainder is by no means rich in oily matter, as the poverty of skim milk plainly shows.

When the cream is agitated for some time, or churned, the semi-solid particles of fat aggregate, and we have a mass of butter. The remaining fluid, termed buttermilk, contains casein and lactin, or sugar of milk, in solution. This sugar very soon decomposes, forming lactic acid (from *lac*—Latin for milk), which gives to buttermilk its sour taste.

In the manufacture of cheese the casein (Latin, *caseum*, cheese) of course is the principal ingredient. The casein is coagulated by an acid, usually obtained from the stomach of a young calf, and called rennet. The curd thus obtained is pressed, and, after a variety of manipulations, becomes cheese.

Butter is a rather complex organic compound, consisting chiefly of olein, margarin, and stearin. The olein is the largest and most important constituent, and one most familiar to our eyes, in the shape, more or less pure, of the fixed oils, of which olive oil is a good example, as it contains seventy-five per cent of olein.

The three substances named exist in all natural fats, from which chemists have long been enabled to produce butters which, owing to bad odors and flavors, have never been suited to human wants.

M. Mouriez, of France, was the first to solve the difficulty, and some six years ago gave to the world an excellent method of making good butter from hard beef fats, known as beef suet. This process will be found in the SCIENCE RECORD for 1873.

The process, with modifications by M. Paraf, has latterly been introduced in this country, and is now in successful practical operation in this city, on a large scale, at the establishment of the Oleo-Margarine Manufacturing Company, in 56th street, near Third avenue, where one or two tuns of the new butter are now daily turned out, and find a ready market.

The article to which we refer does not differ materially in composition from ordinary butter, olein (and that of a very pure character) being the principal ingredient, no casein being present, which is the primary cause of rancidity in butter. The olein from which this artificial butter is prepared is obtained from beef suet.

The general process of manufacturing artificial butter is as follows: The suet is first washed thoroughly, for two hours, in water, to remove all superfluous animal matter, and is then, by means of a "hashing machine," shown in our illustration (Fig. 1), ground thoroughly, and pressed through a fine sieve or plate of iron pierced with fine holes, which forms one side of the machine. The machine consists of a series of sharp blades set on an axis like the thread of a screw. These are contained in a closely fitting chamber or cylinder placed horizontally. The cylinder is divided into two portions, hinged together on one side, and capable of being securely fastened or bolted on the other, when the machine is in operation. The upper half can be readily thrown back, should the machine become clogged or when it becomes necessary to cleanse it. The shaft on which the knives are fixed extends through one end of the cylinder, and is geared in the ordinary way, by means of a belt and pulley, to the shaft of the engine transmitting the power.

A large iron trough lined with porcelain is supported above the cylinder with its revolving knives. This trough or feeder has an aperture in one corner, which fits over a corresponding hole in the upper part of the cylinder, through which the suet is fed to the machine. When the machine is in operation, the suet is not only effectually hashed in the cylinder, but forced by the screw thread set knives through fine holes bored in the opposite end of the cylinder. The machine we saw in operation was capable, it was stated, of hashing 1,000 pounds of suet in an hour. The fat comes out of the hasher in the form of a jelly considerably whiter than when put in, owing to its finely divided state, and the uniform distribution of olein through it.

The material is now in a proper condition for the second operation, which has for its object the separation of the fluid olein, and the solid margarin and stearin from the animal

FIG. 3.



MANUFACTURE OF ARTIFICIAL BUTTER.—FILLING THE BAGS FOR THE PRESS.

tissues which enveloped them. For this purpose it is put into a number of steam vats, shown in the illustration (Fig. 2). These vats are of the ordinary wooden description, with steam pipes entering the bottom, the steam being admitted or cut off at pleasure by stop cocks. Here the fat is raised nearly to the temperature of boiling water, the steaming being continued for two hours. The heat causes a separation of the olein and stearin from the animal matter, the former rising to the top, while the latter sinks to the bottom. The material is well stirred during the time the heat is continued, and when the process is completed the oil is drawn off while still hot, and then allowed to cool slowly in

FIG. 2.



MANUFACTURE OF ARTIFICIAL BUTTER IN NEW YORK.—THE STEAMING VATS.

tanks placed below the steam vats. About 90 per cent of a mixture of olein, margarin, and stearin are thus obtained from a given weight of suet, the remainder (10 per cent) being, of course, the tissue and muscular and fiberous parts of the material.

The real fat being thus separated from the superfluous animal matter, the next step is the separation of the fluid olein from the solid margarin and stearin. One of the lower tanks, seen beneath the steam vats in the large illustration (Fig. 2), containing the mixed fluid and solid parts of the fat, is moved to a small table in another part of the room. On the table are small tin molds, six or eight inches long, four or five wide, and two or three deep, each one taining a small cotton bag, with sufficient margin of cloth to form a double lap from each side. Here may be seen the operation of bag filling (Fig. 3).

The partly crystalized and lumpy fat is ladled into these molds until full, when the laps of cloth from each side are turned over upon the top, and the material inclosed. The bags contain about two pounds each, and after using once are carefully washed to avoid any taint or rancidity which might injuriously affect the butter. Our sense of smell being acute in some directions, we applied one of the bags to the nostrils. It was clean and sweet. This, though apparently a small matter, the proprietors of the establishment have not overlooked. The floor, indeed, and all the articles in use gave evidence of care and cleanliness, which is next to godliness.

When the bags are full they are put between sheets of galvanized iron and placed in the oil press (Fig. 4), which is a combination of the toggle joint with a closely cut thread screw, as shown in the engraving. The pressure is gradually applied to the contained fat, and there presently issues from the pores of the cotton a fine yellow oil, which drips into a receiving trough at the bottom of the press, and is afterwards dipped or ladled into ordinary galvanized iron milk cans.

It is this oil, olein, containing in solution more or less margarin and stearin, from which the butter is now to be churned, as we shall presently describe. This expressed oil has neither taste nor smell, and is a very pure article of olein. The residuum left in the bags is solid stearin, which, the proprietors informed us, is worth two or three cents per pound more than the ordinary stearic acid, and is used chiefly for candle-making.

We now come to the last operations connected with the manufacture of the artificial butter, to wit, the churning (Fig. 5), which is the same as the ordinary churning of cream. The churns have revolving paddles, and the oil on being placed in the churns is mixed with one fifth of its weight of sour milk. The churning operation is continued for twenty minutes, when the compound has assumed the semi-solid condition of soft butter, which a slight diminution of temperature renders firm. The churns are worked in a cool chamber, rendered so by means of a reservoir of ice suspended overhead. The butter is now colored yellow by admixture of a little vegetable annatto, which is harmless, and after being salted is worked like ordinary butter on a working table, with a presser, as shown in the illustration (Fig. 6). The churning of the oil with the sour milk increases its weight from the absorption of water, so that three pounds of oil will make four pounds of butter. From one hundred pounds of suet, seventy pounds of butter are produced, twenty pounds of stearin, and ten pounds of scraps. The change from the liquid to the semi-solid condition is due probably to some molecular change or oxidation of the oil during the process of churning.

We tasted some of the butter thus made and prepared for the market. With the exception of a slight granular consistency, we could perceive no difference between it and good ordinary firkin butter. This peculiarity, it is stated, disappears after keeping for some length of time.

The butter made in this way can be afforded much cheaper than the ordinary article, but it must not be supposed that the cow's occupation is forever gone. Suet is an article the supply of which is limited, and it is only in large cities, or localities where beef cattle are largely slaughtered, that it will prove profitable to engage in the manufacture of this artificial butter. The company expect, we were told, to enlarge their works to the capacity of some twelve tuns of butter per day. This is only about one tenth the quantity daily consumed in the city of New York.

The butter made can be transported to and will keep in warm climates, owing, as before stated, to the absence of the readily putrescible compounds existing in ordinary butter. Shipments have already been made to South America; and as regards home consumption, it is said that hotels in this city, and even a fashionable club, are customers of the company for this artificial butter.

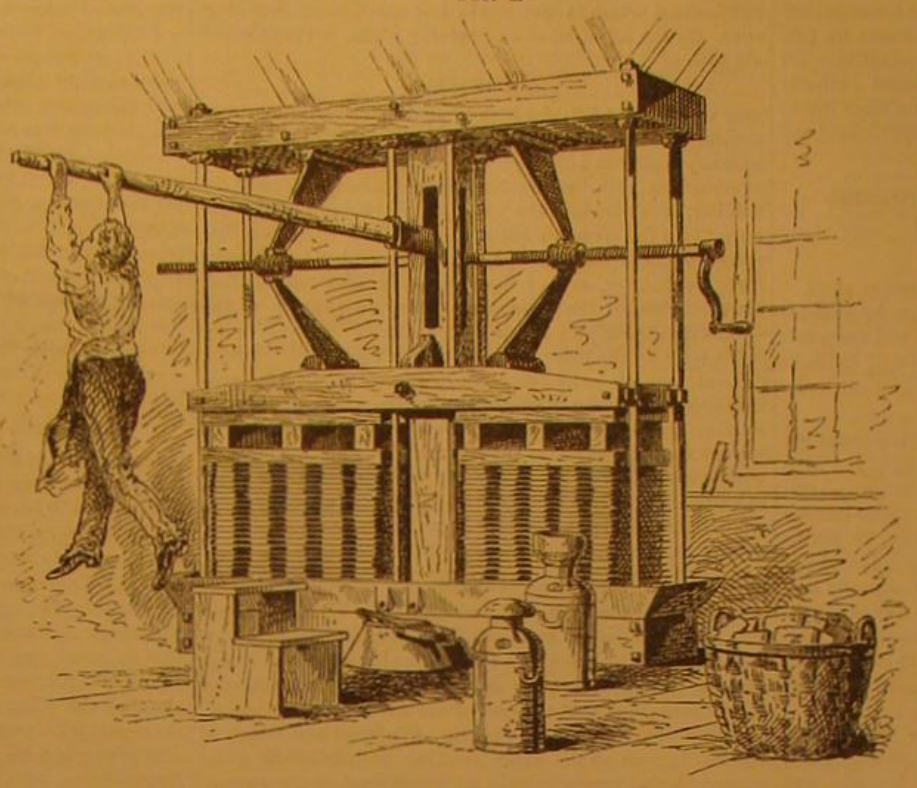
Preparation of Pure Chlorophyll.

"The plant used in my experiments," says F. A. Harsten, "was the ivy (*hedra helix*) which possesses two advantages; first, that it can be obtained at all seasons of the year; second, that it is very rich in chlorophyll. Beside this, the chlorophyll of this plant is not easily decomposed by such agents as light or alkalies. The leaves are chopped up fine and mixed with alcohol of 55° to a *magma*, which is pressed out after standing 12 hours. The object of this is to prepare the leaves for the action of the benzole. The alcohol extracts the water from the leaves and also the bitter principle (*hederin*) and especially large quantities of a soapy substance. After the alcohol has been removed by pressing, the leaves are mixed with benzole, and let stand for 24 hours, in which time the benzole extracts the chlorophyll. The benzole is now pressed and distilled off. The residue remaining in the retort is of a fatty nature and dark brown color. Three hundred grains of leaves furnish about 8 grains of residue which contains fat, chlorophyll, and a yellow coloring substance. This residue is boiled for 10 minutes with soda (80 grains of extract to 10 grains soda and 150 grains water). When cold it is filtered through 4 or 5 thicknesses of paper, and a dark green alkaline fluid obtained, while the insoluble fatty soap and the yellow coloring matter remain in the filter. From the green solution the chlorophyll soap and soluble fatty soaps are separated by common salt, or nitrate of soda, and the soaps washed with solutions of the same salts. After the soap is freed from alkali, it is dissolved in water and sulphate of copper added. In this way a beautifully colored powder is obtained, which contains chlorophyll oxide of copper and a copper soap. It is washed rapidly to remove all the sulphate of copper, and then dried. The dry powder is boiled with absolute alcohol and then washed with ether and benzole. These solvents remove all the copper soap and some of the chlorophyll compound. The chlorophyll oxide of copper which remains is suspended in alcohol and decomposed by a current of sulphuretted hydrogen. By exposure to the air, the alcohol evaporates, leaving the chlorophyll in the form of fine brittle grains of a dark green color, almost black. It is insoluble in water, but dissolves in alcohol and hydrochloric acid with a very beautiful green color. This green color differs, however, from the green of the leaves, since the latter is modified by the yellow coloring matter.

I have the following grounds for considering the chlorophyll free from fats: 1. It was dry and brittle; 2. On heating it, no smell of acrolein was produced; 3. It is easily soluble in alcohol and hydrochloric acid.

I have also prepared compounds of chlorophyll with lead and silver, but neither can be employed for preparing pure chlorophyll. The chlorophyll oxide of silver blackened easily in the light. The lead soap could not be removed so readily from the chlorophyll lead compound, by the use of absolute alcohol, ether and benzole, as the copper soap."

Fig. 4.



MANUFACTURE OF ARTIFICIAL BUTTER.—EXPRESSING THE OLEIN.

Fig. 5.



MANUFACTURE OF ARTIFICIAL BUTTER.—CHURNING THE OLEIN WITH MILK.

Fig. 6.



MANUFACTURE OF ARTIFICIAL BUTTER.—WORKING THE BUTTER PREPARATORY TO PACKING.

New Plan for Obtaining a Powerful Light.

Herr Edelmann, of Munich, has devised a very simple and satisfactory mode of obtaining a powerful light, well suited for photographic purposes, if the materials employed be judiciously selected. He has found that the oxyhydrogen flame produced from common coal gas and oxygen at ordinary pressure produces an intense light, of any desired color if, by means of it, we burn a mixture of picrate of ammonia with a suitable metallic salt.

To this end a hollow cone of hard gas carbon—similar to that used in electric lamps—is prepared of the following dimensions: Hight, one and three quarter inches; diameter, one inch, tapering to three quarters of an inch, and pierced by a tube tapering in the same direction from half to one quarter of an inch. This conical carbon tube is placed, narrow end down, upon an upright oxyhydrogen jet, the compound nozzle of which fits into the narrow end of the inverted cone of carbon. The oxyhydrogen jet is the usual kind of double tube, the coal gas issuing round the oxygen nozzle; and when the gases are ignited, they burn through the center of the cone, which then resembles a small carbon furnace one and a half inches in depth.

The number of these cones to be made corresponds with the number of intensely bright colored flames required. When the gases burn in the ordinary way, scarcely any light results; but in order to produce the desired effects, we spread over the inner surface of a cone, with a spatula, a paste made by rubbing together in a mortar picrate of ammonia, the metallic salt desired, and alcohol. The cones are then allowed to dry at ordinary temperature, and placed over the double tube when light is required. To produce the flame, the oxygen tube, which should be movable in a vertical direction, is raised as high as possible, the coal gas lighted, and the oxygen then turned on. By moving the oxygen tube slowly downwards, and regulating the gas supplies, the point at which the greatest brilliancy is produced can be readily ascertained. The light obtained is very intense and steady while it lasts.

If a white light be desired, sulphide of antimony or magnesium filings can be mixed with the picrate of ammonia; but if it be desired to use the light for showing on the screen metallic spectra, the chlorides of sodium yellow, thallium green, iridium blue, and calcium are most suitable; while Herr Edelmann finds that the chlorates or nitrates of strontium red, barium pale green, and copper deep green, afford the most satisfactory results. For photographic purposes the

antimony would be most suitable, but it should be mixed with the picrate of ammonia with caution.

This plan of obtaining a powerful metallic light is specially recommended for illustrating some of the phenomena of spectrum analysis. At present it is usual to employ the electric light for the purpose of projecting spectra on a screen in order to exhibit them to a large audience. The cost and inconvenience of the electric light is, however, so great as to debar many from trying to exhibit these beautiful experiments. Edelmann now proposes the above plan for producing intensely brilliant metallic flames as a substitute for electric method, and states that he has succeeded perfectly in projecting the spectra on a considerable scale when using the very simple and inexpensive source of light above described.—*British Journal of Photography.*

LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 14.

BRUSSELS, September, 1873.

Leaving Berlin immediately after breakfast by express train, after a ride of four hours across a level and frequently sterile country, which is remarkably devoid of interest, we arrived at the pleasant and quaint old German town of

HANOVER.

Here we dined, and then spent two hours strolling about the principal streets and the noble park, and calling at the celebrated polytechnic school, of which our venerable and distinguished friend, Dr. Karmarsch, is the head. The curious architecture of the older buildings of the town, in which wooden framing with brick filling produce an odd and not unpleasing effect, contrast remarkably with the pretty cottages and fine modern residences which have been built in brick and stucco near the railroad station. Hanover is well known as the capital of the late kingdom of the same name, but is not less widely known as the birthplace of Herschel and the home of Leibnitz.

Resuming our journey toward Cologne, we were entertained by the conversation of an intelligent young Turk, whose place of residence was Constantinople, but who had left his home and his harem to see the great exhibition and to travel in Europe. We were pleased to learn that the women of his country are, at last, offered some opportunities of acquiring knowledge. There are twenty-four advanced schools for young women, in his native city, which are fully attended, the students being from fifteen to eighteen years of age. The seclusion of females is, however, quite as carefully looked to as ever, and our fellow traveller was greatly shocked and surprised by our accounts of the progress and of the aspirations of the strong-minded of the sex in the United States.

Crossing the Rhine on a fine specimen of a very bad kind of iron bridge, the lattice girder, the traveller finds himself in

COLOGNE,

or *Cöln*, as the Germans call the city. It is a curious old town, with exceedingly narrow and labyrinthine streets; but it contains almost nothing to attract the stranger, with the important exception of its great cathedral. This famous structure is well worthy of the reputation it has acquired, notwithstanding the fact that that it is still far from completion, although commenced six centuries ago. Its immense size and its symmetry of form, and the beauties of its architecture, make it probably the finest specimen of the gothic style in existence. The length of the building is something over 500 feet, its breadth 231, and the hight of the principal towers, when finished, will be 532 feet. The ridge of the roof is 250 feet above the pavement, the nave rises 165 feet, and the aisles 80 feet. No description can do justice to this magnificent and colossal pile; and only repeated visits and comparison with surrounding objects enable the traveller to obtain a just idea of its immensity. The gracefulness and the richness of gothic architecture are nowhere in the world, probably, more fully illustrated than in the cathedral of Cologne. The work of completion is now progressing rapidly, but the building has been so long in course of erection that the repairing of the decaying stonework of the earlier must accompany the labor of completing the later construction. The excursion up

THE RHINE

is always anticipated by the traveller in Europe with a degree of interest which is perhaps unequaled by that felt in any other part of his journeyings. And he is probably seldom disappointed. Our little party certainly was not, and the long sail from Cologne to Mayence, occupying the whole day, was one of extraordinary pleasure, while the return next day over the same route was hardly less enjoyable.

There is probably no point on the Rhine at which the natural beauties of the scenery exceed those of our own noble Hudson where it breaks through the Highlands at West Point; no part of the Rhine can equal in its picturesque and wild beauty those northwestern examples of fine river scenery, the Dalles of the St. Louis or of the St. Croix, and nowhere on the Rhine can be found any one spot of as great historical interest as many that might be named in Great Britain; yet it may well be asserted that in no other part of the world can the intelligent traveller and the appreciative observer of Nature find such a combination of these attractions, in one uninterrupted series, as upon this splendid German river, between Cologne and Mayence. Magnificent scenery of ever changing but never intermitted beauty, picturesque old ruins of castles, around which cluster the most interesting and important reminiscences of a thousand years of German history, and each of which is founded upon some promontory or craggy mountain side which itself is often the subject of an old and romantic tradition, or of some still more improbable but none the less interesting fairy tale, in which sprite or gnome or nymph lures an unfortunate victim to destruction or leads him to unimaginable bliss, are seen at every turn. Leaving Cologne, and passing Bonn, the noted *Sieben Gebirge* (seven mountains) rise into view, their rugged sides and ruined castles awakening in the traveller a sensation of mingled admiration, surprise, and interest which is not again lost until he reaches Mayence. On the one side, at an imposing hight, is the splendid old ruin of

DRACHENFELS,

near which Siegfried, the hero of that noble but sanguinary ancient German poem, the *Niebelungenlied*, killed the dragon so many centuries ago. On the other side is Rolandseck, another fine ruin, which has been rendered famous by Schiller, who here lays the plot of his "Knight of Gottenburg." In the river we notice the island in which was immured the beautiful girl who had supposed her long absent lover lost forever, one of the thousands who fell fighting the barbarians of the East; and above, on the top of the overhanging precipice which forms the river bank, is the castle built by the lover after his return from a long imprisonment, and where he spent the remainder of his life, looking down upon the roof which sheltered his lost bride. Farther on, the high rock *Erpelerlei* raises its basalt crest seven hundred feet above the river; and from top to bottom, wherever earth will lie and wherever terraces can be made to sustain them, it is clothed with a mantle of green vines laden with the wine-producing grape.

We pass the old city of

COBLENTZ

and, opposite, the immense fortification of Ehrenbreitstein with its four hundred guns and its immense range of outlying works. It is stated that this almost impregnable stronghold has sufficient storage capacity to provision 8,000 men for ten years, and that the cost of the fortification amounted to nearly ten millions of dollars. We pass the bridge of boats and go on up the river, meeting with beautiful gems of scenery and romantic ruins at every bend of the stream. We pass the extensive ruins of Rhinefels, and the beautiful remains of Rhinestein, the homes of the booty-loving and law-defying old robbers who, in ancient times, took toll of all who passed on the river. We pass around the projecting rock where, sitting high above the stream, the beautiful *Lurlei*, by her entrancing songs, draws the unfortunate fishermen resistingly into the raging whirlpool at her feet. Then we pass the two old castles, which, confronting each other, are called the "Mouse" and the "Cat." Near Bingen we see an island in the middle of the stream on which is an old tower, and, overlooking it from the river bank, is the equally old castle of Ehrenfels. Here, according to tradition, the rich and avaricious old Bishop Hatto (of Southey's ballad) stored his grain in the tower, and lived in comfort in his castle, while the people, far and near, were dying of famine. Holding his grain in expectation of a rich harvest of gold when the highest attainable price should induce him to sell, the miserly wretch finally removed, for safety, to the tower where he could better watch his treasure, as well as defend himself against the attack of the maddened people. He was there destroyed by an army of starving rats, which gathered from all directions to feast upon his stores, and to visit upon the wicked proprietor a righteous judgment. We pass

JOHANNISBERG,

the source of the finest of Rhenish wine, and, steaming along through a more level and less beautiful country, we gaze with intense interest upon the scenes which were, centuries ago, so attractive to Charlemagne, and which were so often visited by his successors.

At Mayence we find another bridge of boats, and we watch the operation of opening and closing, to allow the passage of vessels, with some curiosity. The rapidity and ease with which a section is dropped down with the current and swung out of the way is as remarkable as is the difficulty and the slowness with which it is hauled back into its place. Near the bridge are several *schiffmühle*, grinding away very busily, and, about them, are several small boats, either bringing grain to be ground, or taking to the city the flour which has been prepared for the market.

Some distance lower down, we passed a dredging machine, anchored in midchannel and dredging most effectively, its machinery driven, like the *schiffmühle*, by great paddle wheels turned by the current. With unusual reluctance we left this beautiful valley of the Rhine, the most fruitful of all regions of poetry and romance, and pursued our journey westward. A few hours were spent at

AIX-LA-CHAPELLE,

an interesting old town in which we found another of the great German technical schools. With a splendid building, erected by private contributions of public spirited citizens, a fine corps of instructors, and a small but well selected and increasing stock of apparatus, and more than full of students, this school is doing its share of the important work which is so rapidly bringing continental nations into successful competition with Great Britain, in industrial pursuits. The current expenses of the institution are defrayed by the State.

Another moderately long ride by rail brought us across the frontier, and we made our next stop at

LIEGE,

Belgium, near which busy and pleasant city is the town of Seraing and the great establishment of the *Société Cockerill*, the largest of its kind in Belgium and one of the largest in the world. It was this Cockerill company which exhibited the immense blast furnace blowing engine, which, with their locomotive and marine engines, formed so striking a collection in the machinery hall of the great exhibition. The principal works are situated in the valley of the Meuse, six miles from Liége and upon a great coal formation which constitutes one of the principal deposits of Belgium. The works were founded by Cockerill Brothers, a half century ago, for the purpose of manufacturing steam engines and flax spinning machinery. The first blast furnace was erected in 1826.

The establishment now comprises four collieries, producing annually about 350,000 tuns of excellent bituminous coal, thirty iron mines from which are raised 150,000 tuns of ore per year, five blast furnaces yielding 55,000 tuns of pig iron, four new blast furnaces for the production of Bessemer metal, which are still unfinished, two iron and one copper founderies turning out 5,000 tuns of excellent castings, a rolling mill which turns out 40,000 tuns of rails and other sorts of rolled iron, a large steel works containing ten Bessemer converters and producing 17,000 tuns of steel per annum, a forge which has an annual production of 1,500 tuns, large machine shops employing 1,500 workmen, a bridge and boiler shop in which are built 6,000 tuns of boilers and bridges annually and, beside all this, the company has, at Antwerp, a large shipbuilding yard.

THE SERAING ESTABLISHMENT

covers an area of 200 acres, and employs 9,000 workmen. On the place are over 250 steam engines, having a collective power of 8,000 horses. Two millions of dollars are paid annually in wages, 350,000 tuns of coal are consumed, and the annual receipts from sales amount to five or six millions of dollars. This immense establishment has grown up from the small beginnings of John Cockerill and mainly through his energy and business capacity. The great engineer is now deceased, and the works are carried on by the "Société John Cockerill" among whom, it is said, is no less a personage than the King of the Belgians. The coal raised from the shafts within the works is of fine quality, and cokes well. The coking is done partly in ordinary ovens, and partly in Appold kilns, which are said to work finely. The coke is hard, clean, and bright, and seems capable of sustaining a burden nearly equal to that borne by the celebrated English Durham and Newcastle coke.

Pig iron for ordinary purposes is made, of very good quality, from ores of the neighborhood, but ores are imported from Spain and from England for Bessemer pig. Molding sand, fire brick, and fire clay are obtained from the neighborhood, and thus the principal part of the raw materials used in the works is obtained from deposits close at hand.

The castings made in the founderies are unusually smooth and clean. The work turned out in the machine and boiler shops is exceedingly creditable. An important feature of the practice here is the use of steel for nearly all moving parts of machinery. It has displaced iron almost entirely in forged work, and, to some extent, it is substituted for iron in even cast pieces. This introduction of steel has taken place here more than at any other place which we have ever visited, and the general success here met with may be taken as an indication of one of the directions in which improvement is going forward. The new steel plant will be expected to produce one hundred and fifty tuns per day of Bessemer metal. The riveting in the boiler and bridge work is, wherever possible, steam riveted. The work, in all departments, seems invariably well done, and is finding a market in all parts of Europe, and, to some extent, even in Great Britain and the United States.

The workmen are paid about three fourths as much here as in Great Britain. Molders receive about seventy-five cents per day, puddlers a dollar to a dollar and a half, pattern makers seventy-five cents, machinists from seventy-five cents to a dollar, riveters seventy cents, and foremen in the several shops from one to two dollars. A day's work is twelve hours, nominally; actually it is sometimes less and not infrequently more. A few women are still employed in the lighter kinds of labor.

The workmen of Belgium are probably more nearly equal in skill to the English mechanics with whom they compete than are those of any other European country.

R. H. T.

Solidification of Nitrous Oxide.

According to Wills, nitrous oxide may be easily solidified by causing a rapid current of air to pass through the liquified gas. Differing in this respect from carbonic acid, nitrous oxide may be kept liquid for some time in open vessels. Carbonic acid solidifies, as soon as it escapes from its containing reservoir, because the tension of the vapor of the solidified acid, even at the moment of its formation, is considerably superior to atmospheric pressure; while liquid nitrous oxide attains —133° Fah. and solidifies at —146°, so that the tension of its vapor is weaker than one atmosphere. The density of the liquid protoxide at 32° Fah. is equal to 0·9004; its coefficient of dilation is very considerable. It is insoluble in water.

A CORRECTION.—In our article on "Specific Heat," on page 208, current volume, the expression (lines 45 and 46) "Specific heat at temperature 39° 1° (T)—1(C)," should read: "Specific heat at temperature 39° 1°—1; specific heat at temperature T—C."

IN Saginaw county, Mich., a poor man named Reif, while boring a well, is reported to have been greatly frightened by the upward flow of gas, the escape of which shook the earth, produced a noise like thunder, and, when fired, shot up a flame fifty feet high.

Recovery of Silver from Cyanide Baths.

Dr. Graeger states that there are many methods of accomplishing this object; but none have been so easily carried out or have obtained enough of the silver as to be satisfactory. The process recently described by Ney, in which the silver was precipitated as a chloride by the addition of muriatic acid, had both these faults. The silver was not all precipitated, the subsequent treatment of the precipitate was not a simple one; and beside, the operation was attended with a strong evolution of prussic acid, which is extremely unpleasant to many persons, not to say dangerous to life.

"By accident," says Dr. Graeger, "I discovered a method of obtaining all the silver in a very simple and easy manner, and one that may be operated by persons who are not chemists. It is based upon an observation made by myself that cyanide of silver is perfectly reduced to metallic silver by grape sugar, provided the solution contains no free alkaline cyanides (cyanide of potassium or of sodium). The cyanide of potassium present is destroyed by adding a suitable quantity of a solution of green vitriol, which converts it into ferrocyanide of potassium. Then grape sugar will reduce the silver in the alkaline solution. In carrying out this method, the silver bath, which has become useless, is allowed to settle, and is then decanted into a large iron kettle, where it is warmed, and protosulphate of iron slowly added until a slight precipitate (oxide of iron) is formed, which does not disappear on stirring. It is next heated to boiling and made strongly alkaline by adding caustic soda or potash, if necessary; and a solution of grape sugar is then added gradually until the liquid acquires a brownish yellow color. The heat is now to be removed and the precipitate allowed to settle, after which the clear solution is removed by means of a siphon, and the sediment, consisting of metalic silver and oxide of iron, is thrown on a filter, washed, dried and ignited. This residue is then treated with nitric acid, which dissolves all the silver and but little of the oxide of iron. The very last trace of silver in the bath is thus separated and dissolved in nitric acid. To test this process, the following experiment was made: 0·85 gramme nitrate of silver was dissolved in 5 cubic inches distilled water, and chloride of sodium, sulphate of copper, sulphate of zinc, caustic soda and carbonate of soda added, together with enough cyanide of potassium to produce a perfectly clear solution. One third part of this solution was treated with a suitable quantity of sulphate of iron, heated to boiling, and the glucose added. The precipitate obtained, when treated as above and tested volumetrically with chloride of sodium solution, showed 0·238 grammes of nitrate of silver; this taken three times = 0·814 grammes instead of 0·85 gramme taken, or 84 per cent. A second experiment gave 94·5 per cent. These results are very favorable, especially when we consider that we were dealing with a solution containing only 4 parts of silver in 10,000 of water. It is a striking phenomenon that not a trace of the copper, which was purposely added to test this point, was reduced by the grape sugar."—*Polytechnisches Notizblatt.*

Recent American and Foreign Patents.

Improved Sheet Metal Roofing.

Edward C. Hegeler and Frederic W. Matthiessen, La Salle, Ill.—This invention consists in the employment of fine corrugations of the metallic sheets used in the construction of roofs, and for similar purposes, and the arrangement of the corrugations in the direction crosswise to the pitch of the roof, also crosswise to the length direction of the gutters, eaves troughs, etc. This fine corrugation may be made one eighth of an inch deep by half an inch in width, or in other proportions. It can be very fine and still allow by its curvings the expansion and contraction of the metallic sheet in the direction crosswise to the corrugation, and thus allow of the bending of the sheets transversely to the corrugation sufficiently to permit the use of the various modes of uniting the sheets of roofing now practiced.

Improved Mode of Attaching Journals to Feed Rollers.

George M. Amsden, South Boston, Mass.—This invention consists in making shafts with ends flaring conically outward, around which the rollers are cast. Screws and nuts on the shaft just beside the rollers draw the journals tight into the holes of the former in case they become loose through any cause.

Improved Doubletree Equalizer.

Wm. Martin, Clarence, Iowa.—This invention relates to double trees that are usually pivoted to the tongue of a vehicle or the end of a plow beam to allow a certain amount of vibratory movement. It consists in remedying the objectionable looseness on the beam or tongue and the want of a proper limitation of the motion of the said doubletree by extending rearwardly the place of the center bolt, and placing in front a friction device which holds the doubletree steady until a greater force is applied at one end than the other, and which, at the same time, regulates the extent of its motion.

Improved Bridge.

Benjamin F. Davis, Hearne, Texas.—This invention consists in a novel method of constructing the arches and chords of truss bridges by successive layers of planks nailed together, and at the extremities of banded and braced wedges.

Improved Adding Machine.

Solomon Pool, Chapel Hill, N. C.—This invention consists in the use of concentric circles with partitions between them, turning upon a revolving plate, around a common center; the circles divided into two or more sections, and the sections into ten spaces each, and so arranged that when an inner circle is turned ten spaces, it turns the next outer circle one space, by means of a drop catch falling through a graded opening in the partition between them, from the outer circumference of the inner circle, and catching teeth arranged on the inner circumference of the circle. The teeth are so graded as to allow the drop, working loosely when down in the opening of the partition, to slide over them when the outer circle is turned backward.

Improved Car Coupling.

Wm. H. Waddell, Lyttleton Waddell and John A. Lutz, Churchville, Va.—This invention consists in a spring-pressed lever in rear of drawhead, provided on one end with a foot piece by which the other end may be removed from over the link hook and allow it to rise; in a treadle and a grapple hook to hold the lever; in a grapple hook bar and trigger, so contrived that the latter lifts the former and allows a spring-pressed lever to turn back and ock the link hook; and finally in the combination of the essential parts so as to form an improved car coupling.

Improved Fruit and Egg Carrier.

Courtenay J. Simmons, Kansas City, Mo.—The invention consists in an egg or fruit carrier made of a series of rows of cardboard pentagonal cells, having their bottoms held thereto by a U-shaped clamp and fitted in obtuse angled recesses on the inside of the end pieces of frame.

Improved Porter's Box.

Isaac Barman, Portland, Oregon.—This invention consists in a box for the use of porters in stores, warehouses and similar establishments, the object of which is to provide a convenient place for the tools and materials used by them in their work. It has apartments, a receptacle for nails, stencils stencil brush, ink, etc., conveniently and compactly arranged.

Improved Steering Apparatus.

William E. Thomas, Queenstown, Md.—This invention relates to means by which rudders may be worked in steering ships, vessels, or boats, and consists in combining with the rudder a sprocket wheel, chain and reversely threaded screws rotating in opposite directions, also in connecting sliding the pinions with screws.

Improved Lemon Squeezer.

Edward M. Sammis, Babylon, N. Y.—This invention has for its object to furnish an improved lemon squeezer, so constructed that a whole lemon may be put into it and the juice expressed without its being necessary to first cut the said lemon, and which will prevent the juice from squirting out over the operator. The invention consists in the knife secured in the cavity of a lemon squeezer; in the arrangement of the knife in the cavity of a lemon squeezer in an inclined position; in the slit or notch formed in the knob or projection, and in side flanges which overlap the side edges and thus prevent the juice from squirting out.

Improved Lamp.

John C. Wharton, Nashville, Tenn.—This invention consists in the construction of a lamp in such manner as to interpose a body of water, or other incombustible fluid, between a small quantity of oil in contact with the wick and the main body of oil contained in a separate reservoir; also so as to supply the flame automatically with oil from said reservoir through the water to the wick: also, in certain cases, when a more complicated but safer lamp is desired, to isolate the oil contained in a suitable reservoir from all contact with any atmosphere whatever, thus preventing the possibility of ignition within the lamp.

Improved Combined Chair and Secretary.

George C. Taylor, Thibodeaux, La.—The object of this invention is to furnish a convenient piece of furniture for family or business use, which combines the advantages of an arm chair, secretary, writing table, drawers, etc., if used by a business man or invalid, with those of a work receptacle, scrap bag, needle and thread repository, etc., if used by a lady. The whole is portable, and may be easily moved to any desired place. The invention consists mainly in combining an arm chair with a case or secretary having movable pigeon hole arrangement, drawers, and folding leaves, with drawers under the seat of the chair, and casters on one side under the secretary to be lifted by the arms of the chair and rolled about.

Improved Coal Breaker.

Rufus A. Wilder, Cressona, Pa.—This invention consists in casting teeth on both sides of the rack plate composing the cylindrical breaker, so that the plate, when the teeth on one side are worn, can be reversed and used on the other side.

Improved Harvester Reel.

Charles F. Goddard, St. Ansgar, Iowa.—This invention has for its object to furnish an improved harvester reel, which shall be so constructed that the driver may conveniently adjust the reel bars, so as to bring leaning grain upon the platform. The invention consists in the reel shaft, made in two parts, provided with grooved and recessed flanged collars at their inner ends. The reel shaft is made in two parts, having flanged collars formed upon their inner or adjacent ends, the flanges of which are securely belted to each other. In the adjacent faces of the flanges are the reel arms which are bent inward at right angles, so as to enter a small disk placed in a cavity formed to receive it in the central parts of the flanged collars, which cavity is made larger than the disk, so that the said disk may be moved longitudinally in a recess with relation to the shaft. The inner part of the shaft is made hollow to receive a rod which passes through it, and to the inner end of which is attached the grooved disk. With the outer end of the rod is connected one end of a lever. The other end of the lever extends back into such a position that the driver can readily operate it with his foot to adjust the reel bars.

Collecting Dust in the Manufacture of White Lead.

Micaiah Tolle, St. Louis, Mo.—The object of this invention is to utilize the lead dust which escapes in white lead factories after having passed through the separator in which the corroded lead has been separated from the uncorroded lead, so that a considerable saving be accomplished, and the health of the workmen be protected against the deleterious influences of the lead dust. The invention consists, principally, in the combination of an elevator with a casing or spout, through which the uncorroded lead is conducted on the elevator, which is submerged in a tank of water, so that the lead dust carried down from the separator is retained therein, and the uncorroded lead carried up by the elevator.

Combing and Mixing Tampico and Bristles.

George Willett, Burlington, assignor to Enoch B. Whiting, St. Albans, Vt.—This invention consists of movable endless chain holders, to which the tampico and bristles are carried by endless belt carriers and so presented to said holders that they project about half their length or more from the side as they are carried slowly along past a comb, so arranged and operated that it combs out the projecting portions thus subjected to it. The invention also consists of a combination, in one machine, of two of these movable holders and combs with endless carrier belts so arranged that they take the partly combed stock from the first holders and comb, and reverse and transfer it to the second holders, so that the uncombed portion is presented to the second comb to be completed by it. The stock is laid on the endless carrier belts a little in advance of the holders, and spread and mixed as evenly as possible, so that it combs together. It may be run through the machine several times till the mixing and combing are satisfactory.

Improved Clothes Reel.

Dennis L. Huff, Bay City, Mich.—This invention relates to the horizontal evolving reels used for hanging clothes to dry; and it consists of an arrangement of tie rods or braces upon the upper side of the arms to reinforce and protect the spider in which the inner ends of the arms are secured.

Improved Rotary Engine.

Francis J. Hollenweger, New Rochelle, assignor to himself, Joseph Martin, and Charles F. Spaulding, of New York city.—This invention relates to two steam chambers and a rotary piston arranged between them, having similar spiral cavities in their adjacent faces. The chambers are provided with passages for the induction and eduction of the steam, and with passages for conducting the steam from the inlet to the outlet, passing successively through the cavities, so as to retain the steam and cause it to act by expansion upon the piston, causing said piston to make several revolutions before said steam reaches the outlet. The steam, acting upon both sides of the piston, balances it and limits its friction. The chambers are provided with bolts to enable them to be accurately adjusted to faces of the piston, and with grooves for containing water of condensation for lubricating said faces and packing them steam tight.

Improved Combined Water Cooler and Filter.

William J. English, Providence, R. I.—This invention consists of a double cased filter with a dead air space between; also of a partition in the inner case, dividing it into two compartments—one for the ice and the water to be filtered, and the other for the filtered water, with a filter in the bottom of the former compartment, arranged in three divisions, through which the water passes successively, the first and last containing gravel, and the middle one charcoal. The filter is also arranged with a sloping top, against which the filtering substances pack by granulation, so that the water must pass through them.

Improved Machine for Sorting Potatoes.

David M. King, Garrettsville, O.—This invention relates to means whereby potatoes may be simultaneously screened and sorted; and consists in two inclined endless screens, the fine one arranged with its upper end projecting and sifting out only the dirt, while the latter is coarse and sifts out all the unmerchantable potatoes. It also consists in using cords and weights to operate with hooks in holding the bags.

Improved Letter Envelope.

John D. McAnulty, No. 127 South Ninth, corner of Fourth street, Brooklyn, E. D., N. Y.—This invention consists of a lock formed in the flaps of a paper envelope by a T shaped slit in one, and a dovetail-shaped tongue in the other, so contrived that by folding the tongue, inserting it in the slit, and then unfolding it, a practicable lock is formed, which, when sealed, cannot be opened without mutilating the envelope to such extent as to clearly show that it has been opened. An engraving of this device was published on page 190, volume 28 of the SCIENTIFIC AMERICAN.

Improved Machine for Making Window Sash.

James Travers, Roslyn, N. Y.—This invention is a device for facilitating the manufacture of window sashes; and consists in a guide for governing the position of the stiles and meeting rails of the sashes in sawing the dovetails and mortises for putting them together.

Combined Chest Protector and Shirt Bosom Support.

John A. Aston and Charles C. McMurphy, Leavenworth, Kan.—The object of this invention is to supply to the public a chest protector made of some stiff material, so that the same may serve also as a support to the shirt front, and not only keep the chest warm and comfortable but prevent also the ungainly folds and wrinkles of the shirt front. This invention consists of a piece of stiff pasteboard or other material covered by linen, flannel, or similar fabric, and suspended around the neck or otherwise applied to the chest.

Improved Tyre Tightener.

Milo E. Jacobs, Winnebago, Ill.—The object of this invention is to provide a device for tightening tyres, when cold, around the wheel without removing them, so that the same are fully protected and strengthened when in use. It consists of the tyre with two ends, so constructed that they are recessed to pass beside each other, and rest with face plates toward the fellies, to be tightened by means of a screw bolt passing through them.

Improved Manufacture of Dies for Punching.

Robert J. Mullin, Providence, R. I., assignor to himself and Michael R. Hanley, of same place.—The object of this invention is to improve the die used for the cold punching of nuts, washers, jewelry, etc., so that they are more durable, require less steel, and offer a greater punching surface. The present difficulty lies in welding the steel and iron parts of the dies together so that the face does not break off in hardening, or when working with it. The invention, which is intended to overcome this trouble, consists in welding the steel into the iron base, flush at the top and extending to within a short distance from the bottom, so that there is a greater depth of steel and greater strength, as the iron part surrounds the steel core.

Improved Machine for Dressing Wood Rails.

Horatio G. Angle, Chicago, Ill.—This invention consists of a small truck on ordinary wheels, and have lateral guide wheels adapted to run along the wood rails or stringers after they have been laid. Vertical and horizontal rotary planing tools are arranged in advance of the front wheels to plane the upper and inner surfaces of the stringers as the truck is moved along. The planing is gaged by the wheels of the truck, and the planing tools are operated by belts and pulleys in the ordinary way, driven by steam or by any power. The depth of the cutting on the upper surface is regulated by a vertical adjustment of the frame on the front truck axle, and the adjustment of the vertical cutters for turning curves and the like is effected by a lateral adjustment of the frame at the rear relatively to the axle and wheels

Improved Eaves Trough Hanger.

Thomas F. Palm, Toledo, O.—This invention consists in one continuous wire, passing around and over the eaves trough, and which is provided with loops and fastened ends.

Improved Grinding Mill.

Ephraim H. Austin, Scott's Hill, Tenn.—This invention pertains to improvements in grist mills of the ordinary kind, having special reference to the means of feeding the grain to the spiral passages in the eye of the runner, and the means of connecting the water wheel, shaft and spindle of the runner.

Improved Turbine Water Wheel.

Angus A. Herriman, Greensborough, N. C.—The object of this invention is to so improve the gates and chutes of a water wheel that an unbroken sheet of water is admitted to strike the wheel without any space for expansion or break of the water, whether the gate be fully or partially open, so that thereby the greatest attainable percentage of power with a partially drawn gate is obtained. The invention consists in the arrangement of flexible wings or guide plates in connection with a circular sliding gate and the chutes.

Improved Windmill.

Ovett B. Knapp, Brandon, Wis.—This invention relates to that class of pumping windmills in which an oscillating regulator vane with automatic apparatus for working it so as to take the wind or not, and another to turn the wheel which has non-adjustable vanes edgewise to the wind for stopping it, are used; and it consists in having the oscillating regulator vane arranged below the shaft on which it is suspended and around which it oscillates, whereby it is made more sensitive to the effect of the wind, and is controlled better than when pivoted at the middle or above it.

Improved Sled Brake.

Peter Cable, Elizabeth, Ill.—This invention consists in the arrangement of a toggle lever having a rule joint and projecting arm or brace for attachment of the operating rod, whereby a dog pivoted to the runner may be caused to take into the snow, and is held in that position without continuance of the force necessary to apply at the outset.

Improved Corpse Cooler.

John Hoffman, Toledo, Ohio.—The object of this invention is to furnish, for the use of undertakers and others, an improved cooling and ventilating casket, through which a constant current of fresh cold air is supplied which carries off all gases of decomposition, conveying the same to the chimney, window, or other place, so that dead bodies may not only be preserved a greater length of time without difficulty, but also without causing annoyance by foul and putrid odors. The invention consists of a casket connected with ventilating pipes or tubes, and a cooler which sends a current of fresh air through apertures of the casket, the cooler forming at the same time one of the supports for the casket.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From September 9 to September 18, 1873, inclusive.

AUTOMATIC VALVE.—G. L. Kitson *et al.*, Philadelphia, Pa.
BLAST FURNACE.—B. Ray, Hudson, N. Y., *et al.*
BRACKET.—J. B. Morrison, Brooklyn, N. Y.
BRAKE.—E. P. Jones (of Shell Mound, Miss.), London, England.
BRIDGE.—J. B. Eads, St. Louis, Mo.
BRIDGE.—J. B. Eads, St. Louis, Mo.
CLOCK CASE, ETC.—C. W. Roberts, Chicago, Ill.
COTTON SCUTCHING, ETC.—A. T. Atherton, Lowell, Mass., *et al.*
DIAMOND CUTTING MACHINE.—I. Hermann, New York city.
ENGINE VALVE.—W. J. Stevens, New York city, *et al.*
FEED WATER INDICATOR.—A. S. Goodrich *et al.*, New York city.
HECKLING MACHINE, ETC.—J. Rhuck, Easton, Pa.
MAKING FERTILIZER, ETC.—J. J. Storer, Boston, Mass.
PAPER BAG.—E. J. Howlett *et al.*, Philadelphia, Pa.
PUDDLING PROCESS AND FURNACE.—W. Sellers, Philadelphia, Pa., *et al.*
RUBBER TUBING, ETC.—C. Bigelow, New York city.
SCREW PRESS.—G. P. Boomer (of Syracuse, N. Y.), London, England.
SCREW VALVE.—P. Corrigan, New York city.
STEAM BOILER AND CONDENSER.—B. T. Babbitt, New York city.
TELEGRAPH PAPER, ETC.—T. A. Edison, Newark, N. J.
TOY.—T. Alexander, Washington, D. C.
TRANSMITTING MOTION, ETC.—T. A. Weston, Ridgewood, N. J.
TRAVELING SIDEWALK.—A. Speer, Passaic, N. J.
WINDMILL.—A. P. Brown, New York city.
VENTILATING AND PUMPING.—G. W. Richardson, New York city.
WASHING MACHINE.—T. Bell, Catskill, New York.
WEIGHING SCALES.—S. Harris, Philadelphia, Pa.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Cheap Engines and Pipe for Sale. See Brady & Logan's Advertisement, page 253.

Chicago Exposition—See Abbe's Bolt Forging Machine and Palmer's Power Spring Hammer, there on exhibition. S. C. Forsaith & Co., Manchester, N.H.

Wanted—New or second hand tools, of following description: One Lathe of about 42 in. swing; 16 ft. Shears; one horizontal Boring Mill to bore up to 30 in. cylinder; one Planer about 32 in. by 32 in., 8 ft. bevel. Parties offering will name makers, state where tools can be examined, and the lowest cash prices. Address P. O. Box 3132, New York City.

Wanted—A machine to separate gravel from and temper clay for brickmaking. J. H. Roberts, Box 49, Pensacola, Fla.

Wanted—Breech loading dbl. bl. C. F. Guns made. Only the Iron work files and fitted. No Stock. Makers, please address E. A. F. Toepperwein, Gunsmith, Leon Springs, Bexar county, Tex.

E. S. Proctor, Moss Bluff, Texas, wishes information how to prepare Spanish Moss for this market.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, Page 389. Circulars free. J. W. Sutton, 96 Liberty St., N.Y.

Tool Chests, with best tools only. For circular, address J. T. Pratt & Co., 53 Fulton St., New York.

Turning, Sawing, or some article in wood to make wanted. Charles Sperry, Westbrook, Ct.

For Sale—An interest in a well established, profitable manufacturing business, capable of great enlargement, for which personal assistance and additional capital is wanted, to the amount of from ten to thirty thousand dollars. The goods made are in extensive permanent demand, the machinery used is simple, and the right of manufacture exclusive. Any active man or company desirous of securing a good and substantial business and first rate article for manufacture, will find this a *bona fide* opportunity. Address F. C. Beach, Box 773, New York city.

Kindling Wood Splitter. Makers, please send address to N. A. Wright, Oswego, N. Y.

Steel Stamps made by Douglas, Brattleboro', Vt.

Engines, Boilers, &c., bought, sold and exchanged. All kinds constantly on hand. Send for circular. E. E. Roberts, 52 Broadway, New York.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable W. D. Andrews & Bro. 414 Water st. N. Y.

Dovetailing Machines and Surface Planers, by A. Davis, Lowell, Mass. Send for circular.

Cabinet Makers' Machinery. T. R. Bailey & Vail.

Reliable Steam Engines, Boilers, &c., 2 to 200 H.P. High grades—for sale at two thirds cost. E. E. Roberts, 52 Broadway, New York.

Wanted—A Cylinder, 6 or 8 ft. in dia. and 50 to 60 ft. long, suitable for treating wood. Address Baugh & Sons, Philadelphia, Pa.

Engines, &c., received for repairs and sale. 10 per cent commission and cost of repairs deducted when sold. E. E. Roberts, 52 Broadway, New York.

Sewing Machine Needle Machinery—Groovers, Reducers, Wire Cutters, Eye Punches, &c. Hendey Brothers, Wolcottville, Conn.

Machine Shop & Foundry for sale—For particulars, address Wagoner & Matthews, Westminster, Md.

$500 will buy the Right of a Toy Gun, hunting scene combined. Address George Stackhouse, Mount Washington, Pa.

Key Seat Cutting Machine. T. R. Bailey & Vail.

English Roof Paint, all mixed in oil ready for use, 50c. a gallon, 116 Maiden Lane, New York.

Patent Petroleum Linseed Oil works in all paints as Boiled Linseed Oil. Price only 50cts. a gallon, 116 Maiden Lane, New York.

Rayner & Bro., Thin Board Manufacturers, 12 Cannon St., N. Y., have 6 of A. Davis' 17 inch Planers.

Patent Chemical Metallic Paint—All shades ground in oil, and all mixed ready for use. Put up in cans, barrels, and half barrels. Price, 50c., $1, and $1.50 per gal. Send for card of colors. New York City Oil Company, Sole Agents, 116 Maiden Lane, New York.

2nd hand Engines, &c., Bought, Sold, and Exchanged—300 on hand. E. E. Roberts, 52 Broadway, N.Y.

We sell all Chemicals, Metallic, Oxides, and Imported Drugs; also, "Nickel Salts" and Anodes for Platers, with full printed directions on Nickel, in pamphlet form, which we mail, on receipt of fifty cents, free. A Treatise on "Soluble Glass" we mail for $1 also. Orders will receive prompt attention by addressing L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

The Leclanché Battery Co. supply the best battery for Burglar Alarums, Bells, &c., No. 40 West 18th Street, New York.

Save money by ordering Machinery of Gear, Boston, Mass.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mf'g Co., 30 Cortlandt St., N.Y.

Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Mercurial Steam Blast & Hydraulic Gauges of all pressures, very accurate. T. Shaw, 913 Ridge av., Phil.

For patent Electric Watch-clocks, address Jerome Redding & Co. 39 Hanover Street, Boston, Mass.

Catalogue on Transmission of Power by Wire Rope. T. R. Bailey & Vail.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Portable Hoisting and Pumping Engines—Ames Portable Engines—Saw Mills, Edgers, Burr Mills, Climax Turbine, Vertical and Horizontal Engines and Boilers; all with valuable improvements. Hampson, Whitehill & Co., Newburgh Steam Engine Works, Depot 28 Cortlandt Street, New York.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

2 to 8 H.P. Engines, Twiss Bros. N. Haven, Ct.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

For best Presses, Dies and Fruit Can Tools Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N.Y.

Stave & Shingle Machinery. T. R. Bailey & Vail.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail, Lockport, N. Y.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

L. H. Mace & Co., Refrigerator Manufacturers, 115 E. Houston St., N. Y., have 2 of A. Davis' Dovetailing Machines.

No inconvenience is ever felt in wearing the New Elastic Truss which retains the Rupture, night and day, till cured. Sold cheap by the Elastic Truss Co., 683 Broadway, New York.

Buy Iron Planers, Upright Drills, of Gear, Boston, Mass.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Bookkeepers should try the Olmsted Patent Bill File and Letter Clip. They are admirable for all papers. Save their cost in one day's business. Sold by all Stationers. J. H. White, Newark, N.J. Sole Manufacturer.

Foundry and Machine Shop for Sale—A good location for all kinds of work, and manufacturing Agricultural Implements. Good reasons for selling, and description of property given. Address John Ziegler, Muscatine, Iowa.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.

Steam Fire Engines, R. J. Gould, Newark, N.J.

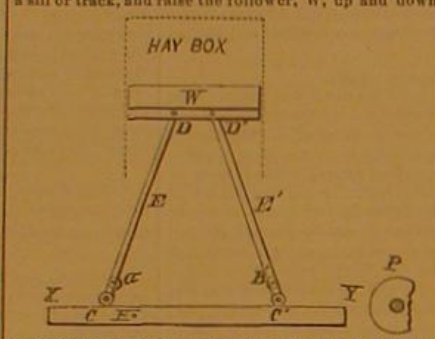
The Olmsted Oiler is the best; it is self-righting, strong and cheap. All Hardware and Tin Houses have it.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Notes & Queries

C. C. says: I have a hay press which works in the following manner: E and E' are levers with track wheels at the lower end, C and C', which roll on X Y as a sill or track, and raise the follower, W, up and down



in the hay box. A chain is fastened to a pin in the side of the track, H, then passes over a pulley at B, thence over a pulley at A, thence over a second pulley at B, thence over a second pulley at A, thence to the power, P. A power of 1,600 lbs. is pulling on the chain at P; what will be the pressure on W, when the levers are 3 feet farther apart at the bottom than at the top? The levers are 8 feet 8 inches long. What power is gained by the 4 pulleys when one end of chain is fixed as above? [Problems involving the principle of this machine have been solved in our paper on several previous occasions. But as this is rather an ingenious combination, perhaps some of our readers may like to work it out.—EDS.]

E. C. M. proposes the following problem: A hemisphere has its base fixed in a horizontal position, and a body, under the influence of gravity, moves down the convex side of it from the highest point. How far from the base will the body be when it leaves the surface of the hemisphere? [This is a very interesting problem, which we throw open to competition among our readers, as we judge it will be more profitable for them to answer the question themselves, than to read our solution. It will be necessary to assume some force acting which will impel the body down the surface of the hemisphere with a given velocity, as it is evident that, if the body were balanced at the highest point, it would remain at rest.—EDS.]

W. J. asks: Is there any kind of gas that will cause iron to rust, or to form a hard coating on it in 12 or 24 hours?

W. J. B. asks: How can I prepare umber from the crude earth?

W. asks: How is silk numbered? Woolen yarn is in "uns of 1,600 yards to the pound, that is, 10 runs yarn is 10 times 1,600 yards to the pound: cotton is in hanks of 840 yards to the pound, so that No. 100 cotton is 100 times 840 yards to the pound.

Z. Y. asks: Will some one please explain the best way to make a wagon wheel?

G. C. McC. asks: How can I enamel bricks so that they will not take in water from the outside of the wall?

C. M. N. asks: How can I make out the dates on worn coins? I am aware of course of the use of the microscope, but is there not something else?

Answers to Correspondents

E. B. H. will find information for making a microscope on pp. 276 and 288, vol. 27.—F. W. P. can make linseed oil varnish by following the directions on p. 152, vol. 28. The lifting power of balloons is detailed on p. 89, vol. 25.—J. C. W. should consult a local geologist. We do not know the nature of the soil in which the tree was found.—J. P. J. will find directions for making hard rubber on p. 378, vol. 28. Type metal is composed of lead, tin and antimony; it can be readily cast in a plaster of Paris mold.—J. C. G. can make his blackboard by following the directions on p. 299, vol. 28.—G. T. H. will find the explanation of time around the earth on p. 401, vol. 28.—J. H. W. will find that the three formulas are the same, and it matters not which form he uses. Muspratt is undoubtedly correct.

D. asks: What is mildew on textile fabrics? Can it be removed, and how? Answers: 1. Mildew consists of microscopic fungi, the growth of which is produced by moisture and a close atmosphere. 2. A remedy for mildewed linen is as follows: Soap the surface of the articles well and rub into them, while wet, finely powdered chalk.

S. D. E. says: I want to construct a 15 inch reflector in this wise: First, I make a reflector of cast iron, and a grinder to match, and grind the surfaces to a proper curve: then I tin the reflector over, and put a sheet of pure nickel, say one thirty-second of an inch thick, between the shell and grinder, and heat till the tin flows. When cold, I grind till the two meet all over, coat with pitch, and polish. Will this make a good reflector? If so, what should the focal distance be of the above size and how large must the small reflector be? Gregory's plan (see illustration) was to reflect the light back through a hole in the large reflector. Is this plan the best? If not, what is? I want to construct the instrument in the most approved manner. I can easily polish a reflector, but cannot make a refractor. By making the base of cast iron it need not be over ¾ inch thick, if ribbed, while a speculum metal one should be 2 inches



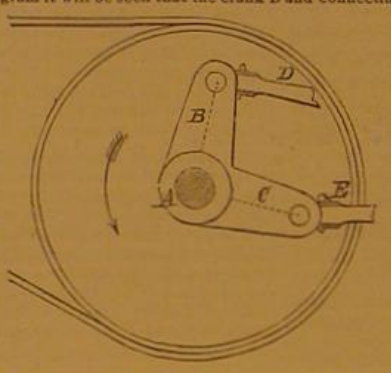
thick to stand handling. Answer: You had better polish the iron, and nickel plate it after you get a good figure. The Newtonian plan is most convenient. The diagonal mirror reflects the cone of rays at right angles to the eyepiece at the side of the telescope tube. Your previous inquiry was answered on page 139 of our current volume.

J. W. asks: Is there any liquid which will take blots or writing off paper without spoiling the appearance of the paper? Answer: Try a strong solution of oxalic acid, applied with a camel's hair brush. Heat the solution if possible before using. Oxalic acid is a poison.

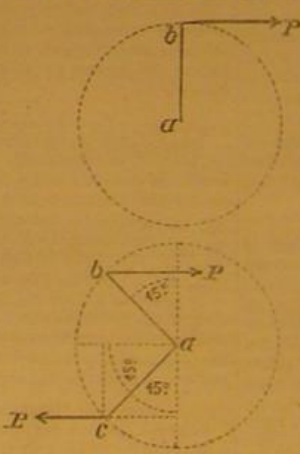
G. G. asks: What is a cheap and durable mode of putting gilt or silvered lettering on glass to have it look neat and tasty? Answer: Glass can be gilded or silvered by blending powdered gold or silver leaf with gum water and a little borax and applying the mixture, or painting the letters on the glass by means of a camel's hair pencil. The article is then heated in an oven or furnace to burn the gum and vitrify the borax, which cements the gold or silver to the surface. It is afterwards polished with a burnisher.

J. B. P. asks: How can I increase the draft of my furnace? The boiler has 39 three inch tubes; smoke stack is 24 inches in diameter and 40 feet high. Would an addition of 5, 10 or 15 feet, to hight of stack, help it? Would a blower introduced into smoke stack above the flues be of use? Answer: Apply your blower in the usual way, below the furnace.

W. D. N. says: I am not satisfied by your answer to Y. E. about his engine and shaft. If, as you say, a shaft were just strong enough to transmit 12 horse power, of course the thirteenth horse would be the feather that would break the camel's back. But I claim that twice (approximately) the power may be transmitted without endangering the shaft, provided it be ample to bear the strain of 12 horse power. By referring to the diagram it will be seen that the crank B and connecting



rod D are at a right angle, at which point (if I comprehend you) is the maximum moment of strain. The crank, C, and connecting rod, E, are nearly on the back center, and consequently are exerting no particular force at all. But as soon as that cylinder takes steam, C and E begin to exert a twisting or wringing force upon the shaft A; increasing it until they reach the point occupied by B and D. In the meantime, B and D have been relaxing their force as fast as C and E have increased theirs, and at the same time; therefore it follows that the shaft is not endangered because the force is no greater at any point of stroke, but more power may be transmitted for the reason that this same maximum moment of strain is continuous during the entire revolution, each engine being an auxiliary to the other to assist it over the dead centers, without suffering a relaxation or suspension of force (not motion) during any part of the stroke or revolution. Answer: We will try

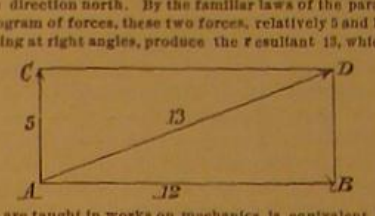


and make our meaning plain, by the aid of the accompanying diagram. In the case of the single engine, exerting a pressure P on a crank a b, supposing, for the sake of simplicity, that all the positions of the connecting rod are parallel, the maximum twisting moment is P×a b. Now add a second crank, at right angles to the first, with same pressure P on the second crank pin and the position of maximum strain, or the point at which the greatest twisting moment is exerted, will be as represented in the sketch, when each crank is 45° from a vertical position. In this case, the twisting moment is P×a b×cos. 45°+P×a c×sin. 45°=P×a b×2×sin 45°=P×a b×$\frac{4}{\sqrt{2}}$=P×a b×1·413. Hence the maximum strain in the second case is 1·413 times as great as in the first.

C. H. H. says: I am running a 9x14 engine in a saw mill, driving a 60 inch circular saw with a 90 inch top saw. Sometimes the piston rod makes a grating noise in the stuffing box; at others, it runs still. I have partly overcome the trouble by raising the ways. What is the cause? Answer: The trouble may be caused by leaks, for want of oil, or because the engine is out of line. It would be necessary for us to make an inspection, before giving a decided opinion.

J. E. H. asks: 1. What is the philosophy of hardness, that is, what is there about one substance that makes it harder than another? 2. Let iron and steel be the substances: why is it that, by heating iron and plunging it into cold water, it will harden the iron? 3. How many elements will fire take out of wood? 4. Will light pass through common window glass faster or slower than, or in the same time as, through the atmosphere? Answers: 1. Hardness is the quality of bodies by which the molecules maintain their relative positions when a force is applied. One substance is harder than another, when it takes more force to disturb the position of its molecules. 2. When a metal is hardened by being tempered, it is supposed that a different arrangement of the molecules takes place. 3. Wood contains water, carbon, oxygen, and from 1 to 5 per cent of ash. When the wood is burned, all the constituents, except the ash, combine with the oxygen of the air. 4. Light passes through glass more slowly than through the air.

E. C. M. says: A force, A B, acts at A in the direction east, while A C acts at same point, A, in the direction north. By the familiar laws of the parallelogram of forces, these two forces, relatively 5 and 12, acting at right angles, produce the resultant 13, which



we are taught in works on mechanics is equivalent to the components 5 and 12. This we can admit in the sense of equal in effect, but as indicating measure of force, 18 is not equivalent to 5+12=17, evidently. What has become of this force 4, which appears in components and not in the resultant? Answer: It is well known that if we apply a force to produce motion in a given direction, only so much of that force as acts in the required direction tends to produce motion. The rest of the force is, in general, apparently lost; but in reality, it is converted into something else. For instance, suppose that pressure is applied to a pump handle in a direction oblique to its axis; then some of the force either compresses the fibers of the handle, in which case it is converted into heat, or it produces greater pressure on the pivot of the handle, when it appears as friction. Take the case given in your illustration, and suppose that a force of 13 acts obliquely on the pump handle: it may be replaced by two forces, one of 12, at right angles to the axis, tending to produce motion, and another of 5, in the direction of the axis, producing end pressure. Here we have replaced a force of 13 pounds by two forces having a volume of 17 pounds, and it may be asked, how did we obtain the additional four pounds? But the answer to this question is, quite evidently, that we gained pressure by making the force act in a different direction, and that all the apparent gain was counteracted by the fact that part of the increased force acted at right angles to the direction of the motion.

F. L. S. says: A book tells that "the area of a circle is found by multiplying the circumference by half the radius." Elsewhere it says: "It follows, then, that the area of a circle is equal to the square of the radius multiplied by the circumference, or 3·1416." It seems to me there is great difference between the half radius and the square of the radius. There must also be a great difference between the circumference and the ratio between circumference and diameter. The number 3·1416 I take to be the ratio. Can you explain this? Answer: The circumference of any circle is equal to the product of the diameter and the ratio of the circumference to the diameter, which latter is constant for all circles, and is expressed approximately by the number 3·1416. Hence the second rule, as quoted by you, making the circumference of any circle and the number 3·1416 synonymous, is wrongly expressed. The number 3·1416, besides representing the ratio between the circumference and the diameter of any circle, is the circumference of the circle in the particular case in which the diameter is equal to one. You can readily correct the rule, by inserting, after the term "circumference," these words: "of a circle whose diameter is unity."

W. H. Y. says: In your answer to T. O'N., you say: "When transmitting power with a quarter turn belt from one horizontal shaft to another, also horizontal, at right angles to it, guide pulleys are generally employed." Not so if said shafts are directly over one another, or at any reasonable distance, providing the receiving side of pulley be in a line with the delivering side. Answer: The case you mention is a special one, and does not militate with the statement that in general guide pulleys are employed. We are glad, however, that you have called attention to the matter; and it would have been better if we had mentioned the exceptional case in our answer.

S. M. asks: In the case of a cast iron plunger, about 3 inches long and ¾ inch in diameter, having to work perpendicularly, how will it do to have the hole in which it works cast large, and fill in Babbitt metal around the plunger to make it work steadily? Will it work true and run well if not oiled? The plunger is flat on one side of its section. Is there any other composition that would do better? Answer: The device mentioned by our correspondent has been tried with satisfactory results.

E. M. K. says: On page 362 of volume XXVII, C. E. G., tells D. G. N. to use a butterfly valve on his engine. We are running a 25 horse power engine at 75 revolutions, belting on to 52 feet of 2 inch line shafting, and thence to a saw mandrel. When we are sawing wide boards (with a 52 inch saw) the governor does not let steam on quick enough. Why cannot we use a butterfly valve on it, and let our saw run well, instead of slacking down in the log from 12 to 24 inches? We use the same engine to run a grist mill with—1 run of stones, 2 grinding wheat and 2 corn. The saw mill stands still when the grist mill is running. I have been thinking of putting a string on the rod that carries the pea that steadies the governor so as to open the governor quicker. Will it work, and will the butterfly valve work on this engine? The balance wheel weighs about 3,000 or 4,000 lbs. Answer: There are governors in the market with valves that will give full opening. The butterfly valve, arranged as you propose, is often used.

B. W. asks: Will wire rope wear well in suspending clock weights? Answer: We think you will find it very durable.

W. R. A. asks: Would a boiler 5 feet long by 14 inches diameter be large enough to drive an engine inches bore x 4 inches stroke? If not, what size would it require? Would such an engine drive a boat 16 feet long, 3 feet wide and 2 feet deep, and at what rate? Answer: You will find general directions as to boiler proportions in answers to previous correspondents. It is impossible to answer questions of this kind, unless more data are sent.

S. A. T. says: 1. What will make a soft waterproof varnish for muslin, one that will not crack? I have constructed an umbrella with 7½ feet ribs, making a diameter of 15 feet; it is covered with muslin, and I wish to varnish it. 2. Can you give me the recipe for Worcestershire sauce? Answers: For a waterproof varnish, take of india rubber 1¼ ozs., bisulphuret of carbon 1 pint; digest in the cold until the solution is complete. Or take linseed oil 1 gallon, dried white copperas and sugar of lead, each 3 ozs., litharge, 8 ozs.; boil with constant agitation until it strings well, then cool slowly and decant the clear portion. If too thick, thin down with quick drying linseed oil. 2. We have never made any chemical examination of this article to determine its composition. Recipes will be found on pp. 249 and 281, vol. 26.

A. J. C. asks: Can water be carried over a hill 50 feet high with a siphon, or can it be raised any higher with a siphon than it can be raised by suction? If a siphon were laid over a hill 50 feet high and filled with a force pump, and the pump removed, would the water run out, or would 33 feet perpendicular hight of water remain in the tube with a vacuum in the tube above, provided the tube was perfectly airtight? Answer: The difference of level between the highest point of the siphon and the level of the water that supplies it must never be more than the hight to which the water will rise, by the pressure of the atmosphere, in a vacuum.

S. M. L. asks: 1. Of what material should I make a pair of rollers for drawing stalks between? The drawing will make considerable friction. Should they be of iron or wood? Would wooden rollers, with a covering of belting or rubber, be preferable to either? 2. The stalks being of unequal size, it is desirable to have the rollers fitted in rubber sockets, so that they will open for large stalks and close on small ones. This would prevent me from having the rollers connected by gear wheels. Would the friction of one roller upon the other be sufficient to draw the stalks through? It is not my object to have the stalks crushed. 3. These rollers being about four feet from the driving power, can I derive the same desirable effects from the rollers by having them driven by a small belt or endless chain as I would by having them driven by gear wheels? 4. Would I derive any benefit by using a fly wheel on the rollers? 5. In preparing a model for the Patent Office, is it necessary that the model be made of the same material that it is designed to construct it of in manufacturing for general use? Or may brass or other soft metals be used instead of iron? Answer: 1. A very common way of effecting this object is by means of cast iron rollers having projecting teeth, which catch the stalks. 2. Rollers which open, driven by gearing, are in use on many clothes wringers. 3. A belt would probably give the best results. 4. We think not, but could not answer certainly without knowing more about the proposed machine. 5. A model for the Patent Office may be made of any convenient material.

N. S. A. asks: Does frost or hoar frost ever form if the mercury stands at any point above 32° Fah.? Answer: Hoar frost is frozen dew, and is never formed at a higher temperature than 32° Fahrenheit. It is true, however, that a thermometer placed in the vicinity might mark a higher temperature, because frost is sometimes formed by rapid evaporation of moisture from the surface of the ground, so that the temperature is lower than that of the surrounding atmosphere. But if some of the frost were collected and placed on the bulb of the thermometer, it would cause the mercury to fall to 32°.

W. W. McC. asks: How are iron, copper, and brass pipes bent for use on locomotive engines, such as for pumps, injectors, sand, heater and blower pipes? Are they bent hot or cold; and if cold, are they filled with anything, such as resin, solder, or lead? Answer: Small copper pipes are generally filled with resin, and bent without being heated. Curves in large copper pipes are formed by hammering the separate pieces before they are brazed together. Small wrought iron pipes can be bent by heating them and applying pressure carefully. They are not generally filled with anything. Large iron pipes of special form are generally made of cast iron, from patterns.

T. W. H. asks for a correct rule for figuring the amount of power from a given number of cubic feet of water, the fall being also given. Answer: Let Q=number of cubic feet of water discharged per minute, h=hight of fall, measured vertically, in feet. P=horse power of the water. $P=(Q\times h\times 62{\cdot}5)\div 33{,}000$, or the horse power of the water is equal to the product of the quantity of water discharged per minute, the hight of the fall, and 62·5, divided by 33,000. Example: What is the power of a water fall, 10 feet high, discharging 50 cubic feet of water per minute? $P=(50\times 10\times 62{\cdot}5)\div 33{,}000=0{\cdot}947$ horse power. All this power cannot be realized by the application of a hydraulic machine, but an amount, varying from 15 to 80 per cent of the whole, will be lost.

C. D. asks: How is iron, such as porcelain kettles, etc., enameled? What are good books on the process? Answer: Iron vessels are enameled by first cleaning with dilute sulphuric acid; the porcelain mixture is then applied in the form of a paste consisting of calcined ground flints, borax and potter's clay; and when this coating has set or become firm, the enamel is sifted over the surface, and then fused in a furnace. For details, consult Tomlinson's "Cyclopædia" and the article on enameling in Brewster's "Edinburgh Cyclopædia."

D. G. H. asks: 1. Is there an easy and thorough method of curing membrane, such as bladder, so that it will be dry, soft, tough, inodorous and durable? 2. I have read in your journal of a new substance, harder than asphaltum, for covering roads. Can you refer me to it? Has any trial been made of it in your city, and with what result? How will it do for cellar floors? 3. What is fuchsin? Answer: 1. There is no easy process. The best method, probably, is that for preparing goldbeater's skin, which is tedious and difficult. 2. "The Coming Pavement" was published on page 16 of our present volume. 3. Fuchsin is a brilliant red color made from coal tar. See page 73 of our volume XXIV.

J. M. asks: 1. Can a wire rope be employed as a belt to run over two pulleys of 16 and 40 inches diameter, respectively, making the 40 inch revolve 50 or 60 times a minute, so as to be trustworthy? 2. How should the pulleys be made? Answers: 1. Yes. 2. Consult a manufacturer.

W. C. A. asks: What gives to Russia leather its peculiar finish and smell, and what kind of skin is used? Does the odor proceed from some article used in the process of tanning or dressing? Why is it not manufactured in other countries as well as in Russia? Answer: Russia leather, known as *juchten*, has long been esteemed for its valuable qualities of resisting moisture and the attacks of insects. Russia was long the only country that produced it, but it has lately been made in Paris. Its odor and peculiar qualities are attributed to the oil of birch bark with which it is impregnated after tanning. In Russia this leather is manufactured from all kinds of skins; but in Paris only sheep and goat skins are used. The method of preparing this article is not very generally known out of the seats of manufacture, but the following details will give an insight into the process: The dried skins are softened by soaking in water for five or six days in summer, ten or twelve in winter, and then well cleansed and deprived of their hair, by steeping in milk of lime. During the steeping the skins are frequently examined; and when the hair and epidermis are detached, they are worked upon the beam with knives. The hair is removed from ox and cow hides by piling them upon one another and thus inducing fermentation. For more delicate skins, bran water baths are sometimes used. The usual steeping and heating, etc., are afterwards given, and then the clean skins are introduced into a vat, holding a fermented menstruum of rye, oatmeal, salt and leaven. These are left here for 48 hours or longer, until raised. The tanning process is then begun by first steeping the skins in an infusion of oak or willow bark, and afterwards they are interstratified in a tan pit with layers of coarse willow bark, and charged with the liquor of the last steep. Fresh bark and solution are substituted for the exhausted material, every fifteen to twenty days, and from three to six such changes are required, according to the thickness of the skins. Very thin skins get but two. After this tanning process, the leather is immersed for a day or two longer in a thin paste of oatmeal, salt and water to remove its rigidity, and then cleaned and allowed to drain. The currying then begins. The moist leather is placed, grain side downwards on a table and treated with a mixture of oil from sea calves and that distilled from birch bark. One part of birch oil and two parts of the other is the standard composition. About 9 ozs. of the mixture are used to each medium sized skin, and it is laid on carefully in a uniform and entire coat. The skins are then stretched upon cords in an open shed and left so till dry.

B. F. W. asks: Is there any way of dissolving gum benzoin so that it will mix with linseed oil? 2. Is there any way to harden the surface of common window glass? If so, how is it done? Answer: Gum benzoin will only dissolve sparingly in linseed oil. Digest the gum in the oil with frequent stirring. 2. There is no method, that we are aware of, of making the surface of window glass any harder than it ordinarily is, yet preserving its transparency.

P. O'B. asks for a formula for preparing adhesive mucilage. Answer: The ordinary mucilage sold at the stationers is far inferior to the old fashioned solution of gum arabic. This mucilage seems to be a solution of dextrin or British gum. Dextrin is formed by the action of dilute boiling acids, or by an infusion of malt at about 160° Fah., on starch. It is also formed when potato starch is exposed to a heat of about 400° Fah. You can make gum dextrin, on the large scale, by observing the following process and proportions: Malt (crushed small) 1 lb., warm water 2 gal., mix, heat the wnole to 145° Fah., add potato starch 5 lbs., raise the heat to 160° or 165° Fah., mash for 25 minutes, or until liquid becomes thin and clear. Then instantly run off and raise to boiling point to prevent formation of sugar. After boiling 3 or 4 minutes, filter and evaporate to dryness by steam heat. There are various other processes, but we cannot determine whether you could make a reasonable profit by manufacturing.

J. F. asks: Can a man give power enough to saw cord wood by a cog wheel with 120 cogs on which is a crank, a pinion wheel with 18 cogs, and a balance wheel 60 lbs. in weight, with a wooden wheel 4 feet in diameter for a drive wheel, with a belt attached driving the saw, the pulley on the saw shaft being 7 inches diameter? Answer: Yes; but as there is always a loss from friction, etc., with every connection, he can probably do better with the old fashioned buck saw and horse, if he is sound in the back.

M. L. L. says: When we see a chain of lightning pass from the clouds to the ground, say at a distance of four miles, we feel no jar until we hear the report. What is it that causes the jar and makes the windows rattle? Is it caused by the sound passing through the air, or is it caused by the electricity coming in contact with the earth? Answer: The jar that you speak of is probably due to the disturbance of the air.

E. P. M. asks: What are the inside dimensions of a square box flume, one mile in length, to be placed under ground and capable of carrying from 1,000 to 1,200 or 1,500 inches of water, it being fed from a reservoir giving eight feet head? Will the pressure of water in the reservoir overcome the friction in the pipe so as to give an outlet to the water on a level with the bottom of the reservoir? Answer: You do not furnish enough data to enable us to determine the size of the the box. In our article on "Friction of Water in Pipes," on page 48 of our current volume, you will find information as to loss of head. The box should be set so as to preserve the level or fall.

A. L. R. asks: 1. Does not an inside cylinder locomotive draw a passenger train more steadily than an outside cylinder engine of the same size? If so, is not an inside cylinder engine better as a passenger locomotive? 2. What good book would you recommend on locomotives? Answer: 1. We think not. 2. Weissenborn's work, now in course of publication.

A. M. asks: 1. Can I braze or solder brass to brass? If so, what kind must I use? 2. Is there any book published that will give me an idea about breech-loading rifled cannon and small arms? Answer: 1. Use spelter solder and sal ammoniac. 2. The specifications and drawings issued at the Patent Office are divided into classes, and those of any class are sent for ten cents each. Breech loaders are in class 18. We cannot advise you as to a trade in your locality.

E. T. L. asks: Where a book of recipes is compiled from various sources, and few if any of the recipes, processes, etc., are original, does the copyright of such a book protect it from being published in part by others, or prevent others from copying from it? In other words, what does the copyright cover in such a case, the whole book, the arrangement, or only the title? Answer: Matter which has already been published cannot be protected by copyright. The copyright of such a book as you mention would cover the title and the original matter only.

W. A. B. cannot remove the scale from his boiler. Answer: Send us a specimen of the scale.

W. S. P. asks: 1. If an engine of sixteen horse power be applied to pump atmospheric air into another engine of same dimensions, will the engine No. 2 which is worked by air have the same number of horse power as engine No. 1? 2. If so, what temperature will the air be heated to while undergoing such pressure between the two engines? 3. If the air be exhausted in a large pipe or tunnel, 4 feet in diameter and 100 yards long, open at the end furthest from the exhaust, what would be the temperature in any part of the pipe or tunnel? 4. Will compressed atmospheric air work a concentric rotary engine? Answers: 1. No. 2. You will find a table of temperatures due to pressure on page 155 current volume. 3. This question could not be answered without knowing the size of the compressing cylinder. 4. Yes.

P. J. T. says: What are the proper dimensions of a boat to run with an engine 3½ x 4 inches? Please state diameter and pitch of screw wheel. 2. What sized boiler is best suited for the same? Answer: 1. Boat from 25 to 30 feet long. Screw from 1½ to 2 feet in diameter, 3 feet pitch. 2. Boiler with about 100 square feet of heating surface.

H. A. F. asks: How can I cure a dog that is troubled with a humor or vermin, I hardly know which? Answer: Your animal is probably suffering from mange. Administer flowers of sulphur internally, and wash externally with carbolic soap.

T. R. F. asks: Can any of the readers of the SCIENTIFIC AMERICAN inform me where anhydrous sulphuric acid (SO_3) and nitric acid (NO_5) can be seen? Answer: We have no doubt that Professor Chandler of the School of Mines, Columbia College, would give our young correspondent an opportunity to see what he wants in the fine laboratory of that institution.

C. E. asks for a description of the vulcanizing process. Answer: A full description of the vulcanizing process would be too lengthy for this place. It consists in combining sulphur or the mineral sulphurets with india rubber. The discovery of the singular action of sulphur on caoutchouc was made by Charles Goodyear, of New York, in 1842. See specifications of patents of Charles Goodyear, 1842, and of Thomas Hancock, England, 1843.

W. F. H. asks: Is cider boiled in an iron kettle injurious to the health? If sweet cider be brought to the boiling point, then skimmed and strained and barreled up tight, will it keep sweet during the summer? Answer: We would not risk boiling cider in an iron kettle, either as regards health or for the purpose of preserving it. Boiling would cause its change to vinegar more quickly than anything else. We will give you a process which has proved successful, but which the trade may consider trade secrets. To 1 barrel of new cider, add ½ part sugar and 2 handfuls of fish sounds to clarify. Let stand 2 weeks in cool place, then rack off into a well washed cask or barrel, and add from 1 to 2 dozen whites of eggs; let stand another two weeks, and then rack off into another barrel. Add finally 2 gallons of whisky, stirring well, then bottle. This cider will keep sweet through the summer.

J. S. asks: Is a safety valve 3 inches in diameter large enough for two boilers 16 feet long, 44 inches in diameter, with four 12 inch flues in each? How do you obtain the proper diameter for a safety valve for any sized boiler? This is my rule; is it correct? From six tenths to eight tenths of a square inch area of valve for each square foot of grate surface. Answer: We expect soon to publish some remarks on the proper proportions of safety valves, giving most of the rules in common use. You will find some rules in back numbers of our paper. Your allowance agrees well with the practice of many engineers.

H. asks: Can you suggest a cheap and quick method of restoring a badly smoked ceiling other than scraping it? Answer: Wash the ceiling with a brush and abundance of clean water, and then whitewash.

J. W. asks: What are the principal surface indications of a lead or silver vein, and does said vein always keep in one direction? If so, will it not terminate at some point? Answer: The ores of silver belong chiefly to primitive rocks, and occur in veins which traverse granite, gneiss, micaceous and argillaceous slates, greenstone, sienite, hornblende and porphyry. They have also been observed in veins which traverse graywacke, compact limestone, etc., but seldom or never in more recent secondary rocks. Galena, or sulphuret of lead, usually contains more or less silver, and occurs most frequently in secondary rocks, especially in compact limestone. In Silesia, galena occurs in a bed of brown ferruginous marl, in the famous mines of Missouri in red clay, often marly, containing masses of quartz and resting on limestone; in Pennsylvania in limestone; in New York traversing a slaty rock; in Massachusetts at Southampton the bulk of the vein is quartz; in Maine in granite. Veins are often divided into several branches which sometimes terminate in the contiguous rocks and sometimes wind and return into the principal vein.

W. asks: What is the difference in the weights of a ball that weighs 10 pounds in air and the same ball 100 feet under water? Answer: Under water, its weight would be diminished by the weight of an equal volume of water.

C. F. H. asks: How can I guard against the deleterious effects of the dust arising from emery wheels and belts used in grinding and polishing iron and steel? Is there any kind of shield, that can be worn by a workman, that will prevent the fine metallic particles from finding access to the lungs? Answer: Put a hood over the wheel and run a small pipe to an exhaust air blower. The suction will take off all dust. This plan is used in many establishments, one blower serving to take the dust from several wheels.

A. F. G. says: I accidentally found that I can temper gun or other springs under the hammer by using the following recipe: 1 oz. corrosive sublimate and 1 oz. sal ammoniac, a few handfuls salt, dissolved in water, putting fine salt in the smithy fire while at work. Dip your hammer in the solution and keep the anvil wet all the time. Work the steel till nearly cold. This will give the required temper without any other process. Answer: We do not think that your chemicals have much to do with your success in tempering steel, but the welding, hammering and gradual cooling have a great deal.

D. R. K. states that the lamp black in his ink for marking packages floats at the top of the fluid. Answer: There is no method of preventing the lamp black from rising to the top, unless you make the fluid thick enough or of sufficient consistency to hold it, as it will not dissolve. We offer you a recipe for a marking ink, which we hope will prove better and cheaper than the other: Lamp black (previously heated to dull redness in a covered vessel), ¼ oz., triturate with good black ink, gradually added, 1 pint. Observe similar proportions.

S. W. G. asks: I wish to elevate water 115 feet in half a mile, from the spring to a reservoir, from which I have 23 feet fall to the ground; what is the best means for the purpose? Is not the hydraulic ram the best for a stream only large enough to fill a two inch pipe? What per cent of volume could be elevated to that hight, and what size of pipe would be the best? Answer: We would not like to give a decided opinion on such a matter without knowing more about it. A good engineer should be consulted in a case like this.

B. P. asks: Is there any method by which I can utilize the domestic supply of water for motive power? Would a small turbine wheel attached to the water pipe furnish sufficient power to run three printing presses? Answer: A small turbine would do the business. Some years ago we witnessed the operation of the large presses of the *Traveller* newspaper in Boston by means of a turbine, and probably you can get the information you wish at that establishment.

H. asks: Can I warm a room 15x20 by the aid of a gas stove in order to make it sufficiently comfortable for a sitting and sleeping room? Answer: Unless your room is exposed, or has a large glass window surface, you could probably make it comfortable by means of a gas stove. But unless you can provide a small pipe to carry off the products of combustion, we would not advise you to use it.

G. A. W. asks: 1. What are the uses of collodion, and (2) of what is it made? 3. What are the best solvents for the same? Answers: 1. Collodion is extensively used in the art of photography, in combination with chemical agents that are sensitive to light. It is also used in surgery, both in the natural state and combined with medicinal substances. As a dressing for wounds, it unites the cut or torn surfaces closely, and prevents the action of the air; and it being transparent, the wound can be inspected when necessary. 2. Collodion is gun cotton or pyroxylin dissolved in a mixture of alcohol and common ether. Pyroxylin is made by immersing clean carded cotton for 4 or 5 minutes in a mixture of equal parts of concentrated nitric and sulphuric acids. The cotton is then squeezed free of acid, afterwards washed thoroughly and finally carefully dried by hot water or steam at a heat not higher than 180° Fah. 3. Collodion will dissolve Venice turpentine, castor oil iodine, etc.

A. B. asks: How is fire communicated to the gas in a kerosene lamp, thereby causing an explosion? Is it through the wick, or does it take fire from the heating of the lamp? Answer: Generally there is a leak; and when the oil gets low, the space above it is filled with gas, which is thus readily inflamed. In the case of very poor oil, the heat is sufficient.

R. W. asks: How can I make blue and green glazing for common earthenware? Can I make a glazing without melting the ingredients into glass before it can be applied to the work? Answer: A glaze for common earthenware is made as follows: White lead (pure) 53 parts, quartz or ground flints 36 parts, Cornish stone or felspar 16 parts, white flint glass 5 parts; reduce to an impalpable powder, grind with water to a very thin paste, dip and fuse. This may be colored blue by oxide of copper, added in quantities according to the shade desired. Earthenware may be glazed by throwing common salt into the heated furnace containing the ware.

T. W. D. asks: What substance is there, the vapor or fumes of which, expelled or liberated by heat, will bleach vegetable substances on a large scale? Sulphur will not do. Answer: Chlorine is probably the most effective bleaching agent known; and in the form of chloride of lime is very extensively employed. You can use gaseous chlorine instead of the usual solution of chloride of lime, and in the same way as sulphurous acid gas. The vegetable substances must first be boiled in a weak solution of soda or potash to remove resinous matters, grease, dirt, etc., and then hung up after washing, in a capacious room, into which chlorine gas is admitted. You can make chlorine as follows: In a leaden retort, capable of being heated by steam underneath, mix cautiously oil of vitriol and water each 7 parts, and allow to cool. Add, when cool, common salt 4 parts mixed intimately with peroxide of manganese 3 parts. The gas comes off slowly at first, but a gentle heat causes it to rush forth in large quantities.

J. W. H. says, in reply to H. M., who asked how to make good ice cream: Take 1 gallon of good milk or cream, the yolks of 18 eggs, 1½ lbs. of sugar, and 2 vanilla beans; and you will have the ingredients for 1 gallon of vanilla ice cream. Any other flavor may be used. Take the yolks and the sugar (well pulverized) and beat them well together. Mash the beans well and add them. Put the milk over the fire, boil it, take it off, add the eggs, etc., and again boil it, being very careful not to burn it; in a few minutes take it off. Let it get cool, after which you may freeze it in the ordinary way, and you will have nice ice cream.

J. D. replies to a querist, who asked if a 12 horse power separator will run harder with tumbling rods than with a belt: "If you drive with an engine, it will take 20 horse power to stand with rods what 10 will do with a belt. I know this by experience."

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

I. O.—Your pebbles are quartz. The largest one is colored by oxide of iron. They are of no value.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Patent Systems. By T. W.
On the Marsupialia. By N. B. H.
On Flying Spiders. By T. C. E.
On the Witch Hazel. By S. F. C.
On a Proposed Balloon. By J. C. W.
On Cooking Stoves. By D. R. W.
On Poisonous Undershirts. By J. N.
On Patent Rights. By H. A. W.

Also enquiries from the following:

A. Y. H.—A. G. G.—W. E. W.—A. B. C.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

September 16, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alloy to resemble silver, A. E. F. Bandvin 142,789
Anchor, C. A. Chamberlin 142,789
Arm pit shield, J. Sibley 142,875
Bale tie, G. Bredle 142,894
Bale tie, F. Cook 142,772
Bale tie, J. McMurtry 142,808
Bale tie, cotton, O. E. McClean 142,832
Bath, vapor, J. Biller 142,767
Bed bottom, spring, G. W. Brown 142,895
Bedstead fastening, C. Wolf 142,973
Beer, cock for drawing, J. Moffet 142,869
Bell, door, E. B. Sims 142,958
Belt shifting mechanism, T. Reeve 142,814
Bending sheet metal, W. F. Kastler 142,921
Blasting plug, D. Shoemaker 142,918
Boat detaching apparatus, H. Ashford 142,834
Boat, life, J. Adams 142,893
Boiler feed, R. Rafael 142,886
Boiler flues, etc., cleaning, T. H. Donohue 142,778
Boot edges, etc., trimming, C. J. Addy 142,756
Boot soles, trimming, J. C. Ratelle 142,942
Boot soles, forming, C. H. Brigham 142,893
Boring machine, coal, D. Shoemaker 142,950
Boring machine, bit for, D. Shoemaker 142,949
Box, porter's, L. Barman 142,888
Box, work, E. Hinckley 142,786
Bridge, J. R. Durfee 142,776
Bridge, J. M. Goodwin 142,785
Brush machine, E. A. Hill 142,913
Brush, wash board, and roller, I. Hussey 142,853
Buckle, harness, K. Frazer 142,907
Bustle, M. Boupart 142,764
Butter coloring compound, G. Bogart *et al* 142,891
Calendering machine, D. Schofield 142,872
Can for paint, etc., O. E. Walker 142,971
Cane, needle for weaving, D. C. Mosher 142,808
Car axle, Ahrens & Gerhard 142,757
Car coupling, W. W. Haver 142,849
Car coupling, J. V. Reed 142,943
Car coupling, S. B. Replogle 142,815
Car coupling, W. F. Senior 142,873
Car coupling, J. E. Smith 142,818
Car coupling, Taylor & Withington 142,962
Car coupling, P. M. Thompson 142,965
Car coupling, Waddell & Lutz 142,970
Car door, operating, J. A. O'Hare 142,810
Car, sleeping, J. T. & D. B. Leighton 142 923
Car stove, railroad, A. Reese 142,867
Car ventilator, S. C. Maine 142,799
Car ventilator, A. J. Morrison 142,807
Car wheel, Tiranoff & Kousskoff 142,968
Car wheels, mold for casting, J. B. Tarr 142,821
Carpet, B. Scott 142,947
Carpet rag looper, F. G. Egger 142,778
Carriage clips, die for forming, E. Meeker 142,804
Carriage lock blanks, cutting, Insull *et al* 142,854
Carriage top prop, L. W. Blessing 142,889
Cartridge, Logan & Hart 142,924
Caster, table, H. Fachs 142,905
Casting metals, core for, O. D. Hunter 142,790
Cesspools, etc., cleaning, J. P. F. Datichy 142,840
Chain, ornamental, W. F. Davis 142,841
Chimney cowl, G. H. Garderwine 141,909
Cisterns, cut off for, C. Wuerz 142,822
Clamp, Payne & Imhof 142,938
Clock calendar, N. T. Worthley 142,975
Clock calendar movement, G. R. Williams 142,829
Cloth cover, painted, W. D. Richardson 142,868
Cloth measuring device, O. B. Holbrook 142,787
Coal and rock cutting machine, H. F. Brown 142,896
Cock, stop, J. W. Birkett 142,763
Coloring from vegetables, L. M. F. Bretonniere 142,892
Compass, beam, N. Toulmin 142,823
Condenser, surface, H. C. Bucknam 142,766
Corpse preserver, H. Kersten 142,919
Dental composition, G. F. J. Colburn, (r) 5,572
Disinfectant package, W. P. Tenny 142,963
Drill, rock, W. Weaver 142,824
Drilling machine, Thorn & Haven 142,966
Eaves trough hanger, T. W. Bailey 142,758
Eccentric, J. C. Butterfield 142,898
Egg carrier, C. J. Simmons 142,952
Engine, explosive, J. M. Welbourn 142,980
Engine governor, steam, R. W. Gardner 142,846
Engine governor, steam, S. P. Ruggles 142,869
Engine valve, steam, H. I. Hoyt 142,788
Fence, portable, W. W. Potts 142,865
Fence post, J. Gibbs 142,910
Fence post, E. King 142,795
Fire place, J. M. Irwin 142,791
Fish dressing machine, Kelsey & Hosmer 142,918
Gage and alarm, pressure, N. Toulmin 142,969
Gage, machinist's, S. H. Bellows 142,761
Gas, illuminating, W. H. Sterling 142,959
Gear, trotting, H. Schmalhausen 142,871
Glass blowing machine, S. L. Fleishman 142,845
Grinding cylinder heads, J. Sherrell 142,874
Harness bench iron, Thornton & Latta 142,967
Harvester, J. W. H. Doubler 142,903
Harvester, J. G. Perry 142,811
Harvester, J. D. Wilbur 142,828
Harvester, corn, J. Kilborn 142,920
Harvester rake, S. D. Locke 142,798
Harvester reel, J. Werner, Jr 142,881
Harvester binder attachment, W. L. Sanford 142,870
Hay, etc., loading, J. H. Bean 142,836
Hinge for lounge, A. Spieyel 142,957
Hinge, spring, S. Joyce 142,855
Hinge pivot, solid belted, J. J. & L. Crooke 142,774
Ice cream freezer, C. E. Simmons 142,951
Ice tongs, E. C. Johnson 142,916
Iron and steel, welding, J. Popping 142,939
Key board, transposing, A. D. B. Wolff 142,974
Kiln, lime, J. L. Messer 142,805
Lawn seat, W. C. Metcalf 142,927
Leather, coloring, Koppitz & Mayer 142,797
Locomotive smoke stack, J. Hughes 142,851
Locomotive spark conveyer, etc., E. A. C. Fox 142,906
Loom stop, electrical, G. F. Lufbery 142,925
Malt dryer, P. Schuff 142,916
Mattress frame, Whittlesey & Peters 142,827
Mattress, tightening wire, D. J. Powers 142,940
Medicine case, M. O. Baldwin 142,887
Metals, testing strength of, T. Olsen 142,937
Mills, bolt for grinding, J. T. Noye 142,809
Miter box, J. P. Tierney 142,879
Molding machine, W. J. Roda 142,880
Needle hooks, forming, N. Paine 142,863
Nut lock, H. C. Lowe 142,858
Nut lock, C. H. Taylor 142,877
Ore washer, I. T. Halstead 142,848
Packing, piston, C. A. Hodge 142,914
Paddle floats, adjusting, J. B. Baptista 142,835
Pail, milking, A. J. Johnson 142,917
Pan, bake, J. G. Metzker 142,928
Piano, bell, C. G. Buttkereit 142,768
File supporter, C. West 142,972
Pinchers, die, W. E. Snediker 142,953
Pipe, coupling for, D. Jones 142,792
Pipe elbows, forming, H. B. Morrison 142,929
Pipe, bending metal, J. Sargent 142,945
Pipe patterns, mold for, N. P. Bowser 142,765
Pipes, etc., making drain, A. Müller 142,930
Planing machine, S. W. Nelson 142,936
Planing cutter head, J. D. Kimball 142,794
Planter, corn, M. Knickerbocker 142,922
Plow, C. Marsh, 2d 142,800
Plow point, reversible, R. M. Pattillo 142,864
Plow, wheel, Terry, Case, & Larkin 142,964
Portfolio holder, J. B. Aiken 142,684
Postal card screen, L. Conroy 142,899
Press, butter print, Coates & Criswell 142,838
Press, cotton, P. & R. A. Williams 142,882
Printer's leads, apparatus for casting, W. Filmer 142,783
Propeller, screw, Stevens & Miller 142,820
Pruning implement, Hulse & Crum 142,915
Pruning shears, W. Baker 142,886
Punching and shearing machine, W. Lyon 142,926
Rafts, float for life, Mason & Rogers 142,931
Railway rail joint, W. H. Skidmore 142,954
Railway signal, J. F. Ross 142,944
Railway switch, Clark & Chaney 142,837
Rake, horse hay, C. Edgar 142,844
Refrigerator, T. D. Kingan 142,796
Refrigerator, transporting, J. Moos 142,806
Roof, fireproof mansard, J. W. Kennedy 142,793
Rubber packing, etc., C. L. Frink 142,908
Rubber for brush backs, E. A. Hill 142,911
Sausage stuffer, P. W. Brownback 142,897
Saw files, tip for, H. Disston 142,900
Saw mills, crank for, A. Rodgers 142,816
Saw swage, J. E. Emerson 142,779
Saw teeth, J. E. Emerson 142,781
Saw teeth, blank for, J. E. Emerson 142,780
Sawing machine table, H. O. Reed 142,813
Sewing case, F. Benkendorff 142,762
Sewing machine, clamp for, J. G. Powell 142,812
Sewing machine guide, W. A. Springer 142,819
Sewing machine power, A. W. Cochran 142,839
Shovels, etc., manufacture of, H. Lowman 142,859
Sled, bob, J. W. Doty 142,902
Soldering machine, J. F. Spence 142,956
Spark arrester, J. E. Dustin 142,904
Spoon and fork handle, E. C. Moore (r) 5,573
Stamp affixer, R. P. Thian 142,822
Steam jet, E. Korting 142,856
Stove, cooking, Nation & Little 142,935
Stove pipe holder, G. Eckel 142,777
Stove pipe joint, J. Weaver 142,979
Stove pipe thimble, J. R. Fulton 142,784
Stove, railroad car, A. Reese 142,867
Stove, reservoir cooking, Nation & Little 142,931
Stove, reservoir cooking, Nation & Little 142,932
Stove, reservoir cooking, Nation & Little 142,933
Stove, reservoir cooking, Nation & Little 142,934
Street sweeper, C. Geiger 142,847
Telegraph receiving register, M. F. Wessmann ... 142,825
Telegraph switch board, W. D. Sargent 142,817
Telegraph transmitting key, M. F. Wessman 142,826
Thill coupling attachment, H. J. Stubbs 142,960
Thrashing machine, J. B. Suitt 142,961
Tool, compound, F. W. Farrar 142,782
Treadle mechanism, B. B. Chandler 142,770
Truck for rails, etc., C. A. Ball 142,759
Tub, butter, A. J. Drake 142,842
Tyre upsetting machine, J. L. & A. H. Yeager 142,833
Valve, pressure regulating, Craig & Brevoort 142,773
Vehicle wheel, C. W. Spayd 142,876
Vehicle wheel, J. B. Withey 142,831
Vehicles, spring coupling for, H. P. Dolson 142,901
Ventilating window sash, C. Pullinger 142,941
Ventilator, car, S. C. Maine 142,799
Ventilator, car, A. J. Morrison 142,807
Vessel for transporting grain, Demartini *et al* 142,842
Vise, G. N. Stearns (r) 5,574
Washing machine, J. H. Hill 142,850
Washing machine, M. W. Staples 142,958
Watches, reversible pinion for, G. Hunt 142,789
Water wheel, E. Overton 142,862
Well tubing, oil, J. Moloney 142,861
Wheel turning machine, J. W. Hill 142,912
Windmill, Atwood & Bodwell 142,885
Wire way, elevated, Lantis & Davis 142,857
Wrench head, L. Coes 142,771
Yoke holder, neck, G. R. Huntley 142,852

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,408.—KINDLING COMPOSITION.—E. Bellinger. Nov.26.
26,475.—BREECH LOADING ARM.—B. Burton. Dec. 3.
26,487.—SCREW TAP.—W. Foster *et al*. Dec. 3.
26,506.—WATER TRAP.—J. A. Lowe. Dec. 3.
26,582.—HARVESTER.—J. Gore. Dec. 10.
26,599.—HORSE HAY RAKE.—S. Lessig. Dec. 10.
26,891.—SPECTACLE CASE CATCH.—G. N. Cummings. Jan. 7.

EXTENSIONS GRANTED.

25,484.—GRAIN SEPARATOR.—J. L. Booth.
25,499.—CAR SEAT.—E. Wheeler.
25,506.—LAMP.—H. Halverson.
25,508.—SHEARS.—R. Heinisch.
25,544.—TRY COCK.—J. F. Cook.

DESIGNS PATENTED.

6,882.—LAMP BOWL.—J. S. Atterbury *et al*, Pittsburgh, Pa.
6,883.—TUG CLIP.—J. Letchworth, Buffalo, N. Y.
6,884.—CHAIN.—H. H. Markley *et al*, San Francisco, Cal.
6,885.—OIL CLOTH.—C. T. Meyer *et al*, Bergen, N. J.
6,886.—FRUIT JAR.—S. B. Rowley, Philadelphia, Pa.
6,887.—AQUARIUM FRAME.—G. E. Smith, Chicago, Ill.
6,888.—CARPET.—H. Smith, Kidderminster, England.
6,889.—KNITTED FABRIC.—T. Langham, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,451.—MEDICINE.—S. Bonsall, Philadelphia, Pa.
1,452.—SAWS, ETC.—H. Disston & Sons, Philadelphia, Pa.
1,453.—CIGARS.—Goldsmith Bros. *et al*, Chicago, Ill.
1,454.—CIGARS.—J. Heller, Chicago, Ill.
1,455.—MASS LICORICE.—Hoffman & Co., Baltimore, Md.
1,456.—LICORICE PASTE.—Hoffman & Co., Baltimore, Md
1,457.—STOVES.—W. J. Keep, Troy, N. Y.
1,458.—MANILA PAPER.—J. Robertson & Son, Putney, Vt.
1,459.—BARRELS OF WHISKY.—W. S. Stewart, St. Louis, Mo.
1,460.—PETROLEUM.—Atlantic Refining Co., Phila., Pa.

SCHEDULE OF PATENT FEES!

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

VALUE OF PATENTS,

And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent,

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

Reissues.

A reissue is granted to the original patentee, his heirs or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have to his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co. 37 Park Row New York

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

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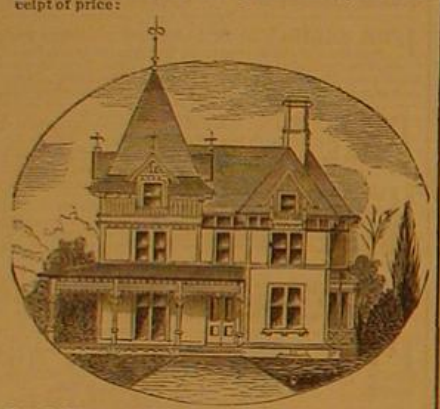
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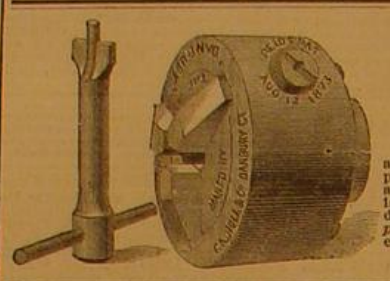
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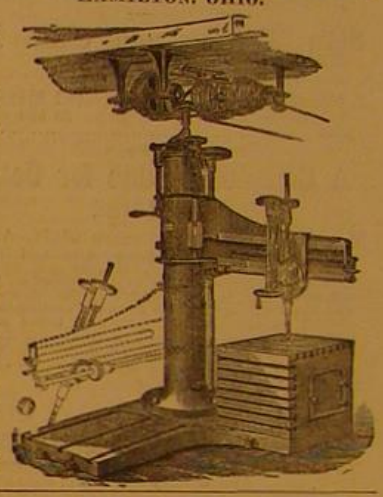
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