

SCIENTIFIC AMERICAN

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

Vol. XXIX.—No. 17.
(NEW SERIES.)

NEW YORK, OCTOBER 25, 1873.

\$3 per Annum.
IN ADVANCE

APPARATUS FOR EMPTYING CESSPOOLS.

While the system of sewerage, or water carriage of night soil, as a means of removal, has been largely adopted in the more advanced cities of the world, still by far the larger portion is deposited in vaults and cesspools; to the sanitarian, therefore, the question of how this refuse shall be removed from such receptacles, without that violence to the senses and to decency and without that detriment to public health so long tolerated as an inevitable accompaniment of the well known and well nigh universal bucket system, is one of no small importance.

Up to the present time none of the various methods proposed have been largely adopted or attended with substantial success, although the most plausible solution would seem to be the use of some means of conveying the soil to an airtight tank without agitating or exposing it to the open air.

The principal mechanical difficulty has been the inevitable obstruction and choking, of the valves and working parts of the pumps usually employed, by the innumerable odds and ends that find their way into the depository. Strainers for excluding every thing from the pumps except the more fluid portions have been found of little avail, as the material, with its obstructions, is not only not removed, but is as much a clog to the strainers as to the pumps.

Various pneumatic systems have been proposed, and several methods of exhausting the tanks have been employed, among them the use of air pumps worked by hand or steam; or, when attached to the tank, such pumps have been made to exhaust the air from it by being geared directly to the wheels of the tank, so that while it was being drawn through the streets to the vault, the air would be exhausted and the tank be in readiness for filling.

In other cases exhaustion has been effected by injecting steam or heated air into the tank and subsequently condensing or cooling it, or by filling the tank with water and discharging it through a tube, having its outlet some 35 or 40 feet below. All of these systems, though excellent in theory, have encountered many practical difficulties. What is needed is a pump so constructed as to raise and force, by direct action and without obstruction to its working parts, the contents of sinks and cesspools, just as they occur. To this must be added the requirement that, in discharging the matter into the airtight

receptacle, no offense be created by the escape of noxious gases.

Such an efficient direct-acting pump, an airtight tank, and a deodorizing attachment are claimed to constitute the prom-

face between its two sides, and therefore closely engage and surround whatever obstruction may be passing through it at the time of its collapse, forming about the obstruction an airtight joint, Fig. 2. At the succeeding stroke the

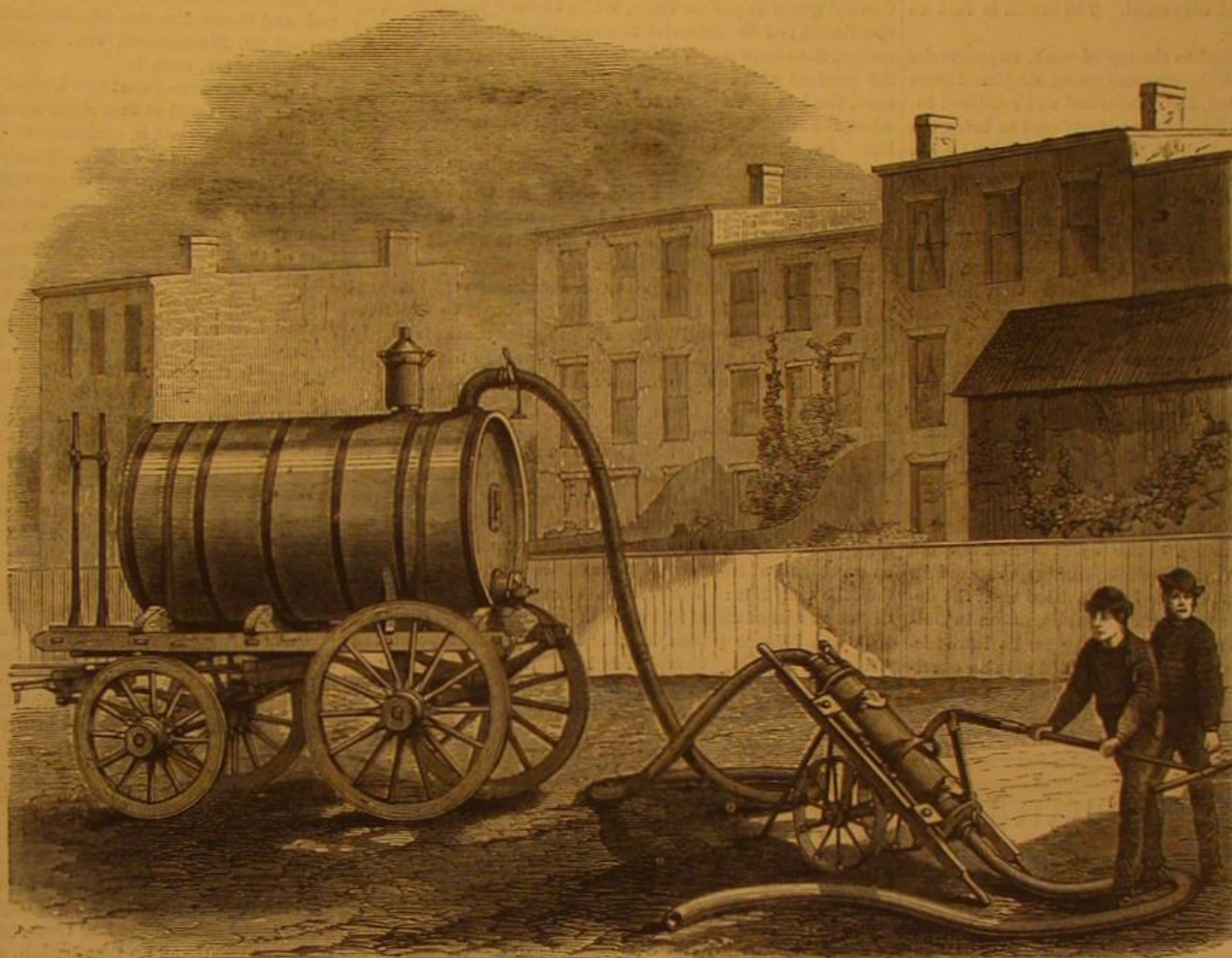
valve is again distended, and the obstruction passes forward without in the least interfering with the action of the pump. Each valve is provided at its base with rigid straps or braces, C, which prevent it from being forced into the port by external pressure.

The pump is single acting (Fig. 2), and in form a straight cylinder, provided with one fixed valve (the induction) and one movable, both marked A in the engraving, the latter attached to the piston, D, moving in the center of the cylinder. The passage of the material through the pump is therefore direct and without counter currents; and such is its capacity for passing obstructions that we have seen large pieces of cloth (and it is stated, an entire pair of heavy cloth pants may be) pumped through with ease. In fact, any obstacle not too large to enter the suction hose, and of whatever length, will pass

freely through the valves without interfering with their action. This capacity for passing obstructions renders the use of a strainer on the end of the suction hose superfluous, and it is used with a clear, free opening. Usually this will not become obstructed, the hose being of three inches inside diameter; but in cases where a large quantity of tough and tangled material is present in the vault, such as masses of shavings and rags, a curved foot pipe is used, having an opening on its side of the full capacity of the hose. Should an accumulation of tough materials occur at this point, it is removed occasionally by the action of a sliding blade or cutter, attached to the foot pipe and operated by a rod. This device is only used in the worst cases, but by its use the capacity of the apparatus is greatly increased, and it is under more perfect control.

The rods, E, moving the piston, are placed at the sides of the pump, and do not obstruct the opening through it.

For convenience, the pump is mounted on wheels placed at the center. When in position for work, it stands at an angle of some thirty degrees elevation, and is conveniently operated by the brake or lever. By reason of its inclined position, the air contained in the pump is displaced with



APPARATUS FOR EMPTYING VAULTS AND FOR THE REMOVAL OF NIGHT SOIL.

Fig. 2.

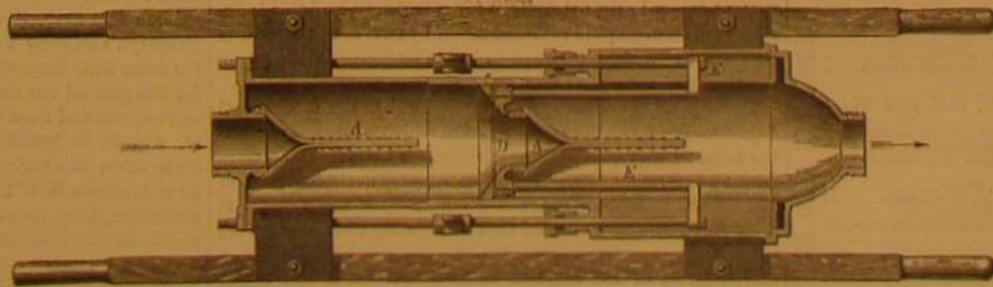


Fig. 3.



Fig. 4.



the valves. Virtually, these appliances, by their construction and positions in the pump, form a continuation of the connecting hose leading from the vault to the tank, and, being in direct line with each other, offer little resistance to the passage of the material. The valve shown in the sectional view of the pump, Fig. 2, and in the smaller engravings, Figs. 3 and 4, is made of soft, elastic, vulcanized rubber, A, tubular in form; and being composed of two flat pieces placed face to face and riveted together at their edges, is, in its normal condition, collapsed. Its length is equal to some three diameters when open. One end is distended, and, embracing a collar, B, that surrounds the port, is securely fastened thereto by clamps and bolts. There is, therefore, a collapsible tube, one end of which is permanently distended to embrace the port through which the material passes. This passage, in one direction, is direct and unresisted through the valve, while it cannot take place in the opposite direction by reason of the collapse of the tube by the pressure on its sides. The valve, being of much greater length than diameter, presents an extended bearing or contact sur-

Fig. 5.



facility and the valves retain their charge. The pump, therefore, seldom requires priming, even when used to raise the material a great distance. Two props in front serve to support the pump firmly while being operated. They are closed in when not in use. The balancing of the pump on two wheels at the center also renders the discharging of its contents and cleaning very convenient, by reversing the inclination, in which position it may also be readily charged, when necessary, through the induction port, the discharge being closed.

The couplings, F, used for connecting the sections of hose together and to the pump and tank, are of novel construction and designed especially for this purpose. Those attached to the pump and tank are furnished with fixed wrenches, by which the connection is quickly and perfectly effected. When the hose is detached, both portions of the coupling are sealed with suitable caps, and the entire apparatus rendered airtight. The receiving tank used is of ordinary construction and provided with inlet and discharge openings, and also with an indicator for showing correctly the quantity of material contained. The action is said to be sensitive and accurate.

A flanged collar, attached to the top of tank, supports the charcoal furnace in which the noxious gases, displaced from the tank while being filled, are deodorized and rendered inoffensive. This form of deodorizer is employed as being the most efficient and economical. The purifying action of the fire is intense, and the displaced gases, after passing through it, are entirely without odor.

In addition to its use for removing night soil, the apparatus is claimed to be equally efficient in removing the contents of sewers and traps in a like inoffensive manner.

The original patent for the use of the deodorizer, in combination with an airtight tank, for cleaning sinks and cesspools without offense, was granted to Louis Straus, January 28, 1868, but the apparatus has been in very limited use, owing to the inefficiency of the pumps heretofore designed for use in connection with it.

The patent on the pump valve was granted to William Painter, of Baltimore, August 5, 1873. Patents on other portions of the apparatus are now pending, and the company is about to apply for patents abroad.

The apparatus, we are informed, has already been adopted in the National Capital to the entire exclusion of the old bucket system. The plan there employed is represented in Fig. 5, the soil being pumped into barrels fitted with the deodorizing furnace. It is also in successful operation in Baltimore, and negotiations are now pending for its introduction in other cities. Our large engraving will give an excellent idea of the complete apparatus as it appears in use.

For further particulars, address The Odorless Excavating Apparatus Co., 44 North Holliday street, Baltimore, Md.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year.....	\$3 00
One copy, six months.....	1 50
CLUB RATES (Ten copies, one year, each \$2 50.....)	25 00
(Over ten copies, same rate, each.....)	2 50

VOL. XXIX., No. 17. [NEW SERIES.] Twenty-eighth Year.

NEW YORK, SATURDAY, OCTOBER 25, 1873.

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TECHNICAL RESEARCH AND EDUCATION.

One of the most eminent English chemists is reported to have recently said, in response to a question relative to the progress of original investigation in England, that in that country such research seemed to be declining, while in the United States far more was being accomplished toward its pursuit. Were we disposed to doubt the latter part of this assertion, and even were we unaware of the constantly advancing labors of the scientists of Yale, of Harvard, of Cornell and of other seats of learning throughout the country, we should be strongly inclined to admit its truth from the evidence afforded by a recent visit to that model technical school, the Stevens Institute. In three laboratories we found original labor in virtually actual progress, and from three workers—professors, yet only students in that highest of colleges. Nature—we gleaned a few general words in explanation of the object to which the researches of each were directed,

President Morton's investigations into the beautiful phenomena of "fluorescence," and also his brilliant discoveries of thallene and petroleucene, we have already described in detail. We have also alluded to his spectroscopic researches in relation to the uranic salts, and we found him still engaged upon the same subject. We were shown his laboratory for the purification of the uranium, a process of some length, carried on by himself in order that he may obtain the metal free from impurities, with which he states it is always combined when obtained direct from commercial sources. From the result of this operation he obtains various compounds of the body, among which are several new salts; among others, thallio-uranic sulphate and rubidio-uranic sulphate. President Morton is also investigating the properties of chrysene and pyrene, both substances obtained from coal tar subsequent to the production of anthracene, and which differ from each other in many respects. We were also shown a specimen of pure anthracene, which appeared in delicate sheets of a pearly luster, almost perfectly white. Other specimens of the same substance, not so pure, had a decided greenish yellow tinge, while another preparation, by distillation; of the material resembled moist sugar, with, of course, the above noted difference in tinge. A very beautiful product also obtained was pure alizarine, from anthracene, the last process of the operation being sublimation, when the alizarine appears of its natural brilliant orange red hue. Dr. Morton tells us that he has been unable, thus far, to obtain thallene in sufficiently large quantities to meet his requirements—he wanted a barrel of it—and that he is therefore turning his attention to anthracene as being the nearest similar substance. He hopes, eventually, to be able to produce, from thallene, artificial alizarine.

Professor Mayer is engaged upon a series of very interesting investigations in acoustics, mainly relative to the relation between sound and heat. He promises some strikingly original experiments and important lectures in the course of the next month or two, which we shall take occasion to lay before our readers.

Professor Thurston, our late correspondent from the Vienna Exposition, has returned to this country and is engaged in the continuation of his experiments on the torsional strength of materials; obtaining his results by the aid of the testing machine of his own device, an invention which we have already described. His most recent work has been upon specimens of iron and steel, from which he has obtained the following data: The pieces were made in nearly uniform thickness and of about $3\frac{1}{2}$ inches in length. In the center, a neck was formed $\frac{1}{2}$ inch in diameter, to which point the strain was applied. Sample No. 1 was of Ulster iron, 1 inch bar, twisted to 220°; it broke under a torsional force of 225 pounds. No. 2, ordinary spike iron, nail rod, $\frac{1}{2}$ inch bar, angle 150°; it broke at 240 pounds. No. 3, French tool steel annealed, $1\frac{1}{2}$ inches round, angle 160°; it broke at 400 pounds. No. 4, Bessemer steel $1\frac{1}{2}$ inches round, angle 75°; it broke at 300 pounds. No. 5, Lowmoor iron, 1 inch square forged down from $1\frac{1}{2}$ inches, angle 220°; it broke at 200 pounds. No. 6, common American iron, make unknown, $\frac{1}{2}$ inch bar, angle 220°; it broke at 200 pounds. No. 7, Naylor's tool steel, $\frac{1}{2}$ inches octagon, angle 140°; it broke at 400 pounds.

It would be hardly fair to close this brief reference to the labors now in progress at the Stevens Institute without duly crediting the work of the students as well as that of the professors. Among the practical results of the instruction afforded, we were shown two admirably constructed magic lanterns, destined for use in the lecture room, made entirely by a pupil, and in a manner which would compare favorably with that of skilled instrument manufacturers. Besides these there were a large number of metal articles used in blowpipe operations, and also many other excellently made tools and instruments for the chemical and physical laboratories, all entirely the handiwork of the students. We also noticed several original designs for machinery, and an admirably executed graphic representation by curves of the results obtained by Professor Thurston in his late experiments upon the torsional resistance of wood.

There is an excellent system carried out in the mechanical department of the Stevens Institute which we do not remember to have seen practiced elsewhere, and which it appears might be advantageously followed in every technical school. We allude to instructing the student how to invent. It must be generally conceded that the young man who leaves his college, perhaps an able draftsman but withal a mere copyist of the original ideas of others, labors under disadvantages and will find greater obstacles in his path of progress than another student who graduates able to suggest, modify or even invent plans to suit the varying circumstances. Than this, no fact seems to be more thoroughly recognized in the course of study above referred to; and instead of requiring the pupil to duplicate completed plans or produce merely handsome drawings, he is called upon at once to use his own brains in direct origination, and thus to apply in practice the instruction he gains in theory in the class room. To each student the Professor assigns some special work; to one, for instance, he hands a rough general idea of a steam governor, and tells him to improve it and construct a finished machine, bringing in every requisite calculation; to another, he assigns a peculiar form of steam boiler; to a third, an anchor hoisting gear for the Stevens battery; and so on through the class, each individual being left free to design precisely as he chooses, working only from the mere crude hint given him in the beginning. If the articles are of such a nature as are capable of ready construction, they are actually made within the Institute in the machine or instrument shop, and afterwards utilized for their purposes; so that the pupil not only designs but in some cases sees em-

bodied the result of his thought. It is needless to add that if the student has any inventive genius, this means develops it; and he leaves the school with a mind trained to think independently, or, in other words, to grapple at once with the problems which are constantly presenting themselves in the everyday practice of his profession.

THE VIENNA PRIZES.

Seventy thousand articles have been exhibited at the Vienna show, and 26,002 awards have been distributed. Of this aggregate number of premiums, 421 were diplomas of honor, 3,024 medals for progress, 8,800 medals for merit, 8,326 medals for good taste, 978 medals for art, 1,998 medals for coöperation, and 10,465 diplomas of merit or honorable mention. These were awarded as follows: Austria (without Hungary) 5,991, Germany 5,066, France 3,142, Italy 1,908, Hungary 1,604, Spain 1,157, England and colonies 1,156, Russia 1,018, Switzerland 722, Belgium 612, Norway and Sweden 534, Turkey 470, Portugal 441, United States 411, Denmark 309, Holland 284, Roumania 238, Japan 217, Brazil 202, Greece 183, China 118, Egypt 75, Republics of Central and South America 44, Persia 29, Morocco, Tunis, and Tripoli 20, Madagascar, etc., 10, Monaco 9, Mexico, Siam, and Turkestan, each 1.

It will be noticed that the United States ranks No. 14 on the list, and it will at first sight seem rather curious that we should be distanced in numbers of prizes gained by countries so far behind the age as Spain or Turkey. It is hardly fair, however, to draw any comparison except through the relative proportion of distinctions gained as compared with the number of exhibitors from each nationality, while the nature of the articles for which the honors were given must also be taken into consideration, regarding which facts accurate information has not yet appeared. The position of the United States is, of course, attributable to the paucity of our representation, a circumstance, however, which cannot be urged in the case of England; so that, so far as that country is concerned, and even considering everything, we are somewhat at a loss to understand how, not merely with its own fine display, but also with that of its dependencies, Great Britain managed to reach so low a place on the list.

We expected, as a matter of course, to see local industries fostered, and consequently the leading of the nations by Austria, followed closely by Hungary, does not surprise us. The proximity of Germany, France, and Italy also accounts for their large figures; but on what possible ground Spain, a country for the past three years in a constant state of turmoil, with what little industries it had all but paralyzed, and producing nothing of major importance either in manufactures or arts, is granted a higher number of prizes than England, is totally beyond our comprehension. We shall await the full reports of the exhibition with increased impatience, if only for a solution of this paradox.

FAILURE NO. 2 OF THE BALLOON TO EUROPE.

Soon after the collapse of the *Daily Graphic* advertising balloon, on the occasion of its original inflation preparatory to the start for Europe, the proprietors determined to make use of such portions of the cloth as might be serviceable in the manufacture of a smaller gas bag for another trial. They accordingly reduced the bag from a capacity of 500,000 cubic feet to 250,000; and on October 6th, at 9:30 A. M., Mr. Donaldson, the aeronaut accompanied by two newspaper men, Ford and Lunt, started from Brooklyn, N. Y., "direct for Europe." During the preceding week Donaldson had made a couple of short ascensions in a small balloon, and had no difficulty, he said, in reaching that "easterly current."

On this last excursion, the balloon was provided with a life boat, as a car, to be used in case the voyagers should, by any unforeseen circumstance, be compelled to descend upon the raging deep. The boat was stocked with water and provisions for 40 days, together with a considerable quantity of sand ballast. The morning of the ascent was fine, and the balloon rose majestically, passing northerly over the cities of Brooklyn and New York at an elevation of about a mile, and for some time formed a conspicuous object in the heavens, for the gaze of our citizens. But it finally faded away into a mere speck and then wholly disappeared, going northeasterly. At 3 P. M. intelligence was received that the balloon had come down in a furious rainstorm at New Canaan, Conn., 60 miles from New York; and from the accounts of the poor aeronauts, they narrowly escaped with their lives. They represent that they sailed along beautifully until about 1 P. M., when they suddenly entered the precincts of a violent rain storm, which, spite of all they could do in the way of throwing out ballast, drove the balloon down to the earth, upon which they were tumbled in great disorder and violence, while the big bag and boat brought up against the trees and rocks. The balloonists further admit that, almost from the beginning of the voyage, they had to continue throwing out ballast in order to keep themselves afloat, which would seem to indicate that the balloon was in a leaky condition at the start. The *Graphic* people, however, insist that the machine was sound and strong, and allege that the fall was due to the great weight of water which accumulated on the surface of the balloon. If this is the fact, it might be desirable to provide the balloon with an umbrella, on the next trip to Europe, to keep off both rain and sun.

CAOUTCHOUC FROM COMMON PLANTS.

The extensive demands for india rubber, and the comparative scarcity of the supply, has augmented the price until it now stands at nearly one dollar per pound in this market. The crude matter comes from tropical regions, and is derived mostly from certain trees, the nomenclature and localities whereof were presented in a recent article in the *SCIENTIFIC AMERICAN*.

A variety of attempts to find substitutes for rubber, or new sources of supply, have been made. In the matter of substitutes, several valuable compositions have been invented, which are used in place of rubber for specific purposes.

Among the new sources of supply are the fruits, seeds, and juices of various plants, which have been successfully treated by Mr. D. M. Lamb, of Strathroy, Canada. By fermenting the asclepias or common milkweed plant, followed by pressure and evaporation, he separates a gummy liquid having the characteristics of rubber, and, like it, capable of vulcanization.

From the bamboo berry grown in the South, from flax seed and other seeds, he also obtains in this manner a similar gum, from which, it is said, a good article of vulcanized rubber may be made, and also an excellent waterproof varnish. It is alleged that these substances may be produced at a cost not exceeding 20 cents per pound, and that a company with a large capital subscribed is about to introduce the manufacture here.

RECENT GUNNERY TRIALS.

The special Board appointed to make comparative trials of howitzers, field guns, and mitrailleuses, assembled at Fort Monroe on the 1st of October and closed their labors on the 6th. The trials were made under direction of General Gilmore, President of the Board, assisted by Colonel Treadwell of the Ordnance Department, and Captain Lorraine of the Artillery. The trials were made on the seashore near the Fort, the target being 9 feet high and 40 feet long.

The guns tried consisted of the ordinary Napoleon 9 pounder field gun, carrying 12 lbs. caulkers; weight of gun about 900 lbs.; worked by 8 men; range of firing 800 yards; the ordinary 8 inch field howitzer, weight of gun about 2,500 lbs., worked by 8 men, range of firing 800 yards; the small Gatling gun, caliber .42, weight of gun 200 lbs., worked by 2 men, range of firing 800 and 1,200 yards; the one inch Gatling gun, 900 lbs., worked by 4 men using canister cartridges each containing 21 half inch balls, range of firing 800 and 1,200 yards.

The remarkable advantages of the Gatling gun were never more thoroughly established than on this trial. At 800 yards the small gun threw 600 shots in 90 seconds, of which 515 hit the target, being from 8 to 10 times more than the hits made by the howitzer and field guns.

At 1,200 yards range the latter guns, owing to some defect in the ammunition, were withdrawn, to be tried on another occasion.

At 1,200 yards range the Gatling guns, both sizes, exhibited great success in striking the target with deep penetration. The heavy Gatling threw 5,355 missiles in 90 seconds, of which 1,595 struck the target. These are remarkable results and have probably never been surpassed in this species of gunnery.

CRUDE PETROLEUM FOR FUEL.

We are indebted to our correspondent at Norristown, Pa., Mr. H. L. Acker, for a further communication in reply to our comments on his letter upon the above subject, recently published.

He states that further trials, from which more exact data may be expected, will shortly be made; and it is therefore unnecessary to give his present letter in full. He informs us that the price of coal at Lamokin, Pa., is \$6.30 per ton, and the price of crude oil 6½ cents per gallon in bulk; and, on an allowance of 4 lbs. of coal per horse power per hour as a basis, he figures the relative costs of the two fuels at \$5.40 for coal for ten hours, and \$4.37½ for the petroleum.

In respect to an allowance of 4 lbs. of coal per hour, he says: "That is, of course, when the boiler and engine are most favorably constructed. But you are aware that, as a general thing, this will not hold good," etc. We will here remind our correspondent, and others who are studying on steam power, that a favorably constructed boiler and engine, properly run, should consume not over two pounds of coal per hour per horse power, and it is this quantity of fuel that they must beat, if they expect to drive coal out of use. We allowed 4 lbs. for the particular engine referred to, because more than half the fuel actually required to do the work is ordinarily wasted. But it is an unnecessary waste.

By reference to back numbers of the SCIENTIFIC AMERICAN, our correspondent will find plenty of examples of marine, portable, and stationary steam engines which run on 2 lbs. of coal per hour per horse power. Nearly all of the ocean steamers now plying between New York and Liverpool run on 2½ lbs. per horse power per hour, some of them on 2 lbs., while the Cowper compound marine engine runs on 1½ lbs. This latter is the best practice yet reached, we believe; but theoretically, we ought to use only ½ of a pound of coal per horse power per hour.

STREET PAVEMENTS.

About three years ago, the subject of street pavements attracted considerable attention, and we had specimens of nearly every description that had ever been patented laid in various parts of the city. The general interest in this matter seems of late to have died out; but to those who own horses or have any regard for the sufferings of the noble animals, this will always be a subject worthy of consideration. The patent pavements, almost without exception, were found to be worthless, and the city authorities at last found this out and came to the conclusion that stone in some shape, and stone only, was fit for the pavement of our streets, particularly the thoroughfares. Of the other kinds of pavements, the Nicholson is the only one which has still any advocates.

It is a good pavement as long as it lasts; but its lack of durability, the insecure foothold it affords in frosty weather, and its high price, are drawbacks which will always tell against it; besides, it cannot but be considered prejudicial to the public health, for it absorbs a portion of the effete matter constantly deposited upon it, and retains this in a moist state, favorable to decomposition, much longer than any other pavement we have. Of the stone pavements, the Belgian and the Guldert are generally acknowledged to be the best; and their superiority over the cobble stones, as usually laid in our streets, cannot be denied. The principal complaint against these pavements, particularly the former, is that the stones wear smooth and the horses slip; not only in winter, when there is frost, but at all times when dragging heavy loads and on starting. The fault found with the cobble stones, as they are put down in the streets of New York, is that the smaller stones sink after they have been subjected to a certain amount of travel, the larger ones, against which the hoof is apt to strike when thrown forward, remaining prominent, tearing off the shoe and causing the horse to stumble. Moreover, owing to the numerous inequalities of the surface, the horse must expend an increased amount of force to pull his load, and starting is rendered very difficult. But if cobble stones are properly selected, that is, if they are small and of a uniform size, they are superior to any stone pavement ever put down in giving a good foothold and doing little injury to the hoof.

Now, notwithstanding stone pavements are the only ones to be recommended at present, it is possible we may be able to secure something better for the future; and it being a matter of so much importance, there is every reason why the city government should seek to encourage experiment. Not such experiment as was tried under the old régime and which cost the tax payers so much; but let each patentee have a chance to exhibit his pavement, and demonstrate to the public whatever merits it may possess, by laying down a hundred feet or more in some of our public thoroughfares at his own expense. In this age of progress and enlightenment, it would seem as though we might ride with more comfort and have some feeling for our horses.

To the city railroad companies this is a matter of special interest, and it seems strange that they have not made greater exertions to protect their horses' feet and thereby diminish one great item of expense. No one has ever rode on the front platform of any of our horse cars without noticing with pain the difficulty the poor brutes experience in starting for want of a good foothold. The average length of time that a horse is serviceable on any of the city lines of cars is about three years and a half, and at least fifty per cent are rendered unfit for service on account of injury done to their feet or limbs, or from strains, the result of frequent slipping and consequent over exertion.

A model pavement would be one affording a good foothold, impenetrable by water or moisture and comparatively level, that is, presenting an even surface. It should possess a certain amount of elasticity, which would not only render it less injurious to the horses' feet but would tend to deaden the sound of vehicles passing over it. If such a pavement could be produced at a reasonable price, and if it were durable, it would certainly meet with public favor, for it would prove a blessing to the horse and a great saving to the owners of horses.

CURIOSITIES OF BUTTER AND CHURNING.

The art of making butter is by no means of modern date; this, the derivation of the word from the Greek *buturon*, and this again from *bous*, a cow, and *uros*, cheese (literally cow's cheese) sufficiently indicates. But although the word is of Greek derivation, it was late before this people had any notion of it. Their great poets, Homer, Theocritus, and Euripides, who, like Shakspeare, drew the stores for their immortal creations from all sources of knowledge, do not speak of it, although they mention milk and cheese. Aristotle, the famous philosopher of olden time, first speaks of a fat substance contained in milk which, under certain circumstances, becomes like oil. Herodotus the Greek historian is the most ancient writer who, in his account of the Scythians, describes a process for making butter. The word *buturon* first occurs in Hippocrates, who was nearly contemporary with Herodotus, in the fifth century B. C. "The Scythians," says Hippocrates, "pour the milk of mares into wooden vessels and shake it up violently, making it foam, when the fat part which is light rises to the top and becomes *buturon*." Dioscorides, 33 B. C., says that good butter is prepared from the fattest milk of sheep or goats, by shaking it in a vessel till the fat separates. He says, also, that it can be melted and poured over pulse and vegetables, instead of oil, and might be used in pastry instead of oil. It is evident from this that drawn butter is not a modern invention, and that our pastry cooks have certainly learned something from their grandmothers.

But the principal use of butter among the Greeks and Romans was as an ointment and a medicine. The Romans were accustomed to anoint the bodies of their children with it to render them pliable, and the Burgundians extended its applications by using it as a hair oil. Plutarch, the prince of ancient story tellers, informs us that a Spartan lady once paid a visit to Berenice, the wife of Delotarus, and that one smelt so strongly of ointment and the other of butter, that neither could endure the other. We are not told what kind of ointment it was, but we can safely assert that the butter must have been very rancid.

The ancient Christians of Egypt burnt butter in their lamps instead of oil; and in more recent times, it was used for the same purpose in Roman Catholic churches, during the Christmas festival, to avoid the great consumption of

olive oil. The Cathedral of Rouen has a tower called the butter tower, from the fact that the Archbishop of Rouen, in A. D. 1500, finding the supply of oil to fall during Lent, permitted the use of butter in lamps, on condition that each inhabitant should pay six deniers, with which money the tower was built. There are other "butter towers" at Notre Dame, Bourges, etc.

It is evident from the early history of butter that the Greeks and Romans did not use it to any extent in cooking or in the preparation of food, but Anaxandrides, a poet who lived shortly after Hippocrates, mentions a banquet where the Thracians ate butter, to the astonishment of the Greeks. But the article formerly called butter was oily and impure, wanting the firmness and consistency of that of modern times. It was consequently prone to decomposition, and its use limited. The ancients had usually accustomed themselves to good oil, and butter, in later times even, has been very little used in Italy, Spain, and the south of France, but was sold chiefly by the apothecaries for medicinal purposes. Most modern Biblical critics agree that the word translated butter in our version of the Scriptures means milk or cream, or, more properly, sour thick milk. In the 30th chapter of Proverbs, we find a verse beginning "the churning of milk bringeth forth butter, etc." This would certainly seem to describe the preparation of butter, but the original Hebrew words *chaleb metz* signify squeezing or pressing, as for example, the udder of a cow; so that milking, and not making butter, is supposed to be meant. It is very probable that the formation of butter was discovered by accident in the transportation of milk in skins, which are still used in Barbary. In this country the Arabs churn their cream by suspending it contained in skins of goats in their tents and pressing it to and fro. Dr. Chandler, in a journey from Athens to Corinth, noted the mode of churning in the Levant. It consisted in securing the cream in skins, and then treading them with the feet. In Bengal, probably owing to indisposition to exertion in consequence of the excessive heat, they manage to make butter come by simply turning a stick around in the milk, but the product cannot be large. The inhabitants of the interior of Africa seem to be favored with respect to butter. The famous traveller Mungo Park, whose adventures delighted our boyish days, says that a tree grows there, resembling American oak, which bears a nut like an olive. When the kernel of this nut is boiled in water, it yields a butter, which the traveller asserts is whiter, firmer and of a richer flavor than any he ever tasted from cow's milk; and which will keep without salt for a whole year. The natives call it *shea toulou* or tree butter, and large quantities are made.

SCIENTIFIC AND PRACTICAL INFORMATION.

TEST FOR ARSENICAL COLORS ON WALL PAPERS AND IN PAPER GENERALLY.

Professor Hager recommends the following method for detecting this dangerous class of arsenical colors, which, we may remark, are not confined to green alone, for even red sometimes contains arsenic: A piece of the paper is soaked in a concentrated solution of sodium nitrate (Chili saltpeter) in equal parts of alcohol and water, and allowed to dry. The dried paper is burned in a shallow porcelain dish. Usually it only smolders, producing no flame. Water is poured over the ashes, and caustic potash added to a strongly alkaline reaction, then boiled and filtered. The filtrate is acidified with dilute sulphuric acid, and permanganate of potash is added slowly as long as the red color disappears or changes to a yellow brown upon warming, and finally a slight excess of chamellion solution is present. If the liquid becomes turbid, it is to be filtered. After cooling, more dilute sulphuric acid is added and also a piece of pure clean zinc, and the flask closed with a cork split in two places. In one split of the cork a piece of paper moistened in silver nitrate is fastened, in the other a strip of parchment paper dipped in sugar of lead. If arsenic is present, the silver soon blackens. The lead paper is merely a check on the presence of sulph hydric acid. According to Hager, the use of permanganate of potash is essential, otherwise the silver paper may be blackened when no arsenic is present.

CURIOS SUBSTANCES IN GUANO.

In former communications, says *La Nature*, M. Chevreul has called attention to the unexpected effervescence manifested by guano when combined with water. The author now considers that this property is due to the presence of bicarbonate of ammonia.

It is quite credible that this effervescence might take place if the guano were placed in a moist field, the material losing instantly all its excess of carbonic acid and consequently its activity. Once saturated, it becomes inert. M. Chevreul finds that the material dissolved by the water is crystalline and, as above noted, constituted by an ammoniacal salt but as yet the acid is not determined, though it is probable that it belongs to the long series of uric derivatives. The residue obtained after the action of water is partially soluble in alcohol, the solution containing various immediate principles of the guano, and among them the odorous principle or avic acid. The portion not dissolved consists especially of phosphate of lime.

It is an interesting fact in relation to avic acid that guano, despoiled of this substance and hence rendered inodorous, regains in a short time its characteristic aroma. The same has been found true of musk, which although once deodorized becomes again a perfume after several years. It is believed that, by a peculiarity analogous to the above, game leaves upon the ground a permanent scent, traceable by the delicate organs of the dog.

INEXTINGUISHABLE FIRE FOR LIFE BUOYS.

In order to provide a prompt means of support for men who may happen to fall overboard at sea, all vessels in the United States navy are provided with life buoys. These, usually two in number, are hung directly over the stern, so as to fall well clear of the ship when they are let go. The apparatus consists of two hollow copper vessels somewhat elliptical in form, joined together by a horizontal bar, three feet or so in length. The latter is attached at its middle to a vertical standard, on the lower part of which is a cross-piece for the person to rest his feet against while he clings around the standard above the crossbar with his arms. The upper end of the standard carries a square plate of metal, on which is coiled a tube which is always kept filled with portfire composition, of gunpowder or other ingredients, which will burn for twenty minutes or so with quite an intense flame. The buoy is attached to the vessel by a simple tripping apparatus communicating with a pull on or near the taffrail. The plate carrying the portfire fits under another piece on which is placed a lock and hammer which, when sprung, explodes a cap, and so ignites the portfire. For this also there is a pull, generally placed immediately beside the one above mentioned. Night and day at sea, a man is kept stationed at this post, and it is his duty the instant the cry of "man overboard" is raised, to pull first the portfire handle to light the powder, and then to let the buoy drop, while a hand in the mizzen top watches its position and that of the person in the water, and so directs the movements of the rescuing boat.

Once afloat, the apparatus remains upright and of sufficient size to be readily discerned by a swimmer during day, while its bright flame directs him toward it at night.

As may be imagined, there is an objection to the use of any combustible liable to be extinguished by water or wind, as, if portfire or other composition be not directly put out by spray or rain, its flame may be so weakened as to render its light too faint for the discernment of objects in its neighborhood. Messrs. Silas and Seyferth, in order to obviate this objection, have suggested the use of phosphide of calcium. This substance is prepared by distilling phosphorus over lime heated to a low redness. An anhydrous mass of a dull red color is obtained, hard enough to strike fire from steel, which experiences no change in dry air nor in oxygen at the ordinary temperature. In a moist atmosphere it slakes, emits phosphuretted hydrogen, mixed, however, with free hydrogen, and not self-lighting; but if it be thrown directly into water, phosphuretted hydrogen gas only is evolved, and this, as is well known, takes fire spontaneously in atmospheric air. The form of apparatus proposed is

represented in our engraving, for which we are indebted to *La Nature*. The buoy is of wood or cork, analogous in form to that ordinarily employed in the French navy, and has in its center a hollow space in which is arranged the lighting arrangement. The latter is composed of a metallic box containing the phosphide of calcium, through which passes a tube which extends beyond it a short distance both above and below. This tube, in the portion which traverses the box, is pierced with a number of holes so as to admit the water necessary for the decomposition of the phosphide. Two cocks, arranged one at the upper part of the tube and the other below the metallic reservoir, are rigidly connected

first five minutes, of some 11 inches in length. On the occasion of experiments recently made at Toulon, with a charge of 7,084 grains of phosphorus and a tube with an opening of 0.1 inch in diameter, the flame lasted for one hour and ten minutes.

It is suggested that phosphide of calcium might be arranged with ordinary life preservers so as to float in a suitable vessel at some distance from the swimmer, and thus mark his position. It would also be useful, in cases of wreck, to enable a vessel, over which seas are continually breaking, to communicate with the shore, or it might be employed on railroad trains in distress as a signal inextinguishable by wind or rain.

We learn that the apparatus, as above described, has been distributed throughout the French navy, for experiment in different parts of the world, in order to determine not only the operation in cases of necessity, but also whether the phosphide will keep perfectly when submitted to variable atmospheric conditions.

Ditching by Steam Power.

In North Germany the reclamation of the extensive low lands, that have heretofore remained uncultivated for lack of drainage, is now proceeding with vigor under the auspices of a company employing a large capital and effective steam ditching machines. Each machine cuts a canal 20 feet wide and 6 feet deep, and from 100 to 120 feet in length, every 10 hours. The peat is delivered on the surface of the ground alongside the canal, where it is dried, cut into bricks, and sent to market. It is an excellent fuel. In Holland and Friesland there are 1,000 square miles of this bog land now worthless, which will be rendered habitable and profitable as fast as the canals are cut, to say nothing of the immense quantities of fuel that will be obtained by the ditching operation.

THE ENGLISH STEAM LAUNCH FIREFLY.

Some time ago we gave an account of the trial of the steam launch *Firefly*, one of those wonderful little high speed vessels for which Messrs. John I. Thornycroft and Co., of Chiswick, England, have gained such a reputation. Of this craft we now publish a sketch, from *Engineering*, which will serve to show her general character. Although only 53 feet long over all, 6 feet 6 inches beam, and 2 feet 6 inches draft of water, the little vessel made, on her trial the speed of 18.94 miles per hour, the observations of the runs being made with a care and accuracy which admits of no question. The *Firefly* is driven by a pair of engines of the inverted direct acting type, with 6 inch cylinders and 8 inch stroke, also made by Messrs. Thornycroft; and it was



INEXTINGUISHABLE FIRE FOR LIFE BUOYS.

together by a rod. These are worked by the traction of a cord attached to the upper cock, which is protected against shocks by a metallic cup, through which the line passes. The latter arrangement is connected to the tube with a screw, so that it may be removed and the box lifted out to renew the phosphide when exhausted. There is also provision made for hermetically sealing the contents by a little melted rosin in a suitably placed cavity.

The entire device is suspended by a single cord, which is cut by the operator. A slight line is connected with the cocks, and also with a staple on a pulley through which the suspending cord of the buoy passes, so that when the latter falls its weight is sufficient to cause the thread first to open the cocks and then to break. The apparatus adrift, the water enters the bottom of the tube and, rising up, enters the phosphide through the perforations. The reaction set up disengages gas, which escapes at the upper orifice of the tube, giving a flame of intense brightness and, during the



THE ENGLISH STEAM LAUNCH FIREFLY.

built for Mr. Henry Morel, of the *Société de la Lys*, of Ghent.

Messrs. Thornycroft and Co. have made a specialty of these high speed boats, and there appears to be constantly increasing demand for them. The firm are now constructing some of these launches with compound engines.

PERIPOLAR INDUCTION.

Those of our readers who have attended the very interesting lectures delivered by Professor Mayer, of the Stevens Institute, Hoboken, N. J., on the subject of magnetism, will remember the striking experiments which he performs with the aid of the huge electro-magnet belonging to that institution and a disk of copper suspended so as to freely swing between its poles. When the magnet is uncharged, the plate vibrates, like a pendulum, from side to side with perfect readiness, retaining its motion for some little time after the impelling force is removed. If, however, a current is established, converting the masses of iron into actual magnets, the vibration of the plate is almost instantly stopped; an invisible resisting medium appears to have been formed between the poles, through which the disk is unable to pass, or, if forced through, acts, as Professor Mayer expresses it, "as if it were penetrating cheese."

On conducting an experiment somewhat similar to this, Faraday was led to the conclusion that the arrest of the copper plate was due to induced currents produced therein. In other experiments, which we will not here describe, the existence of these currents was demonstrated by the direct exploration of a disk of copper turning before a magnet, an operation which defined the paths of the currents with certainty. Foucault modified Faraday's mode of investigation by arranging his plate of red copper on a horizontal axis, and revolving it by suitable mechanism at the rate of 10,000 turns per minute. The disk passed between the two extremities of the soft iron core of an electro-magnet, in which a current could be established at will. As long as the latter remained broken, the plate, when swiftly rotated, would retain its motion for some time; but as in the case already cited, a prompt stoppage followed the establishment of the electrical flow. Foucault intended not simply to reproduce Faraday's experiment, but he wished to study the results incident to the application of a force sufficient to continue the rotation of the disk in spite of the obstruction. It was found that, to accomplish this, considerable mechanical energy must be expended, which could be calculated and which reached quite large figures. What became of the excess of work over and above that necessary to ensure the rotation of the disk, maintaining a given velocity (or, in other words, that rendered necessary by the effect of the current), was the question, and Foucault determined it to be transformed into heat. This conclusion was soon justified by experiment, as it was found that the temperature of the disk became elevated to a degree appreciable by the hand; and when the rotation was prolonged for two minutes and the current produced by six Bunsen elements employed, the melting point of wax could be attained.

We have now given, of the salient points of this study, enough to show its progress up to the present; for since Foucault's experiments, no particularly notable investigations have been made into the action of magnets on copper in motion. M. Le Roux, however, has recently devised the apparatus represented in our engraving, and, besides, investigated that which he calls "peripolar induction."

Supported by iron feet on a solidly constructed table are four coils of isolated copper wire, so arranged as to be connected with a battery by means of the commutator, C, by which the current is interrupted or established at pleasure. Within these coils are cores of soft iron, the extremities of which extend beyond the wire and form the poles of the magnet when the current passes. A disk of red copper, DD', is placed symmetrically in the center of the apparatus and parallel to the axes of the coils, and turns on a horizontal axis which extends between the opposite extremities of the iron, as at A. At this point is shown the pinion which, with other gearing, transmits the motion of the handle to the disk, so as to cause it to rotate 180 times per second, or about 10,000 times per minute. To the ends of the cores of the opposite coils and below are fixed two pieces of soft iron, F', between which passes, though without touching either, the copper disk, D.

Thus arranged, the machine forms a powerful Foucault apparatus, with which the experiments above indicated can be repeated. But above the cores of the magnets are placed other pieces of soft iron, F, arranged similarly to those marked F', which, we have stated, are fixed below. When this portion of the device is in position, all the pieces become magnetized by contact with the electro-magnets; and as is evident, the disk, D, in its entire extent, is submitted to the action of a magnetic field presenting the greatest symmetry in every direction. Here, however, the contrary of that which has been heretofore observed takes place; the

rotation of the disk is as easily accomplished when the current passes as when the circuit is interrupted; and that the same resistance experienced in the Foucault apparatus is not here encountered is proved by the fact that the copper does not become sensibly warmed.

The current nevertheless passes, and zinc is dissolved in the battery. Here then is expended energy which should manifest itself somewhere. The study of the effects which should be produced by reason of the induction led M. Le Roux to admit the existence of a current running from the center of the disk to the circumference; and he proceeded to verify his conclusions. To this end, a vertical metal support is placed in contact with the axis of the disk, and a horizontal rod fixed to this support terminates in a copper wire, the end of which rests on the periphery of the disk. When the latter is turned, with no current passing, no especial effect is observed, except the slight warming of the copper wire by the friction. If, however, the flow of elec-

the sash. By turning the wheel by means of the small projection formed upon it, its motion through the bent slot raises the piece, B, and at the same time draws the face of the latter away from the casing so that it no longer binds.

When the window is up, it can be held in any desired position by causing the device to place itself as shown in the dotted lines, when the wheel comes to the bottom of the slot and, as is evident, pushes out the bottom of the casting. The apparatus falls readily into the position represented, and thus forms a self-fastener when the sash is down.

The advantages claimed are simplicity, ease of application; the non-marring of either sash or frame, a preventive of sash-rattling in windy weather, a positive lock when the sash is either up or down, a self-fastener when the lower sash is down, the holding away of the lock from the frame by the use of the handle when in the act of raising or lowering (as shown by dotted lines), and a peculiar adaptability to car windows. The lock can be easily placed on the right side of the sash as on the left, by being turned upside down; and in either case, if the sash is left raised, it cannot be further elevated from the outside.

Patented August 19, 1873. Further information can be had by addressing the patentee and owner, H. C. Demming, Harrisburgh, Pa.

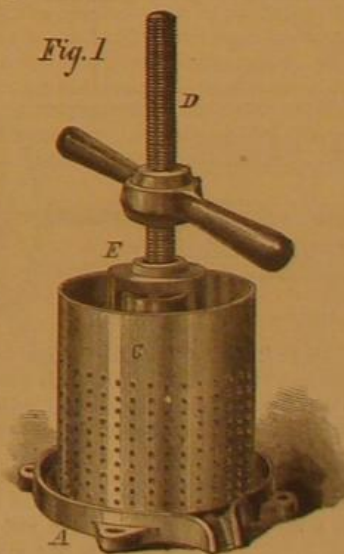
Proposed New Basis for Decimal Measures.

A correspondent, C. A. G., writes to point out that the French basis, the 10,000,000 of one fourth of the earth's circumference, is unsatisfactory as a starting point for the calculation of a system of weights and measures, as the circumference of a circle cannot be exactly ascertained. He proposes to use the secant equal to the radius of the circle, that is, the side of an inscribed hexagon; and he points out many supposed advantages of the change. But as the whole matter is a question of theory, we cannot see that the proposed plan brings us any nearer to absolute accuracy.

IMPROVED PRESS FOR FRUIT, LARD, ETC.

The annexed engravings are views of a new and simple form of fruit or lard press, in which, among other advantages claimed, the usual framework for the screw is rendered unnecessary, and there is a peculiar construction of the press chamber for facilitating the removal of the cake left after pressing.

Fig. 1



A is the base of the apparatus, having radial corrugations raised upon its surface, the channels between which lead the expressed liquid to the spout shown. In the center is a short conical projection, over which fits the lower portion of an inner perforated tube, A. The latter is connected with

Fig. 2



a perforated bottom which, when in position, rests on a flange made by turning the lower edge of the outer perforated wall, C. In the center of the base is a screw, D, on which is a nut provided with suitable handles. This nut

PERIPOLAR INDUCTION.

tricity be established, at that instant a continuous series of sparks leaps from the point of contact of wire and disk, thus denoting the existence of a very energetic current in the circuit formed by the disk, its axis, and the various pieces already described as arranged in connection therewith.

It is in the fact of there being this current, as predicted by theory, that M. Le Roux' idea of peripolar induction is based. No practical application of the discovery has been made; but it is very interesting, in that it confirms many theoretical ideas regarding induction. The machine represented was by Ruhmkorff, the celebrated manufacturer and inventor of many physical instruments, and has been exhibited before many French scientific societies.

DEMING'S CROWN SASH FASTENER.

We illustrate herewith a new and quite ornamental form of sash lock and holder, which can be readily attached to



any window without mutilation of the wood work. The device has no spring to wear out and is composed of but two pieces and a fastening screw. The latter serves as a pivot for the small cog wheel, A, the teeth of which engage in projections, formed, as shown, on the casting, B. When the sash is down the apparatus takes the position shown, so that, on attempting to raise the windows, the wheel, acting against the upper part of the casting, presses the face of the latter firmly against the batten and prevents the elevation of

has a conical depression in its lower face to engage with a corresponding projection on the follower, E. The form of the latter is clearly shown with that of the other detached portions in Fig. 2, while Fig. 1 represents the apparatus set up.

The material to be pressed is placed between the perforated bottom, on B, and the follower. By suitably turning the screw, the latter is carried down, squeezing the contents of the press, the juice or liquor escaping as already noted. It is claimed, in addition to the advantages already referred to, that, by the use of a follower with a conical bearing in the nut, and guided by the central tube, a more even and level bearing on the mass to be pressed is obtained than can be got by the ordinary screw press. After the liquid has been expelled, the cake may be removed by lifting the central tube, B, which brings the mass out with it, and from which the latter can be easily broken away.

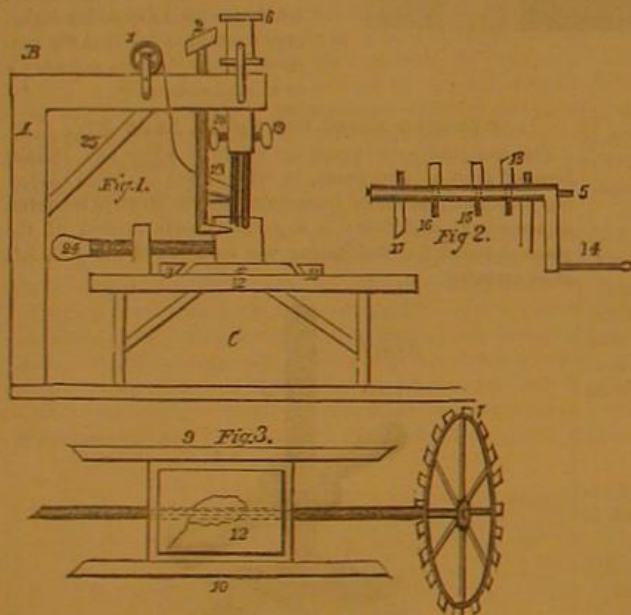
The inventor informs us that the apparatus is well adapted for pressing fruit used in the manufacture of wines, cider, and jellies, and also for dairy purposes in compressing cheese and butter.

Patented September 2, 1873. For further particulars regarding sale of patent rights, address Mr. Joseph Harlan, Lexington, Scott county, Ind.

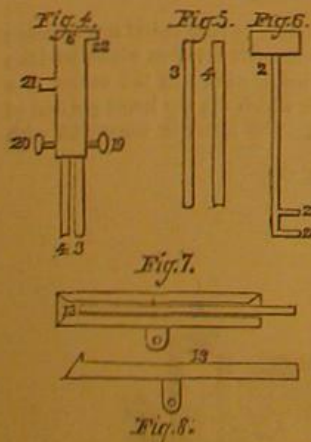
THAT ANCIENT SEWING MACHINE.

We referred, in a recent issue, to the discovery of an old sewing machine patent among the records of the British Patent Office, which, for a short time past, has excited considerable interest in mechanical circles. We present here, with engravings of the drawing attached to the specification. The latter we give below verbatim. The patent was granted to Thomas Saint (cabinet maker) on July 17, 1790, for "An entire new method of making and completing shoes, boots, spatterdashes, clogs, and other articles, by means of tools or machines, also invented by me for that purpose, and of certain compositions of the nature of japan or varnish, which will be very advantageous in many useful applications." It is numbered 1,764, and dated July 17, 1790.

The specifications describe three separate machines; the first a rather primitive contrivance for spinning and doubling the thread, the third for plaiting and weaving, and the second for "stitching, quilting or sewing." The last mentioned is the device represented, which is described as follows: A B C is the frame. Fig. 1 is the reel for the thread. 2 is a spindle which, moving to the right, conveys the thread to the needle at 4, and moving to the left again takes hold of



the stitch and keeps it tight till the needle has brought another stitch through the last taken; and so it goes on alternately until the whole article is completely stitched. 3 is theawl that makes the holes for the needle to pass through. 5 is a spindle that goes through the poppet at 6; while by turning the spindle at 5, the awl and needle is worked by the cogs 15 and 16, which are in the spindle at 5; and the motion of this spindle gives motion to the prongs 26 and 27, which are in the spindle at 2.



14 is a cog that gives motion to the wheel 7, which gives motion to a slide at 12 which moves along the grooves at 9 and 10 by means of a screw that is fixed in the wheel, to which slide the article is fixed for stitching. The prong 26 goes into a hole at the slide 13 and gives motion to it "which draws the thread on the under side of the article and holds it tight till the next stitch is taken, and so on till it is done. 23 in Fig. 6 is a shoulder that the Cog at 15 works against. At 21 is a shoulder that the Cog at 16 works against; these work (in?) the Pop-pet at 6. 19 and 20 are two screws to fasten the Awl and Needle 3 and 4; in 23 is the thread passing in between the Awl and Needle which the eye of the Needle receiveth. 24 is a screw to regulate the distance from the edge or side of

the article you are stitching. 25 is a Brace or support to the top of the Machine. The Cogs 14, 15, 16, 17 and 18 in the Spindle at 5 should be so fastened as to be screwed up or down according to the quality of the article and fineness or coarseness of the stitching required."

The machine was destined for use in sewing together outside and inner soles of shoes, and for joining legs, spatterdashes, etc. It seems quite certain that there was no eye-pointed needle, but that the lower end of this implement, which appears to be fractured, is meant to be notched in order to push the thread through the work.

Correspondence.

Crude Oil for Fuel.

To the Editor of the Scientific American:

In your issue of October 4, in an article on the combustion of petroleum as fuel and for manufacturing gas, you set forth that the best result of combustion of petroleum as compared with coal was as 2 to 3. Now Mr. Daniel Fisher, at Fisher Brothers' storage tanks in Oil City, Pa., has a burner in operation that he has used since last winter continuously. He uses from one barrel and one half to one barrel and three quarters during the run of ten hours, using in the same time one ton of coal. He uses steam as a motive power, throwing a jet of oil into a chamber, thence through a small opening in the chamber to the furnace, the jet being accompanied by a current of air, fed in connection with the oil, of such quantity to make perfect combustion, there being no smoke. Mr. Fisher has not patented his invention, nor does he propose to.

REMARKS BY THE EDITOR.—The idea intended to be here conveyed is, we presume, that 74 gallons of crude petroleum, or 518 lbs., is made by means of Mr. Fisher's apparatus to generate as much steam power as a ton of coal. There is evidently a mistake somewhere. The power of the engine is not stated, and therefore we cannot judge of the economy of the fuel. But we may observe that, if the engine and boiler are well made and intelligently run, then two pounds of coal per horse power per hour would be consumed, on which basis a ton of coal would drive a steam engine of 112 horse power for one day of ten hours, and it would require 1,494 lbs., or 5 barrels, of petroleum to do the same work.

The Hot Air Engine.

To the Editor of the Scientific American:

I have read with much interest the suggestions lately made by the different correspondents for the improvement of the hot air engine. I have had the care of a caloric engine for almost two years. It is of 2½ horse power. I am troubled to keep the upper door and also the poppet valves tight. I would throw out two suggestions that I think would make them better as far as valves and doors are concerned, they are these: Have the door seats cast separately from the engine, and have them fastened to it by a flange around the seat, with bolts screwing into the engine; the door and seat could then be easily taken from the engine and planed or ground together as the case might require. As they now are, it is a vexing tedious job to grind them to a surface by hand, and the change might sometimes save the removal of the whole furnace to a shop for repairs.

I think that the poppet valves would be better if they were made somewhat like a cone, having the same bearing surface as those in use at the present time; this would make them less liable to warp, they would be more quickly ground together if they leaked, and by no possible means could anything lodge on the valves or seat. Sometimes we have had the engine nearly stopped by small lumps of coal catching between the valve

and seat; and at others it bothers me to start it for the same reason.

FRANK O. CLARK.

Illuminating Gas from Crude Petroleum.

To the Editor of the Scientific American:

As you are happy to chronicle any new facts, let me make a statement of what has been done at our mill at Passaic, N. J., since January, 1871, when we had works erected for us, by Dr. W. C. Wren, of Brooklyn, N. Y., for the manufacture of illuminating and heating gas from crude petroleum. The works are the invention of Dr. Wren, and we have ever since been using them to light our mill (which we run all night) with the following results:

First, we use crude petroleum (which is quoted at 6 cents per gallon) and make a fixed permanent gas of eighty candle power. Secondly, we have no difficulty in making the gas. Thirdly, we make, on an average, more than four thousand feet of gas of the above candle power from one barrel of crude oil, which we use through a burner consuming one foot per hour and one foot and three tenths per hour. The barrel of crude petroleum, at the rate of ten cents per gallon, costs us, when made into gas, seven dollars; that is, in practice it costs us seven dollars for four thousand feet of petroleum gas that goes farther and gives us a better light than seventy dollars worth of coal gas at three dollars and a half per thousand. The above is the result in actual practice.

If we used coal gas, we would want five feet and six feet burners for the same light we now get with a one foot and one and three tenths feet burner. We have now had the works in steady and constant use for more than two years and a half. This is no "statement of the inventor," but plain indisputable fact by a consumer.

The retort for making the gas is a simple contrivance, and

is not given to choking with carbon, as you seem to think probable. It is so simple and easy to run that we take any man out of the mill and set him at it.

At some future time (not to use more of your space at present) I will give you some of the results of heating with petroleum gas. MILES WATERHOUSE, Superintendent.

52 and 54 Murray Street, New York city.

REMARKS BY THE EDITOR.—We are glad to make public the excellent practical results here given for the Wren process, which is evidently a discovery of much importance. The apparatus employed involves, we believe, the employment of a series of chambered retorts, through which the oil is slowly passed.

Strange Lightning Freak.

To the Editor of the Scientific American:

About twenty miles east of Santa Fé lay the remains of an ancient Indian city. The church (which is, or was ten years ago, complete) has been so much appropriated by the neighbors that the roof has caved in and only the outer walls are now standing. In one corner, near a tower, a ten year old boy recently took refuge from a thunderstorm. The lightning struck the north side of the tower, tearing the adobe, of which the church is built, for about three feet downward; it then went inside the wall (how cannot be seen) and came out again through the wall of the church, as is shown by an aperture, at the height of the boy's head. His hat shows a large hole; and when his father found him, he showed no sign of life, his eyes were open and his arms a *kimbo*, as if calmly awaiting for the storm to pass. His outer garments are entire; but his shirt is somewhat torn on the back and his drawers are ripped down the left leg. Some scientific travelers advised the father to break into the wall, as they believe that metal inside attracted the lightning and caused this irregular course. He tried and found that there is, inside, a separate wall, apparently built after the original wall was finished, the entire being five feet thick.

About two centuries ago, the Indians had troubles with Spain, and closed up their wells and mines, and left. It is possible that the priests at that time secreted their precious metals in masonry. This will soon be found out; but this is one step more to destroy the remains of strange early civilization in America; and moreover, the Indians (Montezumas) are fast dying out.

L. G. FELLNER.

San Cristoval, New Mexico.

The Bisulphide Auxiliary Engine.

To the Editor of the Scientific American:

Your correspondent, Mr. Joel A. H. Ellis, does himself and his engine great injustice when he says that in it "the heat is used twice;" and this is no mere question of words, for he implies that his machine is a kind of perpetual motion, and leads one to ask why, if the heat can be used twice, may it not in some similar way be used three or an indefinite number of times. Such a statement is calculated to bring into disrepute a really meritorious thing, and is productive of distrust and suspicion in the minds of power users.

The celebrated professor, the late W. J. Macquorn Rankine, has shown indisputably that the efficiency of any heat engine is in a certain way proportional to the difference of the temperatures at which the steam, or other heat vehicle, is admitted to and ejected from the machine. In a condensing steam engine, for instance, the greater the difference between the temperature of the steam in the boiler and that in the condenser, the greater the efficiency of the engine; and, disregarding the question of heating feed water and other economic adjuncts of the steam engine, by continuing the reduction of temperature from that of the exhaust steam in a non-condensing engine to that of the bisulphide condenser, Mr. Ellis has a heat engine, considering it as a whole, working between much greater extremes of temperature than is possible with either the steam or bisulphide engine alone.

With our present light on thermo-dynamics, he may say that, in the steam engine alone a certain quantity of the potential energy, resident in the steam and called heat, is transmuted into external work, and that his bisulphide addition transmutes a quantity of the energy remaining in the exhaust steam into equally useful work; but not that he has used the heat of the steam twice. He transmutes into useful work or uses more of the heat imparted to the water in the steam boiler than can be done with the steam engine alone, but he does not use any of it twice; and a very large proportion of it he does not even use once.

JOHN T. HAWKINS.

New York city.

A White Blackbird.

To the Editor of the Scientific American:

It will give the ornithological world some pleasure to learn that another *rara avis* has been added to its collections. This is none other than a "white blackbird" or, more properly speaking, a "red winged starling." It was secured by Mr. E. A. Andrews, of Watertown, N. Y. While Fayette Noble, of Ellsburg, was "sitting" this gentleman for ducks on the marsh at the mouth of Sandy Creek Landing, Mr. Noble discovered a "white blackbird" amid the thousands of starlings that frequent that marsh. Of course such an object could not fail to attract attention and by dint of careful paddling, Mr. Andrews was at length placed in a position to secure this rare prize. The bird, as we have said, is of the red winged variety, a fledgling of this year, with cream colored feathers interspersed here and there throughout its snowy coat, the cream color predominating especially on the wing, where in another year the red would appear. It is unnecessary to say that the bird was a great curiosity. The oldest hunters on the marsh, who have seen myriads

of blackbirds, as they call them, come and go, never saw such a thing as a white one before. The appearance of this anomalous bird, as he arose and settled amid his companions of a darker hue, was very striking, they seeming to care no more for him than if he were one of their own color.

BIRD LOVER.

[Rev. A. H. Gesner, of Sing Sing, N. Y., states that he had this bird in his hand.—Eds.]

LETTER FROM UNITED STATES COMMISSIONER
PROFESSOR R. H. THURSTON.

NUMBER 15.

PARIS, September, 1873.

LIEGE,

Belgium, and the surrounding country is by far the busiest district that we have yet visited on the continent. The city is quite large, having a population of about 120,000, and has been called

THE BIRMINGHAM OF BELGIUM.

En route to Brussels, our road took us through a wonderfully active country, and we were continually called to look at the smoky, clustering villages, situated in pleasant and romantic spots among the hills, blots upon beautiful landscapes; yet such defects have made this little domain the most successful and prosperous portion of Europe.

The manufacturers of Belgium have a history dating back as far as the Roman occupation of Northwestern Europe at the commencement of the Christian era. The energy and courage, which then won from the great Caesar a respect which was accorded to few other tribes, has never been lost, and has developed itself splendidly in gaining victories of peace. The character of the work done in Belgium is better, as a rule, than is found in any other country of Europe, and is second only to that done in England. In some cases, Belgian manufacturers of machinery have even successfully competed in England with British builders. The country produces its own flax, and textiles are produced from it of the best quality. Cotton and wool are largely imported, and, in some branches, the manufactures of these staples are carried on with greater success than in any other part of the world. The best machinery, however, is usually purchased in England, and the superintendents of mills are frequently imported. The manufactures in iron have an antiquity which antedates history. The Romans are supposed to have found rude forges and furnaces in operation, and vast cinder heaps are found here and there which testify to the extent, as well as the early date, of the transition in Belgium from the age of stone and brass to that of iron; and the method of working has been learned also by the discovery, at Lustin, about three years ago, of two

ANCIENT SMELTING FURNACES,

with their contents just as they were when they went out of blast two thousand years ago. They were merely excavations in the clay, oval in form, some twelve feet long and a yard in depth. No artificial blast was used, but a long channel, opening toward the quarter from whence blew the strongest winds, served to direct the air supply into the lower part of the furnaces. The result was the reduction of the ore without carbonization, the product being a crude sort of wrought iron. The iron, found in the furnaces just referred to, contained nearly 95 per cent of pure iron, the remainder consisting of a variety of generally injurious impurities.

From that time to the present, the Flemings have never lost their skill as workers in iron, and they have succeeded well in keeping pace with the progress of improvement. To day, we are told that Liège possesses 98 iron works, turning out, in 1872, 178,000 tons of pig metal and 103,000 tons of finished iron. Charleroi threw into market 400,050 tons of pig and 250,000 tons of manufactured iron. Verviers, where was built the Thompson road locomotive exhibited at Vienna by Bede & Co., Seraing, where is the establishment of the Cockerill company, Ghent, Brussels and Antwerp and many other towns are well worth visiting, but we had not time to explore other cells of this busy hive of the Flamauds.

Had the Belgians the steadiness and persistence of the English workman, or the energy and activity of the American, this little kingdom would become a most formidable industrial rival to all its neighbors. As it is, the people have nobly illustrated their national motto "*E' Union fait la Force*;" and by industry and frugality, and by close attention to their pursuits, whether of commerce or of manufactures, have converted their once unproductive fields into a vast and beautiful garden, have turned their mineral resources into national wealth, and have built up beautiful towns and magnificent cities in every district of their State. The whole country has an area of but eleven thousand square miles, just the area of the State of Maryland; yet Flanders produces eight millions of dollars worth of flax, Hainault raises two millions of tons of coal, and cotton manufacturing employs some fifteen millions of dollars of capital. Brussels and Mechlin lace, Ghent calicoes, Tournay carpets, the paper and the firearms of Liège, and the more important branches of iron working already considered, have been as useful in stimulating commerce as in directly contributing to the national prosperity.

The work people are not usually as well provided with the comforts and conveniences of life as they should be, but instances are not infrequent of employers making special provision for their welfare in a degree which is not actually incumbent upon them. I am very confident, however, that in no instance, at home or abroad, does the employer fail ultimately to receive a bountiful return for all capital expended in providing for the physical, intellectual and

moral welfare of his employees. Physical benefits conferred bring back a return in healthful energy, intellectual training gives intelligence which invariably finds application, and moral advancement results in an increased sense of responsibility; and all together promote wonderfully that appreciation of the mutual obligations binding master and man which is the best of all preventives of strikes and lock-outs, and of all those unfortunate disagreements which divert the trades unions from their legitimate work and bring embarrassment and distress upon all classes. The Messrs. D'Andrimont have erected, at their collieries at Micheraux, the

HOTEL LOUISE

for their work people. The house contains 200 beds, the rooms are fitted up plainly but neatly, with all modern conveniences, and the prices charged are as slight an advance upon cost as will secure the proprietors against absolute loss. Each man pays about a franc and a half (thirty cents) per day for lodging, meals, washing and necessary attendance. A miner, returning from work, goes to the lavatory, removes his begrimed suit of clothes, sends them down by a "dumb waiter" to the laundry, takes his bath, receives a clean suit of his own clothes in return for those sent down, and makes his appearance ready for his meal, or for cleanly occupation during his "off watch," dressed very like a gentleman, and, with his neat suit and freshly blacked boots, experiences a feeling of self respect rarely known under the ordinary régime of less well administered coal mines.

Here the maximum earnings of a miner are given as about ninety francs (eighteen dollars) in a month, one half of which might have been saved by a frugal single man. In the

COTTON AND WOOLEN MILLS,

as well as in many other branches of industry, the work people labor generally seventy-two hours per week, and no abatement of time is made for women and children, in which classes thirty-five per cent and twenty-five per cent, respectively, of the working population are included. In some cases, the working hours have been reduced to ten, and that without decrease of production. The amount of work done by each hand probably averages less than with us, although the speeds of machinery are about up to our standard. Thus, cotton looms run 125 to 180 picks per minute, woolen 140 or 150, and sometimes at higher speeds. Cotton spindles are driven up to 6,000 revolutions on American and 5,000 on East Indian cotton, woolen spindles make 5,000 or 5,500, and flax spindles 3,500 turns per minute. The number of operatives varies from seven to ten per thousand spindles, a number exceeding the figures of our own and English mills. Some of these mills contain 200,000 spindles, and the tendency is, as with us, continually toward increasing the size of mills, and securing the increase of economy which is a usual consequence of enlarged production. That sound business policy which dictates the purchase of the best possible machinery is also well understood there, and the less frequently acknowledged principle that prosperity always ultimately attends honest work and liberal dealing is, perhaps, more generally recognized than among many other manufacturing peoples.

A pleasant afternoon ride from Liège through a very busy country, during which we were rarely beyond the sound of the armorer's hammer or the hum of spindles, was terminated, toward evening, by our arrival in

BRUSSELS,

a favorite city with travelers, who can usually second the encomiums of Byron, of Scott and of Southey, who were enthusiastic in their admiration.

We had but little time to spare, and could not even find opportunity to call upon our distinguished friend and colleague, M. Le Professeur Lambert, who, some years ago, so intelligently examined the resources and studied the industries of the United States, under the direction of his government. We were more fortunate in the attempt to meet the "friend of excursionists," Mr. Cook, from whom we learned that the party of circumnavigators of the world, who are to trust their fortunes in the hands of his guides, is composed principally of Americans. "*Natürlich*," his German assistant remarked, and the French attendant added: "*parfaitement*." Brussels is indeed a noble city, and we regretted very much that we had not time to explore it more thoroughly, and especially to visit the galleries of paintings for which it is famous, and in which so many of our artists find instruction and inspiration. However, as an uncultivated taste has caused me to prefer the paintings of Titian to those of Rubens, and the masterpieces of Correggio to the *chefs d'œuvre* of Raffaele, this disappointment may have been, in some degree, deserved.

The pleasant streets, the noble old cathedral, the beautiful Hotel de Ville with its odd sculptures and tall, graceful spire, and the magnificent, but still unfinished, Bourse, which we thought the noblest modern structure which we had yet seen in Europe, all delighted us, and we came away most reluctantly, but with the hope that we may see more of this "Junior Paris" at some future time.

We left Brussels by the evening express train and arrived here early next morning. We had not a comfortable ride, for the French railway carriages are not as comfortably cushioned nor as nicely upholstered as those of Germany and Austria. They were in this train nearly as meanly fitted up as the general run of English cars. Reaching Paris at an early hour this morning, we enjoyed greatly the ride to our hotel through the clean streets, already enlivened by crowds of working people on their way to commence their tasks, the clear fresh air giving every one a cheerful humor and a brisk manner that was quite inspiring.

During the short period of our stop here, we have had opportunities of visiting the more interesting portions of the

city and of inspecting the principal edifices. We have visited

NOTRE DAME,

and have admired its architecture and wondered at the strange taste which could have placed above its galleries and on the towers the ugly carved monsters which were probably once supposed to add to the beauty of the venerable pile. In their presence, it is easy to imagine Quasimodo. We have looked upon the tomb of Napoleon Bonaparte, at the Invalides, and, with less of interest, perhaps, but with greater pleasure, have explored the Pantheon, where lesser heroes but greater men are interred. We have admired the Madeleine and the beautiful little Sainte Chapelle, and have viewed the new Opera House from every accessible standpoint. We have enjoyed the "*Concerts des Ambassadeurs*" in the Elysian Fields and have stood in half pleased, half sad admiration within the structure which contains the beautifully executed and wonderfully well designed panorama of Paris during the siege. The spectator is almost convinced as he gazes upon this splendid picture, that he is actually upon the battle field before Paris, so perfectly do the art of the painter and the scenic arrangement combine to deceive him. We have been courteously received at the Ecole des Mines and at the Ponts et Chaussées, and have examined their collections and studied their methods, and have been, in defiance of regulation, shown through the rough looking halls, lecture rooms and dormitories of the famous Polytechnic School, from which have graduated the greatest engineers, both civil and military, that modern France has produced. We have seen the Institute, the home of the French savans, and have looked upon those sad reminders of the existence of the commune and the falsity of the authors of the legend, everywhere seen, "*Liberté, Egalité, Fraternité*," the ruins of the Hotel de Ville, the Louvre, and the Colonne Vendôme.

We have visited that wonderful depository of ancient industrial relics and of the marvels of modern invention and art the

CONSERVATOIRE DES ARTS ET METIERS.

Here we spent a large part of a day, meeting General Morin and M. Tresca, the distinguished *Directeur* and *Sous Directeur*; and, by the kind attention of the son of the latter, we succeeded in making a very thorough exploration of this world renowned institution and of its unequalled collections in every department of human industry. The old looms of Vaucanson and of Jacquard are preserved here in the *Salle des Filatures*, in the midst of a multitude of models and machines belonging to the department of textile industry, and are guarded with jealous care as most precious relics. A long gallery is filled with machinery and models of various sorts of machinery, including beautiful models of steam engines, which have cost, in some cases, several thousand dollars. In the chapel, for this was formerly the monastery of St. Martin des Champs, are steam engines of large size, steam fire engines, turbine water wheels, all sorts of apparatus for testing the efficiency of machinery, and large models driven by steam power. In this hall is the first steam carriage ever constructed, that of Cugnot, which was built in 1769. This was before the introduction of the crank, and the engine has a ratchet-like arrangement by which it turns the wheels. For so old a construction, the work seems surprisingly well done, and the proportions are also good. It is an exceedingly interesting machine. We may hope, but can hardly expect, that some future day may see such a splendid collection in our own country. At present nothing approaching this in extent or completeness exists in any other city in the world.

R. H. T.

A Compound Locomotive.

An ingenious member of the Manchester Scientific and Mechanical Society proposes to apply the compound principle to locomotives. This is how he sets about it, says the *English Mechanic*. He would use steam of 250 lbs. on the square inch to work the small cylinder, and expand this steam into a supplementary boiler bearing a pressure of 60 or 65 lbs. to the square inch, so as to have a surplus of effective pressure of 180 lbs. or 190 lbs. in the small cylinder, or about 60 or 65 lbs. in the larger one. The principal alterations proposed are in the boiler. In adapting his plan to a locomotive of the medium size, he would make the boiler 2 feet longer than at present, and divide it into two distinct parts, the part containing the furnace or fire box to be 2 feet shorter than at present, so as to have the supplementary boiler 4 feet longer, both being equal in diameter, and equal in number, size, and position of tubes, the two parts of the boiler being firmly bolted together, and so arranged that the tubes of one are in a line with the other, so that the hot air and flame may pass freely through from one to the other. An important advantage claimed by the plan is that the driver of the locomotive will be enabled to start his engine with the full power of steam in both cylinders at once, which he could not do if compounded in the usual way. Although this plan will require extra outlay, there will be a considerable saving in fuel, which, with other advantages, it is claimed, will more than compensate for the extra cost. We are not surprised to hear that discussion followed the reading of the paper, in which the feasibility of the plan was generally condemned. Ultimately, however, the discussion was adjourned, in order that the inventor might give further information on the subject.

J. W. S. writes to say that he has a perpetual motion in running order, and he will dispose of it for \$2,000,000 for a "plot;" but if he has to carry it to Washington, he will ask \$5,000,000. The existing financial crisis will, we fear, prevent our correspondent from receiving either of the sums he mentions.

PALMER'S POWER SPRING HAMMER.

In the illustration is presented a view of Palmer's power spring hammer, an invention, it is claimed which has the advantage of being operated by the same power as is used to run the works in which it is used and without the additional expense of extra boilers and attendants. The machine, it is stated, can be governed by the foot of the forger so perfectly as to cause it to crack a walnut or to strike a blow equal to a steam hammer of the same grade. The smallest size will deliver 500 strokes a minute, and is especially adapted to forging cutlery of all descriptions, bowls of spoons, small hardware, jewelry, etc. The medium size is designed for the use of a general forge shop, and will strike 250 blows a minute. The largest forms, it is believed, are as well adapted to all classes of work as the steam hammer, while they are free from the expense attending the use of the latter.

In the engraving is shown a side view of the machine, now on exhibition at the Chicago Exposition. The dies are made in the usual manner, and are keyed in position. The machine is driven by a friction pulley sliding on a splint in the shaft, the belted pulley being loose on the latter. The friction pulley is operated by a forked clutch worked by the right angled levers attached to the long foot lever, which is bent around the fore part of the hammer so as to be accessible on both sides and front of the apparatus. The shaft has a crank forged in the center and carries upon it a connection which extends to a leaved spring. On the other end of the spring is attached the hammer head, in which is keyed the top die. The spring works upon the bearings of a flat rocker shaft to which it is securely bolted.

The operations are as follows: The iron being heated and placed upon the die, the forger places his foot on the treadle to depress it, thus drawing down the arm that moves the clutch friction into the running loose pulley. The crank is thus revolved, drawing down the spring which carries up the hammer head, and producing by its velocity a vibration of the spring in which the blow given is in proportion to the velocity in which the crank revolves. It is aptly illustrated by cracking a whip. To forge a long rod or scythe, an aperture cast through the body of the upright part so as to allow the work to be passed lengthwise the forging dies is provided. The slightest pressure of the foot on the treadle is easily observable in the working of the machine, but the head never allows the dies to meet until there is velocity enough to produce the requisite vibration of the spring. The balance wheel, on the end of the crank shaft, acts in two capacities, the wheel having a balance placed within its rim to counteract the weight of hammer head, thus allowing the hammer to stop in any position in which the friction may leave it, thereby preventing the weight of the hammer head from always resting on the lower die when stopped; and the momentum of the wheel keeps the machine perfectly steady when running, and prevents, by the balance within its rim, that oscillating movement of frame which would be the result of the blow if not thus balanced.

There are, we learn, some twenty of these hammers now in operation in various parts of the country, doing all classes of forging, from the smallest forks upward.

Patented by James Palmer, January 9, 1872, and reissued April 29, 1873. The sole manufacturers are Messrs. S. C. Forsaith & Co., Manchester, N. H., who are also builders of the Abbe bolt forging machine, recently described in our columns. Further particulars may be obtained by addressing them.

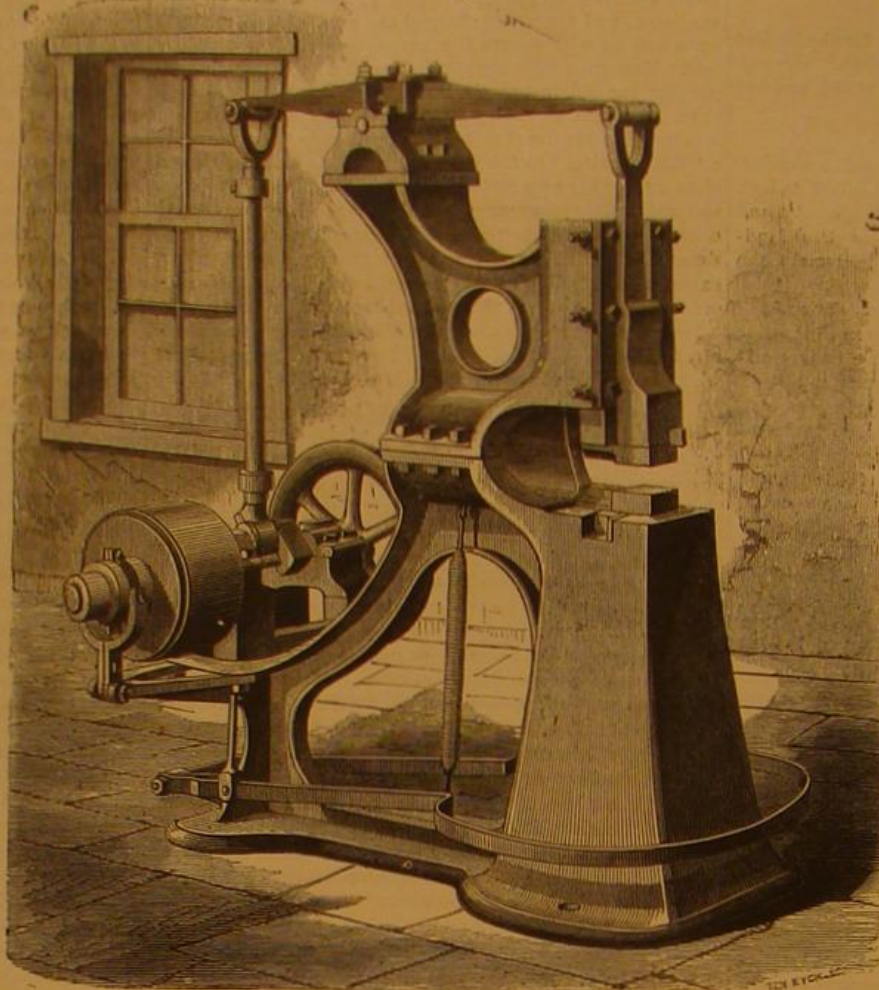
IMPROVED RAILROAD SWITCH.

Our illustration represents an invention which has for its object the construction of a switch connection which shall be free from the disadvantages resulting from the expansion and contraction of the switch rail at different temperatures, causing either a too close contact so as to prevent the working of the rail, or a too wide opening resulting in the battering of the rails and their consequent frequent replacement. In the ordinary form of switch, it sometimes happens that the rails open as much as three inches during the night; while if the fish plates are screwed up tight, the ends may close up entirely in the heat of the day.

A, is the switch rail, connected rigidly, at the point B, to a long timber, C, placed underneath and passing through the cross ties which are cut for the purpose. The connection, at B, is such that the rail, A, pivots freely sidewise, while at its other end it communicates with the track rails, D, by means of a suitable lever connection moving on a bed plate, E, as a substitute for the heavy cast iron blocks. Bed plate E, rests on the cross-ties and gives a more elastic support to the switch rail, preventing thereby the anvil-like resistance and quick wear of the same. The track rails, D, also rest upon the bed plate and are rigidly attached thereto. The timber, C, passes below

the plate under the middle rail and is firmly attached by bolts.

It will be observed that it is not so much the intention to overcome the expansion of the switch rail, A, from point, B, to bed plate, as such would only be about $\frac{1}{4}$ inch in some 18 feet; but the main object sought is to make a firm connection, between rails A and D, so that the adjoining rails of the track cannot crowd the former together. The inventor states, as the result of his experience, that unless some arrangement of this kind be used, the rails, when the fish plates are tightly screwed up, will run perhaps for a quarter of a mile, shoving up the switch joint (that being the weakest part) in preference to overcoming the friction of the



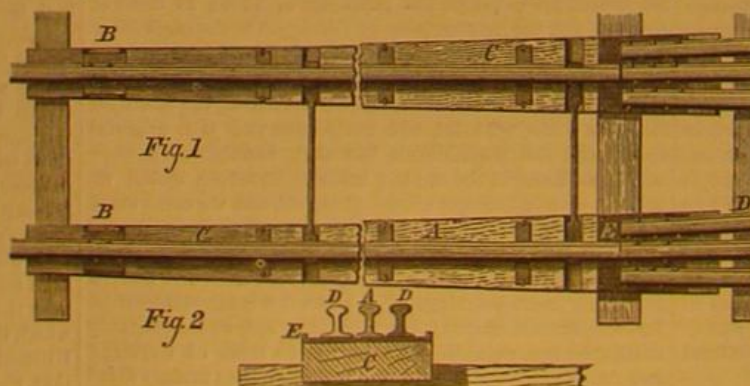
PALMER'S POWER SPRING HAMMER.

fish plates and closing the usual $\frac{1}{4}$ inch spaces left to allow for expansion between every two rails. By the present system, it is claimed, through the means above described, the rails are obliged to fill up these spaces completely, as they cannot crowd or creep toward the switch, so that the latter remains unaffected and the relative distance between the ends of the rails always uniform. The device, we are informed, has been in use on the Central Pacific Railroad during the past summer, and even when the thermometer ranged from 100° to 110°, worked with perfect success. The construction is such as to resist any strains to which may be subjected the plates under both throw and stationary rails, being bent at the end so as to cut down into the timber and thereby be prevented from any possibility of slipping.

Patented through the Scientific American Patent Agency, May 13, 1873. For further particulars regarding rights, etc., address the inventor, Mr. John R. Adams, Truckee, Nevada county, Cal.

Important Patent Litigation.

The loom improvements patented by William Webster pertain to the operation of the wires used in the manufacture of carpets and other pile fabrics. The practical result of the use of the Webster invention is to augment the pro-



ADAMS' RAILROAD SWITCH.

duction of the loom by more than 33 per cent, without increase of the power or other expenses. No sooner had the success of the improvements been practically demonstrated than various carpet and other factories sought to modify their looms so as to gain the same advantage. In this they are alleged to infringe the patents above alluded to, and an

extensive series of litigations has been commenced on the part of the patentees. Testimony is now being taken, prior to argument in the United States Court.

Habits of the Baltimore Oyster.

In a conversation with a prominent oyster packer, says the *Baltimore American*, some curious and interesting features of the oyster trade were related. As is well known, the habits of this bivalve are an entire mystery; what it eats and how it lives are questions not yet understood. The spawn of the oyster floats around with the action of the waves and tide, and adheres to whatever it may come into contact with. Oysters taken from a rocky bed are of superior quality; those taken from a soft bottom are comparatively poor in quality. Thousands of "poor innocent" oysters die annually from resting on a soft bottom, a fact which should arouse the sympathies of all tender hearted people.

The weight of the oyster, as it gradually matures, sinks it beneath the surface; and as soon as it is covered with sediment or mud, it dies. Many people suppose that the oyster really eats, and kind hearted people, buying oysters in the shell, sometimes throw corn meal over them, thinking to feed them. The peculiar noise emanating from them has been supposed to be produced by feeding. All shellfish at times have their shells open, and when touched will instantly close them. The noise thus produced has been mistaken for mastication, when, in reality, it is from fright.

Most of the Baltimore dealers in raw oysters during the summer months transact their business at Fair Haven, Conn., whither large beds of Baltimore oysters have been transplanted. The beds are so arranged that, on the receding of the salt water tide, fresh water from a small stream covers the oysters; it is said that this fattens oysters better than any other method. Orders are received for the article in question during the summer months, and they are taken from the beds and shipped with the greatest possible dispatch, and many eat them with apparent relish, notwithstanding the warmth of the season. Altogether the oyster packing trade of Baltimore is an enormous one, and, in connection with fruit and vegetable packing business, employs a capital of about \$25,000,000, a fact which sufficiently expresses the great importance of this interest to Baltimore.

Determination of the Heat of Combustion of Explosives.

M. M. Roux and Sarrazin communicate to *Les Mondes* the following description of the mode of determination and results obtained, in testing the heat disengaged by the combustion of various kinds of gunpowder. The deflagration was produced in cylindrical cast iron shells of 0.9 inch in thickness and of an interior capacity of from 16 to 17 cubic inches. These bombs were closed by a bronze screw plug through which passed an isolated wire, which conducted a current sufficient to heat a thinner wire within to redness and thus inflame the charge. They were placed in a copper vessel 4.5 feet in diameter, 5.1 feet in height, and containing about 4 pounds of water. The temperature of the bath was determined by the end of a thermometer graduated to tenths of a degree, with reading to hundredths. The water was first brought to a temperature equal to that of the surrounding atmosphere, the explosion caused, and then the difference in warmth noted. The following results were obtained:

	Sulphur	Saltpetre	Charcoal	Units of heat per 2.2 lbs. of powder.	Weight of gas per 2.2 lbs. of powder.
Fine sporting powder	10.0	78	12.0	807.3	0.387
Cannon	12.5	75	12.5	752.9	0.412
Musket	10.5	74	15.5	730.3	0.414
Ordinary com.	13.0	72	15.0	684.2	0.446
" blasting	2.0	62	18.0	572.2	0.499

New Method of Preparing Caustic Soda.

The crude lye is evaporated in cast iron boilers. At a certain heat the cyanides contained in the pasty mass are decomposed, with escape of ammonia and deposition of carbon. When this point is reached, the heat is raised to redness, and the mass becomes more fluid. A sheet iron cover is then fitted upon the boiler, provided with an opening through which enters an iron pipe. This is plunged into the mass, and air is forced in. The graphite which separates rises to the surface and may be collected. The mass is tested from time to time to see if the sulphur is perfectly oxydized. When this is the case the blast is stopped, the mass allowed to become clear, and run off as usual.—*M. Helbig.*

POISONOUS UNDERSHIRTS.—J. N. writes to tell us of an instance of a man being blistered by wearing an undershirt dyed with cochineal. He advised the sufferer to bathe the part in a solution of soap and soda to neutralize the tin which had been absorbed from the dye, and put the shirt through the same treatment. He attributes the evil to the carelessness of manufacturers who send out goods without rinsing or washing them.

A FORTY THOUSAND DOLLAR COW.

We doubt if more extravagant sums have ever been paid for fancy cattle than those lavished during a recent sale of the herd of the Hon. Samuel Campbell, at New York Mills, near Utica, N. Y., as reported on page 201 of our current volume. Representatives of the most prominent short horn breeders in the world were present, including a large delegation of English cattle stock buyers, consisting of lords and other titled persons.

The breeds which brought the largest sums were Duchesses and Orfords; and the first animal sold, known as the 2d Duke of Oneida, a three year old bull, brought \$12,000. The cow represented in our engraving, known as 1st Duchess of Oneida, was next offered, and, after an extraordinarily exciting contest was knocked down to Lord Skelmersdale, of England, for \$30,000. Subsequently other cattle of the same strain followed at \$19,000 and \$35,000, and the interest culminated with the sale of the 8th Duchess of Geneva, the dam of the animal in our engraving, which was bought by Mr. R. Pavin Davis, of Gloucestershire, England, for the unprecedented sum of \$40,600.

The *Lice Stock, Farm, and Fireside Journal*, to which we are indebted for our illustration, says that there were, in all, one hundred and eleven animals presented, and that the amount realized was \$380,890. The Duchess herd was originally from England, imported in 1853, and has been since kept in perfect purity in Dutchess county, N. Y.

HELICOIDAL CONCAVO-CONVEX PROPELLER.

The primary object sought in the construction of the propeller to which our engraving refers is so to form the blades as to impart to the water in which they turn a longitudinal motion in a direction coincident or parallel with the axis of the screw, while, at the same time, avoiding all lateral or tangential motion. To this end the blades are constructed of concavo convex form, to give them greater efficiency, and are combined with a helicoidal curvature, thus obtaining, in addition to advantages otherwise gained, the propelling power and easy rotation of the helicoidal bladed screw.

Fig. 1 is an elevation of the working face of the propeller, and Fig. 2 a section of one of the blades on the line, *xx*. *A* is the front or cutting edge of the blade, and *B* the back edge, considered in respect to its forward rotation.

Located near the cutting edge, at *C*, is the center of concavity, or point from which the surface has a curvature of equal pitch or radius in each direction, inward, outward, or rearward, as indicated by the radial lines shown. It is claimed that, by thus placing the point, *C*, pressure is prevented from being produced at the back of the blade either by the rotary movement of the screw or by the forward motion of the vessel through the water. The blades are perfectly connected to the hub by short arms, as represented, and may be two, three, or four in number, and cast in as many pieces as desired.

The inventor informs us that his theory, claimed as true, has been fully demonstrated by practice. A 30 inch wheel was recently constructed at the United States navy yard, Washington, D. C., and tried on a steam launch; the usual, and best formed, helicoidal four bladed wheel used on the launch was of the same diameter, 30 inches. The pitch of the Eagle Wing was made as nearly as possible the same as the helicoidal, namely, 54°. The Eagle Wing had but three blades. Several experimental trial runs were made, placing the two wheels alternately on the same shaft, and, as nearly as possible, regulating the steam pressure so as to be alike for each trip. The fairest specimen of the trials was a pair of trips from the navy yard ship house to Fort Washington and back. A low pressure of 60 lbs. of steam, as nearly as possible, was carried.

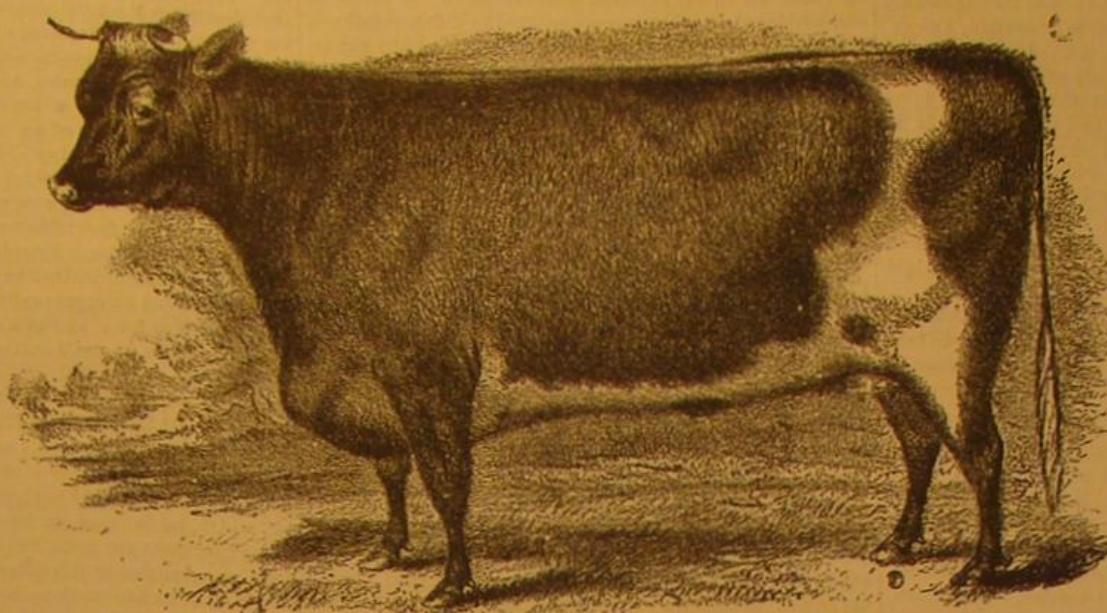
The following are the data of the trial: Helicoidal: Average steam 60-35 lbs.; number of revolutions, 41,920; time occupied, 2h. 54m. Eagle Wing (or helicoidal concavo-convex): Average steam, 59-7 lbs.; number of revolutions, 32,600; time occupied, 2h. 46m. Differences in favor of Eagle Wing: Revolutions, 9,260; time, 8½ minutes.

A trial run from the same starting point to Alexandria lighthouse and back (something over half the former distance), at a pressure of 80 lbs. of steam, resulted as follows:

Helicoidal: Revolutions, 25,180; time, 1h. 30m. Eagle Wing: Revolutions, 21,200; time, 1h. 23½m. Difference in favor of Eagle Wing: Revolutions, 3,980; time, 6½ minutes.

A higher pressure of steam revealed a gain in difference of time in favor of the Eagle Wing, but a proportionate loss in difference of revolutions. This, it is thought, proves the fact that, for rapid revolutions of wheel, the concavo-convexity of the Eagle Wing should be reduced and, possibly, its pitch of blade lessened.

A form and pitch of blade proper for, say, 200 revolutions

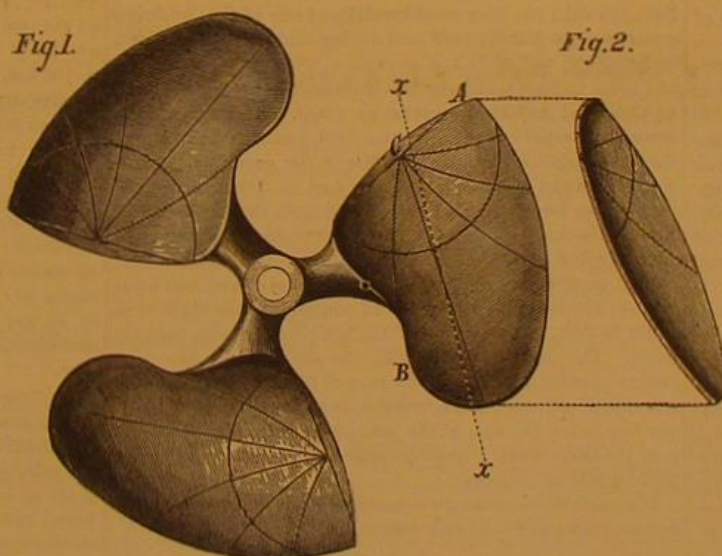


THE CELEBRATED COW, FIRST DUCHESS OF ONEIDA.

per minute, if revolved 250 or 300 per minute, instead of throwing the water back coincidently with the line of the vessel's motion goes further, and throws it across the line.

In the trial tests referred to, it was especially noted that a quick and increased power was exerted by the rudder under the force of the Eagle Wing, the compacted water being thrown directly on the rudder.

In summing up results under the trials made, from 22 to 27 per cent of superior efficiency is claimed for the Eagle Wing, and advantage thereof may be taken either in a speed equal to the best average with much less fuel; or, if the usual amount of fuel be used, a highly increased speed of



HELICOIDAL CONCAVO-CONVEX PROPELLER, OR EAGLE WING.

vessel may be obtained.

The mechanical principles involved in the device are embraced by two patents, respectively dated January 21 and August 26, 1873. Further particulars may be obtained by addressing the inventor, Mr. N. A. Patterson, Cleveland, Bradley county, Tenn.; or for the next ten days he may be consulted personally at the Astor House, New York. We understand that a prominent firm in this city is now making arrangements for a complete practical trial of this propeller.

Telegraphing Maps and Plans.

A very ingenious invention has recently been exhibited by M. Dupuy de Lome, at the French Academy of Sciences. It consists in a mode of sending a plan or topographical sketch by telegraph, without necessitating a special drawing for the purpose. Over the map already made is laid a semi-circular plate of glass, the circumference of which is graduated. At the center is an alidade, also graduated, which carries, on a slide, a piece of mica marked with a blade point. The latter, by its own movement along the alidade, and also by that of the alidade itself, can be brought over every point in the glass semicircle. Just before the plate is a fixed eye piece. Looking through this, the black dot is carried successively over all the points of the plan to be reproduced and the polar coordinates of each noted. The numbers thus obtained are transmitted by telegraph. The receiving device is analogous to that just described, but a simple point is substituted for the mica dot, and by it the designated positions on the glass are successively marked.

The Siemens Steel Furnace as Described by the Inventor.

In the course of a recent lecture at Bradford, Eng., by Dr. C. W. Siemens, he gave the following description of his celebrated furnace for melting steel:

Taking the specific heat of iron at 114, and the welding heat at 2,700°, Fah., it would require 114 × 2700 = 307 heat units to heat 1 lb. of iron. A pound of pure carbon develops 14,500 heat units, a pound of common coal 12,000, and therefore 1 ton of coal should bring 39 tons of iron up to the welding point. In an ordinary reheating furnace a ton of coal heats only 1½ tons of iron, and therefore produces only one twenty-third part of the maximum theoretical effect. In melting 1 ton of steel in pots 2½ tons of coke are consumed, and taking the melting point of steel at 3,600° Fah., the specific heat at 119, it takes 119 by 3,600 = 428 heat units to melt a pound of steel; and taking the heat producing power of common coke also at 12,000 units, 1 ton of coke ought to be able to melt 28 tons of steel. The Sheffield pot steel melting furnace therefore only utilizes one seventieth part of the theoretical heat developed in the combustion.

Here, therefore, is a very wide margin for improvement, to which I have specially devoted my attention for many years and not without the attainment of useful results.

Without troubling you with an account of the gradual improvements, I will describe to you shortly the furnace which I now employ for melting steel. This consists of a furnace bed made of very refractory material, such as pure silica sand and silica or Dinas brick, under which four regenerators or chambers filled with checkerwork of brick are arranged in such a manner that a current of combustible gas passes upward through one of these regenerators while a current of air passes upward through the adjoining regenerator, in order to meet in combustion at the entrance into the furnace chamber. The products of combustion, instead of passing directly to the chimney as in an ordinary furnace, are directed downwards through the two other regenerators on their way towards the chimney, where they part with their heat to the checkerwork in such a manner that the highest degree of heat is imparted to the upper layers, and that the gaseous products reach the chimney comparatively cool (about 200° Fah.). After going on in this way for half an hour, the currents are reversed by means of suitable reversing valves, and the cold air and combustible gas now enter the furnace chamber, after having taken up heat from the regenerator in the reverse order in which it was deposited, reaching the furnace therefore nearly at the temperature at which the gases of combustion left the same. A great reversion of temperature within the regenerative chambers is the result, and the two first mentioned regenerators are heated to a higher degree than the latter. It is easy to conceive that in this way heat may be accumulated within the chamber to an apparently unlimited extent, and with a minimum of chimney draft. Practically the limit is reached at

the point where the materials composing the chamber begin to melt, whereas a theoretical limit also exists in the fact that combustion ceases at a point which has been laid down by St. Clair Deville at 4,500° Fah., and which has been called by him the point of dissociation. At this point hydrogen might be mixed with oxygen, and yet the two would not combine, showing that combustion really only takes place between the limits of temperature of about 600° and 4,500° Fah. To return to our regenerative gas furnace. It is evident that there must be economy where, within ordinary limits, any degree of heat can be obtained, while the products of combustion pass in the chimney only 300° hot. Practically a ton of steel is melted in this furnace with 12 cwt. of small coal consumed in the gas producer, which latter may be placed at any reasonable distance from the furnace, and consists of a brick chamber containing several tons of fuel in a state of slow disintegration. In large works a considerable number of these gas producers are connected by tubes or flues with a number of furnaces.

The Devil Fish.

T. L. P. writes to say that the Italian fishermen of San Francisco, who travel about the Farallon Islands and down the coast, not infrequently take devil fish from eight to ten feet across, and he has heard of one being taken of which the extended arms measured twelve feet. "Some months ago, I saw one (hanging at a door) which measured at least nine feet from tip to tip of the tentacles. I believe that the Italians here eat parts of these repulsive looking creatures, and call them quite good."

MEETING OF THE BRITISH ASSOCIATION.

The annual meeting of the British Association took place September 17, at Bradford, Eng., and was opened by a very able address by the President, Professor Alexander W. Williamson. He discussed the importance and value of the atomic theory in chemistry, paid an excellent tribute to the memory of Liebig, traced the pathway and the difficulties that attend the chemical investigator, showed the importance and value of chemistry in its relations to education, and expressed his opinions upon the proper methods of developing and encouraging the young in the study of the sciences. He thought that our schools and colleges should be far more abundantly supplied with professors and assistants able to teach the sciences, so that the young should be constantly surrounded, as it were, by influences which should lead their tastes in that direction. Secondary schools, he thought, ought to be established, wherein the children of the poor might receive scientific instruction, which would make them more useful, in whatever industrial occupation they might afterward be employed.

In the great task of promoting scientific education and original research, he thought the government ought to take a prominent part, and contribute liberally for the erection of buildings and the endowment of professorships.

STEEL.

In the Mechanical Section, the opening address was delivered by W. H. Barlow, C. E., upon steel, relative to which he presented a large amount of useful information.

The tensile resistance varied in the different qualities of steel from twenty-eight to forty-eight tons per inch, and experiments established conclusively that the relation subsisting between the several resistances of tension, compression, and transverse strains is throughout practically the same as in wrought iron; that is to say, that a bar of steel whose tensile strength is 50 per cent above that of wrought iron will exhibit about the same relative increase of resistance under the other tests. They further showed that the limit of elasticity in steel is, like that of wrought iron, rather more than half its ultimate resistance.

The series of experiments recorded in the book published by the committee gave the results of tempering steel in oil and water. They were made by the officers of the gun factory at the Royal Arsenal at Woolwich, and show a remarkable increase of strength obtained by this process. This property of steel is now fully recognized and made use of in the steel which forms the lining of the largest guns. The third series of experiments was made by the committee upon bars 14 feet long, 1½ inches in diameter, with the skin upon the metal as it came from the rolls. The object of these experiments was specially directed to ascertain the modulus of elasticity. In these experiments sixty-seven steel bars were tested whose tensile strength varied from thirty-two to fifty-three tons per inch, and twenty-four iron bars varying from twenty-two to twenty-nine tons per inch.

These experiments, which were very accurately made, showed that the extension and compression of steel per ton per inch was a little less than wrought iron, that the extension and compression were very nearly equal to each other, and that the modulus of elasticity of steel may be taken at 30,000,000, which result agrees with the conclusion arrived at by American engineers on this subject.

The fourth series of experiments were made by the committee on riveted steel, and show clearly that the same rules which apply to the riveting of iron apply equally to steel; that is to say, that the total shearing area of the rivets must be the same, or rather must not be less than the sectional area of the bar riveted. In applying steel to engineering structures, we may dismiss from consideration those superior qualities which are of high price and made in comparatively small quantities. I propose, therefore, to confine my observations to the mild steels, such as are made by the "Bessemer," the "Siemens-Martin," and other processes, having a tensile strength varying from thirty-three to thirty-six tons per inch, a material which is made in large quantities and at moderate cost.

Following the same rule as is adopted for wrought iron, namely, that the maximum strain on the metal shall not exceed one fourth of the breaking weight, we may consider steel of this quality capable of bearing at least eight tons per inch, instead of the five tons per inch estimated for like purposes in iron. We know from established mechanical laws that the limiting spans of structures vary directly as the strength of the material employed in their construction when the proportion of depth to span and all other circumstances remain the same. We know also that, taking an ordinary form of open wrought iron detached girder (as, for example, when the depth is one fourteenth of the span), the limiting span in iron, with a strain of five tons to the inch upon the metal, is about 600 feet; and it follows that a steel girder of like proportions, capable of bearing eight tons to the inch, would have theoretically a limiting span of 960 feet. This theoretical limiting span of 960 feet would, however, be reduced by some practical considerations connected with the minimum thickness of metal employed in certain parts, and it would, in effect, become about 900 feet for a girder of the before mentioned construction and proportions.

Assuming a load in addition to the weight of the girder of one ton to the foot, the relative weights under these conditions would be as follows:

Span.	Weight of steel girder. tons.	Weight of iron girder. tons.
200.....	57.....	100.....
300.....	150.....	300.....
400.....	320.....	800.....

It is not alone in the relative weight or in the relative cost that the advantage of the stronger material is important, but

with steel we shall be enabled to cross openings which are absolutely impracticable in iron. Steel is used in the Illinois and St. Louis Bridge in America, a bridge of three arches, each of 500 feet span.

There is no doubt of the fact that steel is made and sold which is cold-short, and not reliable for use for engineering purposes. This irregularity appears to arise mainly from the difference in the chemical constituents of the metal or ores employed, or in the process pursued by different makers.

Where large castings and metal of great solidity are required, as in making large guns, there is the method pursued by Sir J. Whitworth, whereby the metal is intensely compressed while in a fluid state. The pressure employed is twenty tons per inch, and its effect in producing solidification is such as to shorten the ingot about 1½ inches for every foot of length. The treatment by compression is especially important where metal is required in large masses and of great ductility, because the larger the mass and the greater the ductility, the larger and more numerous are the air cells, and the effect of the pressure is to completely close these cells and render the metal perfectly solid. By this process, mild steel can be made with a strength of forty tons to the inch, having a degree of ductility equal to that of the best iron. The more highly carbonized qualities, whose strengths range from forty-eight up to seventy-two tons per inch, show a decrease of ductility somewhat in the same ratio as the strength increases.

As to strength and toughness, there are small arms made entirely of steel, of wonderful range and accuracy, capable of penetrating thirty-four ½ inch planks, which is about three times the penetrating power of the Enfield rifle. Secondly, there are the large guns, also entirely of steel, throwing projectiles from 250 lbs. to 310 lbs. in weight, and burning from 40 lbs. to 50 lbs. of powder at a charge, with which a range of nearly six and a half miles is obtained. In both cases the degree of strength and toughness required in the metal is much greater than is necessary for engineering structures. It is unnecessary to occupy more time in multiplying examples of the toughness of steel. It is well known to manufacturers, and must also be well known to many others here present, that steel of the strength of thirty-three or thirty-six tons per inch can be made and is made in large quantities at moderate price, possessing all the toughness and malleability required in engineering structures.

THE BURLEIGH ROCK DRILL IN GREAT BRITAIN.

This drill, like many other excellent devices of American origin, is now extensively used in Great Britain. In a paper read by Mr. J. Plant before the Association, he said that the Burleigh drill has been working daily at one of the Cambrian quarries since March, 1872, and during that period had given satisfaction; and with the exception of new piston rings and some trifling repairs by the blacksmith at the quarry, no breakage of any kind had taken place. The quarrymen were not prejudiced against the drill, but on the contrary they had voluntarily made an offer to the company to drill them holes at the same price per foot as they were paid themselves for boring by hand, and deduct the amount due for such boring monthly from their contracts. This was the plan adopted in all the galleries of the quarry. The actual cost of working the drill was most accurately kept, and comparison showed that the work of untopping the slate rock could be done in two thirds of the time required by manual labor. The cost of boring with the drill during the past twelve months had been at the rate of 5½d. per foot, including steam, oil, attendance, repairs, etc., the same being 2½d. per foot below the cost of the manual labor employed to execute the same work. Another important point was the increased rate of progress.

We shall in our next give extracts from other interesting papers read before the Association.

BARE CHANCE TO ADVERTISERS.

About one year ago, it may be remembered, we announced our intention of printing, during the month of November, 1872, a special edition of the SCIENTIFIC AMERICAN, distinct from our regular weekly issue and consisting of 50,000 copies, the same to be devoted to gratuitous circulation. Although, at the outset, this large number seemed sufficient, we found it in the end to be inadequate for the purpose in view, and accordingly fully seventy thousand papers were printed and mailed from this office, gratuitously, to manufacturers, machinists, engravers, chemists, and in fact to representatives of every calling whom we conceived would find an interest in scientific, mechanical, or technical intelligence.

Many of our regular advertisers, recognizing the advantage of so widely circulated a medium, hastened to secure place for the announcements of their products; patentees inserted descriptions of their inventions; while others, comparatively strangers to our columns, followed a like course. As a result, so far as we have been able to learn, extraordinary returns were obtained by these enterprising business people.

We intend to repeat the experiment, and as will be seen from our advertisement of the fact, elsewhere in this issue, we propose, on the 15th of November next, to print another of these special issues, the first edition of which will be sixty thousand copies. The paper in itself we shall endeavor to make more interesting and attractive than any we have yet produced.

We are now collecting names of all persons engaged in manufacturing pursuits, of railroad officials, contractors, engineers, mechanics, machinists, chemists, inventors, and men of science generally throughout the entire country; and we may safely assert that there will not be a single village

or town in the United States, into the hands of some of the inhabitants of which this special number of our journal will not find its way. It should be remembered that this is no random list of names selected from publications printed for the purpose; but in a great measure a category of persons and firms who have come to our notice during our long experience and intercourse with the industrial and inventing population of the land; so that advertisers will understand that they reach the very people from whom they can expect the most substantial returns, and to whose combined notice they can hope to introduce their products through no other medium extant. Our rates, as stated in our advertisement, remain the same as for a regular weekly issue, thus completing the advantages of an offer, the value of which, we consider, needs no further demonstration.

A few engravings of useful inventions with descriptive matter will be admitted, subject to the approval of the publishers, and upon favorable terms, which can be concluded by letter or otherwise. Patentees of novel devices, desirous of effecting their introduction to the public at large, will thus be afforded an opportunity of presenting them in the most attractive form, and to a class which it would unquestionably require no small outlay in time and expense otherwise to reach.

A VALUABLE DRAFTING INSTRUMENT.

Professor Josiah Lyman, of Lenox, Mass., has recently brought to our notice a very ingenious and accurate mathematical instrument, in the shape of a protracting trigonometrical instrument, which, he informs us, he has made a subject of study and experiment for some fifteen years. He considers (and from an examination of his device, we think, with excellent reason) that he has made an apparatus by which all angles and distances may be put down upon paper with accuracy equal to that of the best field instruments; by which even their errors may be corrected and results obtained (in determining areas, for instance) reliable to one twenty-millionth part of the whole; and of corresponding exactness in the solution of all trigonometrical problems. Traverse tables and in most cases logarithms will be, the inventor believes, thus rendered unnecessary, and hence a large amount of time and labor saved.

Drawing instruments are so frequently imperfect that there is a clear necessity for a device of this description, and we have no doubt but that draftsmen generally will find it of great utility and value.

The Most Powerful Gun in the World.

The new reinforced siege guns lately added to the German artillery, of 21, 28, and 30½ centimeters rifled bore, are said to be the most powerful guns in the world. Their performances are truly remarkable. The last mentioned gun, with 120 to 130 lbs. of prismatic powder of from 1.74 to 1.76 specific gravity, fires a chilled cast iron shell of 600 to 610 lbs. weight with an initial velocity of 1,607 feet per second, which is said to have never been attained before by any rifled gun. At a distance of 1,200 paces, or 988 yards, it sends the shell clean through a 14 inch armor plate and backing. The gun is very handy and easily manoeuvred; it requires one man to handle the breech piece, two to lift up and insert the shell by means of a davit lift, two men to give it its greatest elevation of 17 deg. in 16½ seconds, or its greatest depression of 6½ deg. in 11 seconds, and two men to give it its lateral direction by means of a chain running over jack pulleys.

New Field Guns for the French Army.

The new French field gun, the *canon de sept*, which is constructed by Colonel Reffye, and likely to be adopted as the principal field gun of the army, is, says *Engineering*, made of bronze, with a bore of 8.5 centimeters, length of barrel 187.5 centimeters, and contains 14 grooves, 1.5 millimeters deep, these being twisted from right to left at an angle of 8 deg. 32 minutes, or of 21.3 calibers to a complete twist. The breech closing apparatus is a screw, which fits in a steel nut that is inserted in the end of the barrel, flush with its end face. Screw and nut have their threads cut out at three sixths of the circumference, so that the former may be inserted in the latter by simply pushing it inwards, when it is fastened in it by a turn to the right of ¼ of its circumference. The screw rests in a kind of swing door, similar to the first Prussian model of field gun with piston breech, which supports it when drawn out of the barrel, and facilitates its insertion. The inner head of the breech screw has a slightly concave surface, and bears on the side three twist grooves, which arrangement is intended for extracting the metallic cartridge shell, which serves as gas check. This shell consists of a thin brass bottom, which is provided with a perforated ignition cup, while the cylindrical part is made of tinned sheet iron. The touch hole is bored at an angle through the breech screw and opens at the center of its inner surface in the gun just where it meets the ignition cup, so that the fire ignites the cartridge centrally. The latter consists of 5 disks of compressed gunpowder, each weighing 0.226 kilogramme, and provided with a central canal of 5.2 centimeters in diameter; their total weight is 1.13 kilogrammes. The projectile is an elongated shell, 3 calibers long, weighing 6.9 kilogrammes and is provided with two lead rings as guides. The first trials with this gun, at the Polygon of Vincennes, date back as far as 1870; but only in 1872 was it tested again at Calais in its improved form, and its chief merit seems to be its low trajectory, though it may leave something to be desired with regard to range, accuracy, and durability.

AN underground railway has been constructed in the city of Constantinople, Turkey, and the contractors are now finishing up the termini. It will soon be open for traffic.

NEW BOOKS AND PUBLICATIONS.

ON THE MECHANICAL TREATMENT OF DISEASE OF THE HIP JOINT. By Dr. Charles F. Taylor, Surgeon to the New York Orthopedic Dispensary and Hospital, etc. Illustrated. New York: William Wood & Co.

In this work, the author describes a number of ingenious devices of his own invention having for their object the cure of disease of the hip. Dr. Taylor has become quite celebrated for his successful treatment of hip and spinal diseases by mechanical means. We may state that the appliances indicate considerable mechanical genius, and appear to be of a nature well adapted to alleviate the suffering incident to that common but very distressing malady. We notice that the apparatus of Dr. Taylor received the honor of a medal at the Vienna Exposition.

AN ELEMENTARY COURSE IN FREE HAND GEOMETRICAL DRAWING, for Schools, etc. With Chapters on Lettering and on Geometrical Symbolism. By S. Edward Warren, C. E., Professor in the Massachusetts Institute of Technology. Price 75 cents. New York: John Wiley & Son, 15 Astor Place.

This is a little book especially adapted for beginners, in which the lessons are arranged in such steady progression that the merest child can follow them, almost without aid from a teacher.

ILLUSTRATED CATALOGUE AND QUARTERLY FLORAL WORK. 25 cents per annum. Rochester, N. Y.: Briggs & Brother, Seedsmen.

This catalogue contains an amount of botanical information which is out of all proportion to the price asked for it.

ELEMENTS OF PHYSICAL MANIPULATION. By Edward C. Pickering, Thayer Professor of Physics in the Massachusetts Institute of Technology. New York: Hurd & Houghton. Cambridge: The Riverside Press.

The author of this book has given the world the results of a practical experience of the very highest order. The chapter on the graphical method of teaching physics (which, the author believes, has not attracted the attention it deserves) will interest every one who is concerned, either as teacher or pupil, in the great work on technical education.

ON THE ARRANGEMENT, CARE, AND OPERATION OF WOOD-WORKING FACTORIES AND MACHINERY, forming a Complete Operator's Handbook. By J. Richards, M. E., Author of "A Treatise on Wood-Working Machines." E. & E. N. Spon. New York: 446 Broome Street. London: 48 Charing Cross.

The author, of the firm of Richards, London & Kelley, of Philadelphia, Pa., is well known by his mechanical productions and his previously published writings, to be a constructive engineer of the highest class; and the very numerous woodworkers of this country will find his new book to be full of sound, practical instruction on all branches of the trade, from designing a factory to the use of the simplest hand tool.

WORKSHOP RECEIPTS, for the Use of Manufacturers, Mechanics, and Scientific Amateurs. By Ernest Spon. L. & F. N. Spon. New York: 446 Broome Street. London: 48 Charing Cross.

This book contains an extensive collection of recipes and directions for manipulation in every branch of the industrial arts. The value of such a work is in its accuracy and trustworthiness; and a careful examination of this volume gives us a very high opinion of the manner in which it has been compiled.

THE THEORY AND PRACTICE OF LINEAR PERSPECTIVE, applied to Landscape, Interiors, and the Figure. Translated from the French of V. Pellegrin, formerly Professor of Topography at the Military School at St. Cyr, etc. New York: G. P. Putnam's Sons, Fourth Avenue and Twenty-third Street.

This concise and lucid treatise was selected, in 1870, by the French government for circulation in the public schools and libraries of France, a tribute to its merit which the work deserves, apart from the reputation of its distinguished author.

THE TANTINE COMPANY of Stroudsburg, Pa., have recently issued a handsomely illustrated pamphlet, describing their excellent emery wheels, and, besides, containing a large amount of useful information regarding the proper employment of the same. The emery wheel has sprung into universal favor, and has proved itself a valuable addition to the resources of the shop.

Recent American and Foreign Patents.

Improved Metallic Roof.

Isaac S. Mettler, Jersey City, N. J.—This invention relates to the construction of roofs of buildings, and consists of channels or openings formed beneath the outer covering of the roof, by interposing a layer of corrugated tin, or other sheet metal, between such outer covering and an inner layer, said openings or channels being designed for the passage of currents of air from the eaves of the roof to the ridge or cornice. The channels or openings formed by the corrugations may be connected with a pipe for admitting and conducting steam for melting snow or ice from the roof in winter, if desired.

Machine for Forming the Hooks of Machine Needles.

Nathan Paine, Milford, Mass.—The object of this invention is the improvement of machines for making the hooks of needles used in machines for sewing or stitching leather, also to improve the quality of the work. The prevailing fault of the machine made needles now in use is a too angular form of the inner side of the hook through which the thread passes, which impedes its passage and often chafes the thread and causes the breaking of the needle by the strain of the thread when obstructed by the edge of the hook. This machine obviates this defect by giving the needle a certain compound motion while the hook is being cut, by which the required curved form is secured instead of the angles.

Improved Screw Valve.

Philip Corrigan, New York City.—This invention, a patent for which has also been obtained in England, has for its object to furnish an improved valve so constructed that the valve plug may be conveniently ground to its seat without detaching the valve from its connections. The invention consists in a nut made in sections and provided with lugs having screw threads cut upon their outer surfaces. With this construction, when the valve plug requires to be ground into its seat, the cap nut is screwed out and the valve stem screwed back as far as it will go. The valve stem is then pushed forward, carrying the sectional nut with it, which sections drop off. The cap nut is then screwed back into the screw hole of the body and serves as a guide for the valve stem, so that the plug can be readily ground into its seat. The cap nut is then removed and the sectional nut replaced and the valve is ready for use.

Improved Car Coupling.

Loman D. Bennett, Willimantic, Conn.—Upon the upper side of the drawhead is formed a flange, passing around the pin hole and extending to the cap to keep the end of the pin always in place upon the upper side of the coupling block, the stop in the lower end of the outer arm of the coupling pin being so arranged that the end of the shorter arm of said pin can never rise above the said flange. Upon the upper part of the shorter arm of the pin is formed a collar, which rests upon the flange when the coupling pin is in working position. In adjusting the pin for automatic coupling, the end of the pin is allowed to rest upon the block. As the link enters, it pushes back the block and the pin drops through the link. To uncouple the cars the pin is raised, and its lower end is placed upon the upper side of the drawhead; then, as the link enters the drawhead to couple the cars, the inward movement of the block causes the block to move outward, pushing the pin forward to the pin hole, through which it drops, coupling the cars.

Improved Butter Tub.

Andrew J. Drake, Middletown, N. Y.—This invention has for its object to improve the construction of the ears of that class of tubs known as return butter tubs in such a way as to enable them to hold the covers securely, and at the same time allow said covers to be readily and conveniently detached. The invention consists in securing the cover of a tub by means of two pairs of metal plates, so constructed as to prevent said cover being lifted off, while a screw is arranged to prevent a horizontal or sliding movement thereof.

Improved Stove Pipe Joint.

Jacob Weaver, Tipton, Iowa.—This is a revolving stove pipe, which may be adjusted or twisted to any desired position to be used without delay on putting up the stove, avoiding thereby the annoyance arising from badly fitting or imperfect joints. The stove pipe connection is composed of three sections having elliptical joints, on which they are adjustable.

Improvement in Securing Wheels to Axles.

Robert J. Lessor and John B. Shambo, Brandon, Vt.—The axle box, which is driven into the hub in the ordinary manner, is secured in place by a nut screwed into its outer end, and which overlaps the end of the hub. The inner end of the axle box projects beyond the inner end of the hub, and has a ring groove formed in its outer surface. A lever is pivoted to ears formed upon the axle or clip yoke. Upon the inner end of the lever is formed a lip or straight hook, which fits into the ring groove of the axle box. The lip of the lever is held in the groove of the axle box by a spring, which is secured to the axle by the yoke, and the free end of which presses against the outer end of the said lever as shown in the figure. By this construction the wheel will be held securely upon the axle and held in such a way that the said wheel may be easily and quickly detached when required for oiling the axle or other desired purpose.

Improved Fire Escape Ladder.

Walter W. Parsons, Stanstead, Canada.—This is a pair of suspending ropes, with cross bars at intervals, constituting a rope ladder. At the lower end of the ladder a hook is attached for fastening it. At the upper end the ropes are connected to a roller which is mounted in a frame so as to revolve, and has a crank for turning it by hand to wind the ladder on or off. The roller constitutes one of the bars of the ladder, and another roller of the frame constitutes another bar; and this roller has hooks, by which to attach the ladder to the building. The crank can be folded down in the roller compactly for storing the ladder. For securing the cross bars to the ropes cheaply, a hole is bored through them near each end, and a slot extends from the ends to said holes, so that the latter can be contracted a little to bind the rope so as to be held fast. Slightly conical ferrules are driven on the bars, which are slightly tapered from the holes to the ends to so bind the bars upon the ropes, whereby the said bars will be firmly held in their places.

Apparatus for Cleaning Cesspools, Sinks, etc.

J. P. Florimond Datchy, Brooklyn, N. Y.—The object of this invention is to empty and clean sinks, privies, cesspools, sewers, marshy lands, etc., in a perfectly odorless manner, so that the work can be done in the day time without the least discomfort and annoyance to the occupants of the dwellings, and without the use of separate machines by which the vacuum in the tank is created. The invention consists of a tank of suitable capacity, which is provided with double acting pneumatic pumps and all necessary appurtenances to insure the efficient working of all the parts. The tank is carried on a four wheeled truck of suitable strength, and the vacuum is created by the hind wheels working the air pumps by eccentrics, said action to be discontinued by the application of a regulating gear, which frees the piston from its shaft, according to a gauge placed on a cupola connected with the tank, which assists also the perfect working of the machine. From the model which we have examined we should think this a very useful improvement over the ordinary machines used for emptying and cleansing cesspools and the like.

Improved Windmill.

Ovett B. Knapp, Brandon, Wis.—This invention is an improvement in the class of wheels with which a weight is so connected as to keep them turned in a direction at right angles, or nearly so, to the direction of the wind at any given time. A spiral wind wheel is mounted on the end of a horizontal shaft, which is mounted on the top of a turntable and gears with a vertical shaft through which power is communicated to the pump or other apparatus. The turntable is supported on and secured to a bevel gear which meshes with a pinion on the same horizontal shaft as the pulley. A belt connects the pulley with the axis, which is to be turned by a weight, for acting in conjunction with the vane, for controlling the wheel, the vane being attached to the turntable at one end of its arm, in the plane of the wheel or nearly so, so that its tendency is to turn the wheel out of the wind—that is, edgewise thereto—so as not to work, while the tendency of the weight is to turn it into the wind. This weight is connected with the axis by a rod engaging with the curved teeth of a disk. To start the wheel, the weight will be put on the disk at about the middle of its height, vertically, in case it is desired to obtain full power. This will cause the wheel to turn about one fourth of a revolution into the wind, in case the latter is not so strong as to prevent the weight from turning it too much. If it is not desired to obtain the full power, the weight will not be placed quite so high.

Improved Revolving Fire Arm.

Benjamin K. Dorward, Rockland, assignor to himself and Ira C. Winsor, Coventry, R. I.—The opening through the front end of the inclosing case, through which the cartridges are introduced, is closed by a cap which is held by a spring joint. The cartridges are, by the rotation of the chamber cylinder, carried in front of a pusher, which is in line with the bore of the barrel, the flanges being engaged by a catch. The pusher slides forward and pushes the cartridges out of the chambers into the barrel, to be exploded therein. It is moved forward by a slide. When the pusher withdraws from the chamber, it draws the expended shell into it, and the shell is retained in the cylinder until it comes around to the opening, when it is expelled through a passage by the next cartridge put in. The firing rod is arranged inside of the pusher, which is made hollow for the purpose, and has a spring to throw it back. By pulling the slide back and pushing it forward, the cartridge shell will be withdrawn from the barrel, the hammer will be cocked, the cylinder revolved, and another cartridge introduced into the barrel ready for firing.

Improved Brick Machine.

Peter K. Dederick, Albany, N. Y.—By a weight and the screw a tripping latch and bar are so adjusted that the requisite force for pushing out the mold boxes will be sustained without tripping, but any considerable increase, such as will be caused by the binding of the mold boxes by a stone or the like wedging in between them and the press box, will instantly cause the tripping of the latch, and thus save breaking the machinery. The device on the mixer shaft, by which the clay can be at the same time worked along the mixed clay holder laterally and discharged, and still be of the same consistence throughout the length of the press box, consists in broad arms on the mixer shaft with their planes oblique to the axis of the shaft; arms with their planes parallel with the axis of the shaft; oblique vanes on the arms next to the screen; and discharging blades on the ends of the arms, the said blades being slightly spiral to the shaft, also tangential to a circle about two thirds of the size of the one described by the outer edges of the blades. The oblique or spiral inclinations of the arms, vanes, and blades are all, of course, in the direction required for working the clay across the mixed clay holder from the screen, while the shaft turns in the direction for pushing the mixed clay out through the throat. The lower part of the side of the case of the mill, whereon the press box is arranged, is constructed so as to incline inward as much as possible into the angle of the lower part of the case cut off by the circle described by the discharging blades, and construct the press box on the same inclination and attach it to the said part, and so considerably lessen the waste space through which the clay has to be pushed, and also lessen the mass of clay to be moved, and thereby economize power.

Improved Harvester Cutter.

William E. Stables, Sherburne Four Corners, N. Y.—This invention pertains to the construction of the shanks of harvester cutters and their mode of attachment to the finger bar. By moving the bar until the end of the forward edge of the shanks comes opposite a notch, the shanks may be

raised and withdrawn. In this way any desired section may be detached and replaced without disturbing the others. By this construction, also, the cutters will operate with a shear cut, and, the rear ends of the shanks being pivoted, the cutters will have a greater movement than the bar, so that the pitman crank may be made shorter than is necessary when the cutters are rigidly connected with the cutter bar.

Improved Railway Car Brake.

Wille D. Pope, Gadsden, Ala.—This invention has for its object to furnish an improved brake, which shall be so constructed that it may be instantaneously adjusted to give a greatly increased power. To the shaft, to which the brake chain is attached, is rigidly secured two gear wheels, one wheel being considerably larger than the other. There is another shaft placed with that just mentioned, and to which are attached two gear wheels of different diameters, and in such positions that when the second shaft is raised or lowered to bring one or the other of the wheels into gear, the other of said wheels will be free. A lever, which is swiveled to the shaft and pivoted to a ring bolt, is attached to the platform. The other end is held up by a spring strong enough to support the shaft and its attached wheels. To the upper end of the shaft is attached a hand wheel. By this construction, when it is necessary to apply the brake with increased power, the brakeman presses the free end of the lever down with his foot, which throws the one set of wheels out of, and the other set of wheels into, gear with each other, which gives a greatly increased leverage.

Improved Spring Bed Bottom.

Charles H. Dunks, New York City.—This invention consists in the combination, in a bed bottom, with longitudinal slats, of transverse plate springs, supported upon coiled springs, arranged between the slats. Two slats are arranged to each spring over the sides, so that the thin cross strips of steel will not be bent between them and the top of the spring, and the slats are permanently attached to the cross slats by rivets.

Improved Loom Shuttle.

Joseph Brown, Brooklyn, E. D. N. Y.—A wheel is used for the bobbin, and is fitted on a hub, having a series of tension springs between it and the wheel. The hub having a limited rotation in the direction for reeling off the thread, the bobbin turns on the springs, which thus produce the regular tension required. This hub is made hollow, provided with a volute spring. The spring will turn the hub to wind on the thread whenever there is any slack, and thus prevent the jerking which is liable to take place whenever the slack of the thread is taken up by the motion of the shuttle.

Improved Slings for Loading and Unloading Hay, etc.

George W. Long, Delaware Center, Iowa.—The object of this invention is to provide efficient means for the rapid unloading of hay, corn fodder, sugar cane, manure, and other farm products, by which the whole load is packed and hoisted up directly from the wagon and conveyed and stored at the place of destination. The invention consists of two strong pieces of wood, which may be connected and disconnected by means of lever hooks and string attachment, to which the load is attached by knotted ropes, in connection with a double hook for hoisting. After conveying and hoisting the load to the point desired, it is detached by disconnections of the main pieces.

Improved Gage for Gang Saws.

Norman C. Moody, Manistee, Mich.—This invention consists in mounting the gage blocks, used for gaging the distance of the saws of a gang of saws from each other, on a rod before or behind the saws, so that they can be readily swung into the spaces between the saws and out of them, and be put on and taken off without having to remove the saws.

Improved Corn Planter.

George W. Starrett, Dublin, Ohio.—The drive wheels are made broad to cover the seed, and revolve upon the axle attached to the frame. To the ends of a cross bar are secured the forward ends of the openers, which are made something like a sleigh runner, and the rear ends of which are widened and made open to receive the conductor spouts, so that the seed may be deposited in the bottom of the furrow before it becomes partially filled by the falling in of the soil. To the dropping slide are pivoted the outer ends of two rods, which are pivoted to the forward arm of a three armed lever. By adjusting the ends of the said rods the movement of the dropping slide may be regulated. To the side arms of the three armed lever are pivoted the connecting rods, by adjusting which the throw of said lever may also be regulated. The rear ends of the rods are pivoted to the lower ends of the treadles, which are so arranged that by working his feet the driver can operate the dropping bar to drop the seed. To one of the treadles is attached a rod which projects upward into such position that it can be conveniently operated by the driver with his hand, if desired. This rod has a weight attached to its upper end to adapt it to serve also as a balance to the treadles. The bar can also be operated to drop the seed by means of a hand lever.

Improved Heat Regulator.

Henry Boyle, London, England.—This invention is an ingenious self-acting apparatus for maintaining an equable temperature, chiefly applicable for the purposes of incubating, forcing, etc. The regulator consists of a closed cylindrical vessel, filled with water and wholly or partly surrounded by a jacket, also filled with water but having no communication with the vessel. In connection with the upper part of this vessel is a U-shaped tube of glass, one leg being connected to the vessel, and the other and shorter leg terminating in a contracted neck, to which a long slender glass tube is connected by a flexible joint. This latter tube is disposed in a horizontal or nearly horizontal position, and is suspended at the other end from one end of a counterpoised arm or balance. The vessel and tubes having been first filled with water, mercury is poured into the open end of the balanced tube, and, displacing the water, fills the shorter leg and so much of the slender tube as will cause the latter to balance the counterweighted arm when the water in the vessel is at the temperature it is desired to maintain. Heat is applied, either directly to the vessel, by which it is transmitted to the water in the jacket, or the jacket is heated, and the heat transmitted to the water in the vessel.

Improved Metallic Piston Packing.

James Massey, Chester, Pa.—This invention is designed to furnish an improved piston, which shall be so constructed as to adjust itself to take up the wear, and thus be always steam tight. In the face of the piston head are cut recesses to receive blocks by adjusting which the piston is centered in the cylinder. A cast iron spring or coil is placed upon the piston head, by the elasticity of which the open rings are held out against the cylinder. The open rings have inwardly projecting flanges formed upon their outer edges, which rest upon the edge of the spring. The rings are beveled upon their inner sides, from their outer to their inner edges, to allow the spring to be made heavier in its middle. By the follower of the piston the spring and open rings are held down upon the stationary edge of said piston. A stop piece is attached to one end of the open rings to overlap the other end and keep it in place.

Improved Spring Hinge.

Stephen Joyce, New York City.—This invention is an improvement in the class of hinges specially adapted for use on doors which swing in either direction and are self closing. It consists in the construction and arrangement of a tubular pintle provided with heads or plugs connected by a spring, and having a series of holes to adapt them to receive stop screws for regulating the tension of said spring, and the pintle being enclosed by sleeves having radial wings which form the leaves of the hinge.

Improved Car Brake.

William Warinner, Creelsborough, Ky.—The brake chain is attached to the front end of a main bar, the rear end being connected to a strong spring to assist and accelerate the release of the brakes after use. To both ends of main connecting bar are welded a three pronged fork, between which move the ends of levers. A tongue in the shape of a cross forms the extreme end of main bar, being pivoted to the pronged front end and connecting with links pivoted to the inner ends of the levers. These levers are placed under the truck frames and connect with the brake beams hung at suitable distance from each pair of car wheels from the truck frames. On putting on the brakes, the hand wheel is turned, which causes a forward motion of cross tongue and bar, which is communicated by links to the levers. The latter again, by means of lever rods, force the brake beams on the wheels, so that the powerful friction exerted thereon will soon stop the car.

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Steam Boiler and Pipe Covering—Economy, safety, and durability. Saves from ten to twenty per cent. Callers Spence Company, foot East 9th St., N. Y.

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Wanted—A Rotary Machine, with impression roller attached, for cutting veneer stuff for Berry Baskets. Address H. Humphreys, Salisbury, Md.

Wanted to Manufacture light hardware patents. Address I. H. Baldwin, Meriden, Conn.

Wanted—Patent Office Reports for 1869, 1870, 1871. P. O. 439, New York.

Wanted—Proposals for supplying from three to five tons per week of first class castings, for Steam Engines. For particulars, address Lidgerwood Manufacturing Company, 113 Pearl Street, New York.

For Sale, cheap—A No. 3 "Starveant Blower." Also, a good Bolt Cutter. J. Lavery & Co., Rochester, N. Y.

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The New Elastic Truss presses uniformly all around the body, and holds the rupture easy, night and day, till cured. Sold cheap by the Elastic Truss Co., 63 Broadway, New York.

Save & Shingle Machinery. T. R. Bailey & Vail. Patent on a powerful popular Microscope for Sale. Address James H. Logan, 12 Cedar Avenue, Allegheny, Pa.

Chicago Exposition—See Abbe's Bolt Forging Machine and Palmer's Power Spring Hammer, there on exhibition. S. C. Forsyth & Co., Manchester, N. H.

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 31 Broadway, New York.

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English Roof Paint, all mixed in oil ready for use, 50c. a gallon, 116 Maiden Lane, New York.

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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, Andrews' Patent, inside page.

Portable Hoisting and Pumping Engines—Amer 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 35 Cortlandt Street, New York.

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Estimates Wanted—For furnishing complete, a Steam Laundry, capable of working for one thousand persons. Address, with full descriptions, "Laundry," Key Box 158, Charleston, S. C.

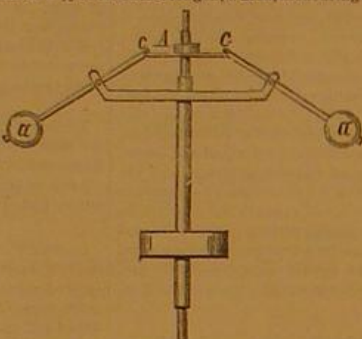
Notes & Queries

A. D. asks: Is there a remedy for snails other than salt?

V. E. asks: How many minutes, and what degree of heat is required to vulcanize a sheet of India rubber, 5-32 of an inch thick, to the greatest possible elasticity?

D. E. R. asks for a remedy for a strange disease among fowls, prevailing all over Northern Texas. "Up to a few days before they die, I do not notice any change in their appearance, except that the comb and wattles become pale, with a slight puffiness around the eyes. They have a great increase of heat, are very thirsty, and still continue to eat heartily up to 12 hours before they die. I have opened a number and find in all an enlarged liver and distended gall bladder. My largest rooster died a few days since, and I opened him, and his liver and gall bladder weighed nearly 6 ozs. I have tried every remedy I could think of to act on the liver. Calomel prolongs their lives a few days; cayenne pepper braces them up for a while, but soon ceases to have any effect. Other remedies do only temporary good, as they all die that become afflicted."

E. A. P. asks: Suppose I have a governor rotating upon a horizontal shaft at a speed of 30 revolutions per minute, and that the balls weigh 10 lbs. each, also that, when diverged to their fullest extent, they describe a circle of 6 feet diameter, and that the longer arm of the lever is $\frac{1}{2}$ of its entire length, which, measuring from



center of ball, a, to c, is 39 inches: How much pressure will be exerted upon the sliding sleeve (A) by both balls? [This is a simple and interesting problem, requiring the application of the principles of centrifugal force and of the lever for its solution. We believe that some of our readers take an interest in such matters, and we prefer to leave to them the solution of the question.—Eps.]

ANSWERS TO CORRESPONDENTS

C. S. D. will find a recipe for ink on p. 106, vol. 27.—A. D. can try powdered borax as a remedy for roaches.—A. S. will find full information on silk-worm culture on pp. 207, 281, vol. 26.—A. S. will find the recipe for cement for leather on p. 119, vol. 28.—J. W. E. will find that a cement for mending rubber boots is described on p. 125, vol. 26.—W. E. L. will find the wheel question answered on p. 252, vol. 23.—D. S. W.'s solution of the train and sliding query is correct.

F. S. D. asks: Is gas formed by passing a current of air through naphtha or benzine lighter or heavier than air, and what is the chemical reaction? Answer: When air is passed through or over naphtha or benzine, it carries off, mechanically suspended in it, a portion of the vapor of the hydrocarbon. There is no chemical compound formed; and as the vapor of naphtha or benzine is heavier than the air, the air charged with their vapors is of course of greater specific gravity than air not so charged.

C. H. K. asks: How can I remove fly spots from a picture? Answer: Try a strong solution of fine soap in warm water, applied gently with a soft woolen cloth.

C. W. asks: What is the cause of the easterly current by which Professor Wise proposed to cross the Atlantic? Answer: The existence of this current is not an established fact, and the object of the transatlantic voyage was to investigate the matter. Of late, many arguments have been advanced pro and con; and it seems to us that, as the matter stands at the present, it is an open question.

W. G. P. asks: 1. How can I make silicate of potassa, or silicate of soda, or what is known as liquid glass? 2. Will you describe a simple process of nickel plating? Answers: 1. Fuse together 1 part of silica and 2 parts of either carbonate of soda or carbonate of potash. 2. To plate with nickel, observe the following directions: In a cubical glass or earthenware vessel, suspend by means of a brass rod, the articles to be plated, and on another brass or metal rod, about an inch from the other, as many plates of pure nickel as there are articles to be plated, each plate of nickel opposite one article. Fill the vessel containing these with a solution of the double sulphate of nickel and ammonia. Now connect the rod on which the articles to be plated are hung with the zinc pole of a galvanic battery and the rod holding the nickel plates with the other pole.

W. F. W. asks: When an engine with a 1 1/2 inch inlet for steam is set 400 feet from the boiler, with 60 lbs. pressure, will the engine get hotter steam by a steam pipe of 1 1/4 inches diameter than by one of 2 inches diameter? 2. Is it economy to lay a steam line 400 feet long in a box underground? Answers: 1. A pipe just large enough to supply the engine will probably be the best, as there will be less radiation. 2. Yes, if you mean to compare this method with that of having the pipe exposed.

P. B. H. asks for an expression of our views on the subject of slow or quick motion in the speed of stationary engines. "I quote the following assertion: 'Probably one half the engines in the country would do their work with one third less fuel if their speed were reduced one third or one half.' On the other hand, most of the premiums that are awarded for the best steam engines go to the class that have a very short stroke with a quick motion, in some cases the piston traveling at a speed of 1,000 feet per minute." Answer: We incline to the opinion that great economy results from a quick piston speed, provided the engine is properly constructed.

T. W. asks: 1. Why is it that a person in the water, by throwing himself on his back and extending his limbs, can maintain his position on the surface, while in any other attitude the body sinks? Is not the displacement the same whatever attitude is assumed? 2. What is the scientific explanation of the motion of a snake's tail after apparent death? Answers: 1. When a person is in the position described, he displaces the most water possible without being fully submerged, as only a slight portion of his face is out of water. 2. It is supposed to be due to unconscious nerve action, which appears to increase in animals with the decrease of intelligence.

J. H. W. asks: What is the alcoholic strength of 4th proof brandy, and what is the origin of that term? Answer: The term "proof spirit," used to denote the amount of alcohol in liquors, is of English origin. Proof spirit contains about 50 per cent of pure alcohol, and any mixture above or under this amount is said to be over proof or under proof. Formerly spirit was said to be 1 to 3, 1 to 4, etc., over proof, by which it was meant that 1 gallon of water added to 3 or 4 gallons of such spirit would reduce it to "proof." This is as near as we can come to the elucidation of your question, the expressions in which may have been due to some local peculiarities of speech.

C. E. C. asks: What is French polish composed of, and how is it applied to furniture and to turned work? Answer: Several varnishes are used under the name of French polish. One is pale shellac 5 1/2 ozs., finest wood naphtha, 1 pint; dissolve. The varnish may be colored to modify the character of the wood. A reddish tinge is given with dragon's blood, alkanet root, or red sanders wood; yellow, by turmeric root or gamboge. The process of French polishing is as follows: The surface of the wood is made as smooth as possible with glass paper and placed opposite the light. A rubber is made by rolling up a strip of thick woolen cloth (dist) which has been torn off, so as to form a soft elastic edge. This should form a coil from 1 to 3 inches in diameter. The workman moistens the middle of the flat face of the rubber with the polish by laying the rubber on the mouth of the narrow necked bottle containing the varnish and shaking up the varnish against it once. The rubber is next enclosed in a soft linen cloth, doubled, the rest of the cloth being gathered up at the back of the rubber to form a handle. The face of the linen is now moistened with a little raw linseed oil applied with the finger to the middle of it, and the operation of polishing commenced. For this purpose the workman passes his rubber quickly and lightly over the surface uniformly in one direction, until the varnish becomes dry, or nearly so, when he again charges his rubber as before, omitting the oil, and repeats the rubbing until three coats are laid on. He now applies a little oil to the rubber and two coats more are commonly given. As soon as the coating of varnish has acquired some thickness, he wets the inside of the linen cloth, before applying the varnish, with alcohol or wood naphtha and gives a quick, light and uniform touch over the whole surface. The work is lastly carefully gone over with the linen cloth, moistened with a little oil and rectified spirit or naphtha without varnish, and rubbed as before until dry.

J. C. P. asks: In your article on page 133 of your current volume, you speak of the albumen of eggs being converted into fibrin. Do you mean the yolk as well as the white? Will any vegetable albumen answer? Is the quantity increased in weight or bulk, as in the Creole plan of converting milk into butter by addition of a little butter to begin? (I have seen two pounds of butter made from a quart of milk by this process.) Does it all become fibrin, eggs, water and all? If so, it would give us cheap living. Answer: The article referred to seems to have given rise to some misapprehensions, which its statements do not seem to justify. It is not claimed that the albumen of the egg is converted into fibrin, as this is not the case. Albumen and fibrin are chemically different, though both contain many of the same constituents, and are probably mutually convertible by the organic forces in the animal body. The white of the egg is pure albumen (dissolved in certain quantity of water) while the yolk is not, but still may be used in the preparation of the artificial fibrin. The eggs probably increase both in weight and bulk by the long digestion in cold water, by absorbing a certain quantity; but no chemical change takes place in the egg material, but only a molecular one, shown by the snowy whiteness of the albuminous parts. Vegetable and animal albumen are identical in composition, and our correspondent can try the process with the vegetable substance.

W. H. J. asks: What is the proper diameter and length of bearing of the crank pin of a steam engine, in proportion to the diameter of the cylinder? Answer: Let D=diameter of cylinder in inches. d=diameter of crank pin in inches. l=length of crank pin in inches. P=maximum steam pressure in cylinder, in pounds per square inch. n=number of revolutions of engine shaft per minute. Then, according to Mr. Van Buren's formula: $l = (P \times D^2 \times 0.7854) \div 350,000$, or the least allowable length of the crank pin in inches is equal to the total steam pressure divided by 350,000. Having settled upon the length of the pin, the diameter may be found by the following rule: $D = \sqrt[4]{(D^2 \times P \times l) \div 1690}$, or the diameter of the crank pin is found by multiplying the square of the diameter of the cylinder by the maximum steam pressure per square inch and by the length of the pin, dividing the product by 1690, and taking the cube root of the quotient.

E. W. asks: What makes water and some other liquids run crooked and others straight? Answer: All liquids descend a slope by the force of gravity; and any divergence from a straight line is caused by the configuration of the surface.

H. M. P. asks: Can a small skiff be propelled by a cylinder, 18 inches long 8 inches in diameter, attached to the stern of the boat beneath the water, and having this cylinder arranged so you can peak it full of water and, with a force pump, put on a pressure of 200 lbs. to the square inch? "I propose to have a valve in the end of cylinder half as large as the cylinder itself; and when the pressure is at its height, to let go the valve. Would the amount of pressure escaping instantaneously exert any power to move the boat in the oppo-

site direction? If so, how much? Answer: The plan is practicable. You will find much valuable information on jet propulsion in standard works on the steam engine and steam navigation.

J. L. C. asks: What advantage is an air pump to an engine, or rather what increase of power does it give to the engine in proportion to the power it takes to drive it? Answer: We will give you an example of an actual case. A pair of high pressure engines, of 200 horse power, were fitted with a condenser and air pump. The mean pressure per square inch was 81 pounds, or $81 \div 200 = 0.0155$ pounds per square inch of pressure on the pistons for one horse power. The air pump had to do the work required to lift 2752.15 pounds of water 14 feet high per minute $= 2752.15 \times 14 = 38,530.1$ horse power, and in doing this, exerted an efficiency of 44.8 per cent, so that the actual power required for the air pump was $1.15 \times 100 \div 44.8 = 2.56$ horse power, equivalent to a pressure of $2.56 \times 0.0155 = 0.02$ pounds per square inch. Before the condenser was attached, there was a back pressure of 2.25 pounds per square inch; and with the condenser, the mean pressure due to a vacuum was 3.14 pounds per square inch; so that the gain from the use of the condenser and air pump was $2.14 \div 2.25 = 0.42 = 7.88$ pounds per square inch, or $7.88 \times 100 \div 81 = 23.88$ per cent.

J. T. S. asks: If I sell a horse for \$40 and gain thereby as much per cent as the horse cost in dollars, what would be the price of the horse? Answer: Let x=the cost. Then $x + x$ per cent of $x = 40$. $x + \frac{x^2}{100} = 40$. $100x + x^2 = 4000$. $100x + x^2 + 2500 = 6500$. $x + 20 = \sqrt{6500} = 80.65 - 20 = \60.65 , nearly.

G. W. S. says: D. should make his lemon sirup as follows: Take pulverized citric acid 3/4 drams oil of lemon, 5 drops; simple sirup 1 quart. Cut the oil with a little alcohol, then stir the whole together; and after heating, strain through muslin.

J. L. says, in answer to the queries of R. C. G. and C. F. C. regarding steam yachts: E. C. G.'s engine is far too large for his boat, and moreover condensing engines are not adapted for use in small screw steamers. If he will put his 20 square feet of heating surface into a vertical tubular boiler 3 1/4 feet high and 40 inches in diameter, capable of withstanding safely a pressure of 80 or 100 lbs. to the inch, and use a direct acting engine 3 x 6 inches, running at 300 revolutions per minute, with a suitable screw, his boat, if of moderately good shape, will probably make about 7 miles per hour. C. F. C.'s engine is also larger than is necessary. A cylinder 4 x 6 inches would be large enough; for which he will need a boiler about 4 feet high and 22 inches in diameter, with 35 square feet of heating surface. With this he may obtain a speed of 8 miles an hour, more or less, according to the shape of his boat. It will most likely be difficult to get a much greater speed in either of these cases. "I think your allowance of 18 to 20 square feet heating surface per horse power is unnecessarily large, and would be inconvenient for this purpose. For successful steam yachting is required a well proportioned boat, small strong boiler with large fire box and many tubes, by which rapid combustion and a high degree of heat are maintained; a well constructed engine with small cylinder and very large steam passages, working somewhat expansively at a high rate of speed with considerable steam pressure; engine and boiler protected from radiation."

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

R. R. R.—This material is a silicate of alumina, containing silica, alumina, traces of oxide of iron, and fossil leaves. It is a blue clay, not the kind usually employed for fire brick.

A. D.—Your tripool seems to be of good quality, but the best plan is for you to send large samples to different dealers and have it well tested.

F. M. S.—This is lignite or brown coal. It might prove serviceable as a fuel if found in sufficient quantities, and if coal be expensive. Its presence is no certain indication of the presence of true coal, as lignite belongs to the recent formations of sedimentary rocks, while coal occurs in the older formations.

COMMUNICATIONS RECEIVED.

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

- On a Lightning Freak. By L. G. F.
- On Decimal Weights and Measures. By C. A. G.
- On Transmission of Power by Belts. By W. A.
- On the Bisulphide Engine. By J. T. H.
- On the Variable Star Algol. By J. M. B.
- On Crude Oil for Fuel. By A. L. S.
- On Water Pipes. By M. S.
- On Gold Pens. By W. V. R.
- On the Divisibility of Matter. By W. S.
- On the Devil Fish. By T. L. P.
- On the Hair Worm. By J. S.
- On Crude Petroleum as Fuel. By H. L. A.
- On Paper Making Statistics. By A. S. G.
- On Water Coolers and Filters. By S. E. G.

Also enquiries from the following:

W. E. W.—J. C. E.—A. G. G.—A. Y. H.—W. E.—F. W.—E. F. L.—B. C. E. C.—A. B. C.

Correspondents in different parts of the country ask Where can I obtain machinery for spinning cotton, adapted for small powers? Who makes brick machines? Who makes wool carding machines? Who sells rice mills, to work by hand? Where can the oak-feeding and allanthus-feeding silkworms be obtained? Where can I obtain a folding clothes rack, to fasten against the wall? Who makes peat-compressing machinery? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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
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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:

22,590.—CLARIFYING CANN JUICE.—R. A. Stewart, Dec. 10.
 26,584.—PLAINING CURVES.—J. P. Grosvenor, Dec. 10.
 26,514.—POROUS WARE.—B. S. Pierce et al., Dec. 10.
 25,627.—CUTTING VERBERS.—R. F. Sturtevant, Dec. 10.
 26,679.—SEAMING MACHINES.—L. T. Hulbert, Dec. 17.
 26,822.—CUTTING ROUND TENDERS.—L. A. Dole, Dec. 24.

EXTENSIONS GRANTED.

25,565.—ROLLING MILL.—J. & G. Fritz.
 25,569.—BEDSTEAD SLAT.—T. Howe.
 25,570.—CAR COUCH.—E. C. Knight.
 25,572.—MOLDING WARE TRAPS.—J. A. Lowe.
 25,586.—BURGLAR ALARM.—A. Q. Ross.

DESIGNS PATENTED.

6,890.—TYPE.—E. C. Rutherford, Philadelphia, Pa.
 6,891.—FURNITURE.—D. Shales et al., Boston, Mass.

TRADE MARKS REGISTERED.

1,461.—SILK FABRICS, ETC.—Bernstein et al., N. Y. city.
 1,462.—HAND SOAP.—O. Cutis & Co., Port Au Prince, Hayti.
 1,463.—JOURNAL PAPER.—P. S. Devian, N. Y. city.
 1,464.—SAWS, ETC.—H. Dieston & Sons, Philadelphia, Pa.
 1,465.—SHIRTS.—Finlay et al., New York city.
 1,466 & 1,467.—BOOT PROPS.—Kearns Peg Co., Andover, N. H.
 1,468.—LIQUORS.—G. W. Kidd & Co., New York city.
 1,469.—CLOTHING.—M. Newman et al., New York city.
 1,470.—TEAR.—Newton & Co., San Francisco, Cal.
 1,471 & 1,472.—LEAF TOBACCO.—Weiss et al., N. Y. city.

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 post 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.

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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 in 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 \$30), 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.

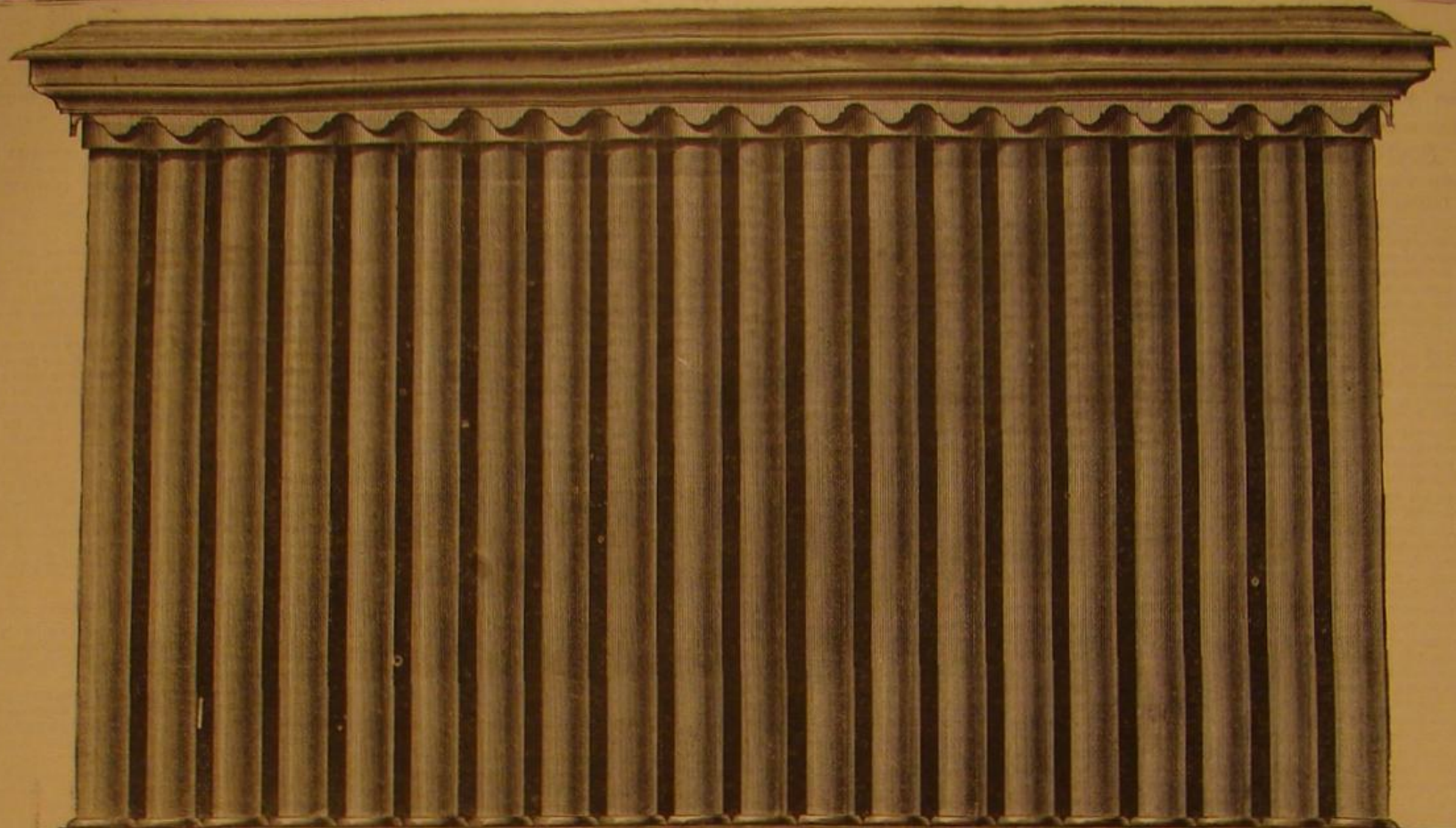
American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

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 instructions.

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 1811 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of 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, New York.

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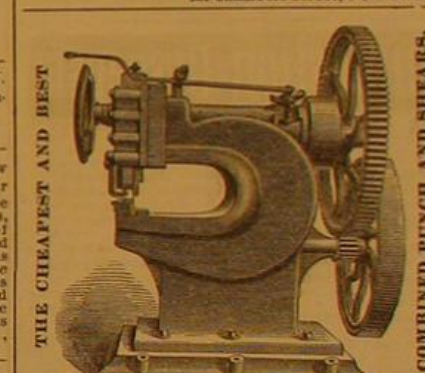
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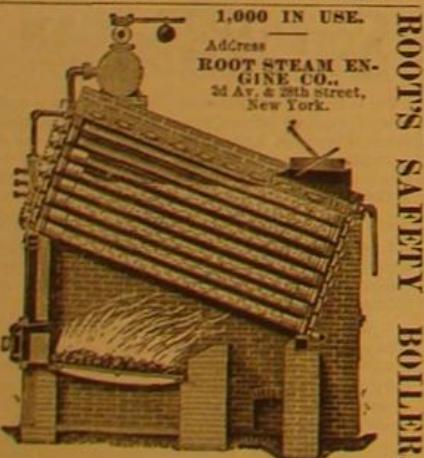
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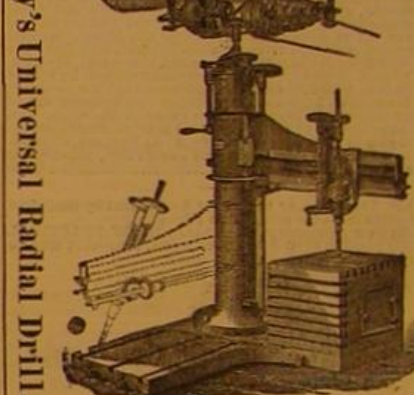
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Vol. XXIX.—No. 18.
[NEW SERIES.]

NEW YORK, NOVEMBER 1, 1873.

[\$3 per Annum.
IN ADVANCE]

JOSEPH GILLOTT.

The early history of the steel pen is curiously obscure. The most diligent search fails to discover the first maker or the earliest date of this implement. There were steel, or rather iron, pens—made, we believe, in Holland—as early as the middle of the seventeenth century. Towards the close of last century, Mr. Harrison, an ingenious Birmingham mechanic, made steel pens for Dr. Priestley. One of them is nothing more than a tube turned out of a flat strip of metal, with the sides and point filed away into the shape of a pen. The first actual supply of such pens, it is believed—the authority for the statement is no more than local tradition—was made by a Sheffield workman, whose name is forgotten. From time to time, as far back as 1809, steel pens, hand fashioned, turned and filed, were made as curiosities or luxuries for presents; but it was not until about 1824 that such instruments were produced in considerable quantities, as regular articles of manufacture. Mr. James Perry was the first manufacturer; but the process was tedious and costly. The metal was steel, rolled out of wire, and for this Mr. Perry paid as much as seven shillings a pound. To the first person he employed he gave five shillings for making each pen; and even when the trade had become regular he gave for some years as much as thirty-six shillings per gross to his workmen. Now—thanks to machinery and modern improvements—pens, not very good perhaps, but good enough to write with, can be made and sold at a profit for 3½ cents per gross!

The first great impulse to the steel pen trade was given in 1820, when Joseph Gillott began pen-making; and since then his name has become so closely identified with the trade, and has acquired such a world-wide reputation, that he has come to be regarded as the Pen Maker.

Though so long resident in Birmingham, Mr. Joseph Gillott was not a Birmingham man by birth. He was born in Sheffield, on the 11th of October, 1799, the son of a workman in the cutlery trade. His own youth was occupied in this business, in which he was both industrious and skillful; indeed, according to the account of old workmen, he was a noted hand at the forging and grinding of knife blades. In 1821, when Mr. Gillott was in his twenty-second year, trade in Sheffield fell off; and work being scarce, the young workman resolved to transfer himself to Birmingham, where, owing to the variety of occupations, a skilled mechanic need never be idle.

His earlier employment in Birmingham was in the light steel toy trade—the technical name for the manufacture of steel buckles, chains, and other works and ornaments of that kind. Some specimens of his workmanship in this trade Mr. Gillott always preserved.

After being for a few years engaged in this trade, Mr. Gillott began the manufacture of steel pens. His faculties of invention and adaptation at once came into play. Such pens as were then made were laboriously cut with shears out of the steel, and were trimmed and fashioned with the file in imitation of the quill. Mr. Gillott adapted the press to the making of pens—the stamping press, then much used in the Birmingham trades, and now familiar to everybody who has ever been in the shop of a metal worker. He saw that the press would enable him to dispense with most of the

slow and laborious operations of pen-making; that it would cut out the blanks, slit them, bend the metal, stamp the maker's name, and thus, by mechanical means, render production at once rapid and certain. But the conception of this idea and the means of working it out were different matters. The metal had to be prepared by rolling, pickling, and tempering for the action of the press. Then special dies had to be made for each size of pen, and for each operation of stamping to which the blanks had to be submitted. Presses of improved construction—quick, light, easily worked, and yet firm enough to strike a sharp, heavy blow—had to be made. And when these difficulties were overcome, there

this respect, to an equality with "the gray goose quill." It is, however, a curious fact—and one worth noting, if only as evidence of character—that Mr. Gillott himself never used a steel pen; he always wrote with the quill. For some years Mr. Gillott kept his methods of working secret, fashioning his pens with his own hands, assisted by a workwoman whom he afterwards pensioned; and many curious anecdotes of the early days of pen-making have been related by this old lady. She used, for example, to tell with great amusement how the first pens were blued in a frying pan over a garret fire. This was at the period when the pens were sold singly, at high prices. Even after the manufacture had been

for some time established, the price kept up. Mr. Gillott has been heard to say that on his wedding day he made seven pounds and four shillings by producing a gross of pens, which he sold at a shilling each.

In 1872, Mr. Gillott employed about 450 persons, the manufacture of pens reached more than five tons per week, and the prices were reduced from one shilling each to a few pence per gross—all the work of the active brain and skillful hand of one industrious and able man.

Every visitor to Birmingham very properly holds that a visit to these works is both a duty and a pleasure. The courtesy of the attendants, the interest of the processes, the cleanly, orderly industry of the various rooms, the wonderful and delicate skill of the slender fingers, and the ready hands, the millions of the little peaceful weapons fashioned for all parts of the globe, are a marvelous tribute to the genius, perseverance, and liberality of one of the most famous heroes of the arts of peace. All readers will be glad to know that Mr. Gillott's eldest son inherits his father's mechanical genius and generous spirit, and that the world famous works are not likely to be closed to the public eyes.

It is not only, however, as a pen maker that Mr. Gillott deserves to be remembered. This record would be incomplete without mention of his great collection of pictures. The taste for art was developed early in life. So soon as he had money to spare, Mr. Gillott began to buy pictures. Apart from business, this was the work of his life; the collection constantly grew, both in quality and extent, until at last his house in the Westbourne Road, Edgbaston, and his residence at

Stanmore, near London, were crowded with works of Turner, Stanfield, John Linnell, Collins, Muller, MacLise, Lealie, Mulready, Cox, Eastlake, Callcott, Webster, Wilkie, David Roberts, Frith, Hook, Poole, William Hunt, Faed, Nicol, Copley Fielding, Prout, and almost every English artist of note.

The sale of his collection—a lamentable dispersion of art treasures—is too recent to be forgotten by our readers. The enormous produce of the sale, \$850,000, affords proof that art not only yields the highest pleasures, but pays in a commercial sense, for Mr. Gillott's pictures brought, in all cases, a large profit upon their purchased price.

Mr. Gillott's figure was short, sturdy, square; his hair and beard (for many years before his death) silvery and venerable; his forehead broad, well rounded, high; his eyes clear, humorous, and bright; his expression pleasant and as



JOSEPH GILLOTT, INVENTOR OF THE STEEL-PEN PRESS.

remained others not less formidable, such as tempering the metal after it had left the press, rendering the newly made pens flexible so as to write easily, cleaning and polishing them without injuring their fineness, and coating them with some kind of varnish, so as to render them attractive to the eye. This was the work which Mr. Gillott had to do; and with much ingenuity and unflagging perseverance he accomplished it.

One of the chief troubles was the extreme hardness of steel pens; when much used, they became pins rather than pens. After many trials Mr. Gillott effected a great and permanent improvement by cutting the side slits in addition to the center slit, which had been solely in use up to that period. To this was afterwards added the cross grinding of the points; and these two processes perfectly succeeded in imparting elasticity to the steel pen, and bringing it up, in

surging; his walk light, active, and firm. His chief characteristics were remarkable quickness and accuracy of observation, wonderful shrewdness, common sense, and frankness; boldness, decision, and enterprise; rare mechanical skill and constructive powers; special talent for arrangement and organization, and rapid and sound judgment on all matters that came before him.

We are indebted to the *Practical Magazine* for the admirable portrait of this remarkable man.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year..... \$3 00
One copy, six months..... 1 50
Answers to correspondents..... 25 00
CLUB RATES: { Ten copies, one year, each \$2 50.
Over ten copies, same rate, each..... 2 50

VOL. XXIX, No. 18. [NEW SERIES.] Twenty-eighth Year.

NEW YORK, SATURDAY, NOVEMBER 1, 1873.

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SECRET SOCIETIES AMONG COLLEGE STUDENTS.

Mortimer M. Leggett, the youngest son of the Commissioner of Patents and a student at Cornell University, was recently accidentally killed during the progress of his so-called initiation into the "mysteries" of a college secret society known as the *Kappa-Alpha*. The circumstances were that the deceased went with a party of members of the above fraternity to a creek just outside the town of Ithaca; and there, blindfolded, he was left, with two companions, standing on the brink of a gorge through which the stream runs. Shortly after, a crashing of bushes, followed by groans, was heard, when the remainder of the party, hastening to the spot, found that the three boys had fallen over a precipice some fifty feet in height. Young Leggett, it seems, struck on his head, sustaining such severe injuries that death ensued in half an hour, while the others were both seriously hurt.

As one of these college fraternities has thus been the indirect means of causing this terrible calamity, we desire just here to express our opinion on the system of secret societies as generally practiced in our institutions of learning. These associations are bodies of students, organized in principle something after the orders of free-masonry or odd-fellowship. In many, the members are numbered by hundreds, and chapters of a single society often exist in a score of colleges at once. The records are handed down from class to class; and out of each set of freshmen, a few individuals are selected for the privilege of membership. When the plan was started (during, we believe, the year 1827) the idea was simply to form clubs of young men, for mutual improvement in debate and such kindred studies as are better pursued by numbers than by single persons, and to keep alive, among *alumni*, pleasant associations of college life. In course of time, the former innocent and laudable object has been lost sight of, or rather relegated to other associations, now existing in many colleges and not included in the list of secret societies; while the cardinal principle of the younger chapters of the latter organizations seems to be nothing more nor less than simple mischief, rendered attractive by a little mystery and concealed under the cloak of such cognomens (symbolized by Greek letters) as "union of souls," "circle of stars," "lovers of wisdom," etc. If the boyish nonsense resulted in the usual students' pranks, it might be passed over with a smile; but such is not the case. The influence exerted, upon boys fresh from school and for the first time free from direct home influence, we believe (from repeated instances within our personal knowledge, and in connection with one of the oldest colleges in this country) to be in a high degree baneful and demoralizing. Unless a youth has well filled pockets, (in which case rival societies vie with each other to see who shall secure him, or rather his money) he is not invited to membership at all. Once joined, however, and held by working upon his fears through the blasphemous oaths of secrecy that he is forced to take, he is inducted, by sheer force of example, through a routine of profanity, intemperance and gambling; while in many cases, if young and innocent, his course leads to graver faults, committed more through a sense of shame and false pride than depravity, and due to the tacit if not open instigation of his unscrupulous elders.

The sad and untimely fate of Mr. Leggett, just at the outset of doubtless a brilliant and honorable career in the calling which his father has so ably adorned, will, from the circumstances under which it occurred, excite a lively and widespread sympathy. It is the first death, which, to our knowledge, has been owing, though indirectly, to the proceedings of these student organizations; though we have heard of numerous cases of maiming and injury thus caused, and of idiosyncrasy and cerebral disease due to the effect of hideous and ghastly paraphernalia upon the imagination of weak minded boys.

There is a notion, which is becoming entirely too prevalent, that colleges are merely convenient places for sending young men to while they are passing through that uncertain and troublesome age, leading to manhood, during which they are expected to sow their traditional wild oats. To this idea, we believe, may be mainly ascribed the barbarities of "hazing," and the no less reprehensible practices of secret societies; while to it also may be traced many of the complaints that our seminaries are inferior in an educational point of view to those of foreign countries. Hazing, already crushed out in the government naval and military schools, is exciting so large a share of public condemnation that there is a fair prospect of its stern repression in colleges generally. The secret societies, we trust, may meet hereafter with similar treatment, at least through the influence of parents if not at the hands of faculties. Harvard forbids their existence among her students, and Cornell at this time would do well to follow her example.

PROGRESS OF PATENTS.

The following were the number of applications for patents made to the principal governments of the world in the year 1872, as given in the published statistics of the British Patent Office:

	Number of Patents Applied for in 1872.
United States.....	18,243
France.....	4,872
Great Britain.....	3,970
Belgium.....	1,921
Austria.....	922
Canada.....	671
Italy.....	521
Saxony.....	259
Sweden and Norway.....	200
Bavaria.....	164
Wurtemberg.....	141
Baden.....	113
British India.....	71
Victoria.....	60
Prussia.....	56
New South Wales.....	42
British Guiana (allowed).....	28
Cape of Good Hope, from 1860 to 1869.....	18
New Zealand.....	18
Mauritius.....	11
Ceylon.....	5
Tasmania.....	5
Jamaica.....	4

The aggregate number of patents applied for in all of the countries above named, in 1872, except the United States, was 14,072, thus showing that in this country the number of patents annually applied for exceeds, by 4,171, the combined number applied for in all other countries above named. The reason for the surprising difference in favor of this country, in the inventive productions of the world, we believe to be due to the superior theory which prevails here concerning the object and uses of patents. We grant patents for the purpose of encouraging the useful arts. We regard the inventor as a benefactor, and place him under no restrictions in the sale or working of his improvement. We grant patents at so low a price that the masses, the poorer classes, among whom the best inventors are found, may readily obtain and hold them.

WOOD AND STRAW PAPER MAKING IN FRANCE.

The improved processes of making paper from wood, straw, and various grasses, as practiced in France, now enables the manufacturers to recover 85 per cent of the caustic alkali, used in the reduction of the raw material into pulp. This is a very important economy.

In order to convert wood into pulp, a strong solution of the alkali is necessary. One pound of carbonate of soda is required to produce four pounds of pulp.

By steeping the wood or straw in the alkali solution, the resinous and other gummy matters are separated from the fibers of the material, and become mixed with the solution. To regain the soda for re-use is now the object of the manufacturer. This is done by evaporating the water by heat, then charring the resulting mass, which yields carbonate of soda, then converting the latter into caustic soda.

The evaporation is effected by passing the products of combustion from the fire which heats the alkaline solution through the liquid which is to be evaporated. For this purpose the liquid is thrown up in the form of a thin spray, by paddle wheels. 12½ pounds of the solution, it is stated, are evaporated for each pound of coal consumed. The carbonate of soda is then subjected to long continued washing in a peculiar apparatus until it is fit for burning, and at last 85 per cent of the original quantity of the alkali is recovered. The former methods only permitted the recovery of from 50 to 60 per cent of the alkali.

TWO INTERESTING DISCOVERIES.

The *America*, a daily journal of Bogota, in a recent issue publishes a letter of Don Joaquin Alvez da Costa, in which he states that his slaves, while working upon the plantation of Porto Alto, Parahyba district, Peru, have discovered a monumental stone, erected by a small colony of Phoenicians who had wandered thither from their native country in the ninth or tenth year in the reign of Hiram, a monarch con-

temporary with Solomon and who flourished about ten centuries before the Christian era. The monolith bears an inscription of eight lines, written in clear Phoenician characters, without punctuation marks or any visible separation of the words. This has been imperfectly deciphered, but enough has been made out to learn that a party of Canaanites left the port of Aziongaher (Boy-Akaba) and navigated about the coast of Egypt for twelve moons (one year), but were drawn by currents off their course and eventually carried to the present site of Guayaquil, Peru. The stone gives the names of these unfortunate travellers, both male and female, and probably further investigations will shed more light on the records they have left.

Another and more astonishing discovery, we find announced in *Les Mondes*. It appears that some Russian colonists, having penetrated into hitherto unexplored parts of Siberia, have found three living mastodons, identical with those heretofore dug up in that country from frozen sand. No particulars are given as to this, we fear, somewhat questionable find. From the statements of M. Dupont, of the Brussels Royal Academy, it would seem that, like the reindeer, the mastodon should not now be extinct, and that the animal is naturally the contemporary of the horse, sheep and pig. Hence the announcement is not without some shadow of probability.

NEW ORDER BY THE COMMISSIONER OF PATENTS.

The subjoined order, recently issued by the Commissioner of Patents, will be fully appreciated by inventors and their representatives, exhibiting, as it does, a determination at headquarters that the chronic indolence heretofore prevailing among certain examiners, shall no longer be tolerated.

U. S. PATENT OFFICE,
Washington, D. C., October 3, 1873.

I have noticed, for more than two years past, that a few of the Examiners are generally from one to two months behind with the work in their rooms. The fact that they so uniformly have about the same number of cases on hand is evidence to me that, with proper effort, they might keep their work closely up to date. The answering of letters and the making of excuses, in consequence of being so far behind, are causes of great loss of time. I shall expect the work of the Office to be promptly up to date by the tenth day of November. If, to do this, it becomes necessary for Examiners to demand of their subordinates more than six hours labor per day, they will do so; but the work must be brought up to that date, and thereafter kept up.

(Signed) M. D. LEGGETT,
Commissioner of Patents

The tedious delays in the matter of official decisions often deter inventors from applying for patents, and are equally discouraging to those having cases pending in the Patent Office. With this rule inflexibly observed, early examination and quick disposal of cases will be insured, thereby largely increasing the business of the Office.

PETROLEUM AND PINE TAR GASES.

Some time ago, it may be remembered, we called attention to the interesting and novel experiments, made by Professor Benevides of Lisbon, Portugal, upon the flame of compressed carbonized gas burning in free air. Ordinary illuminating gas and marsh gas (light carburetted hydrogen) were the subjects of the investigation. Recently the same author has conducted similar inquiries, in reference to gas extracted from the residues of petroleum and of the pine and fir tree, with even more remarkable results.

The gas derived from vegetable sources, used in the experiments, was obtained by the distillation of the residue left after the distillation of the roots, by employing a jet of steam at high tension, which was injected into the distilling cylinders. A liquid was produced from which turpentine was extracted, when there remained a black and thick fluid as residue. The latter, submitted to distillation, disengaged a combustible gas which for some time past has been employed for illuminating several light-houses on the coast of Portugal. The petroleum gas was obtained by the distillation of the residuum of petroleum by the Hirzel system. The gases, thus arising, as well as those derived from the pine, are mixtures rich in hydrocarbons, a phenomenon analogous to that observed with ordinary illuminating gas obtained by the distillation of coal, and contain, in variable proportions, protocarburetted of hydrogen, bicarburetted of hydrogen, carbonic oxide, carbonic and sulphuric acids, etc.

Coal gas possesses in general much of the protocarburetted and little of the bicarburetted. As the proportions of these gases are variable, the density and illuminating power of the mixture likewise vary considerably. The coal gas, as employed in the city of Lisbon and used in the course of the experiments, has a density of 0.4, and its illuminating power, as indicated by the Erdmann apparatus, is 29.

Pine gas has a very pronounced odor resembling that of burned turpentine: its density is 0.8, nearly double that of coal gas. It is a mixture very rich in carbon and requires burners of special construction with very small orifices, in order to avoid the production of smoke and bad odor, as happens when consuming the gas in the ordinary illuminating gas burner.

The air which combines with the flame in the latter case is insufficient to ensure the combustion of the enormous quantity of carbon contained. The illuminating power of this pure gas is much superior to that of coal gas. In experiments with the apparatus above named, while the latter gas gave 29, the former produced an indication as more than 50. The graduation of the instrument stopping at this point (the maximum width of the slit), it was found impossible to cause the brightness of the pure gas flame to disappear entirely, so that the full intensity of its illuminating power could not be

accurately ascertained by this means. With the Bunsen photometer, experiments gave 5 to 1 as the ratio of the respective luminous intensities of pine and coal gas.

Petroleum gas possesses properties analogous to those of pure gas, but has however a different and very strong odor similar to that of phosphuretted hydrogen. Its illuminating power is even stronger than that obtained from gas derived from coal. On burning petroleum gas in a Bunsen burner of ordinary dimensions, the brilliancy of the flame does not entirely depart, as the quantity of air drawn in is not sufficient to cause the consumption of all the contained carbon. When the cock of the rubber sack containing the petroleum or pine gas, under examination in the Bunsen lamp, is very slightly opened, the flame disappears from the upper portion of the burner and leaps to the inferior orifice of the tube. If, however, the said bag be pressed by the hands, the flame returns to the upper part of the burner. Although this experiment may be repeated as often as desired with the gases above named, it cannot be accomplished with coal gas, of which the flame, once produced at the inferior orifice, is not displaced, even if the same pressure be exerted upon the bag as before, thus indicating the greater mechanical energy of the former gases.

Combustion not being complete in Bunsen lamps of ordinary dimensions, the characteristic bands are not clearly defined in the spectra of pine and petroleum gases. The upper part of the flame gives a continuous spectrum, while that of the lower portion is channelled: the lines have the colors of the bands, while red appears at the extremity of the spectrum. On lighting a jet of compressed pine or petroleum gas, escaping from a tube, similar phenomena to those caused with coal gas are observed. With the former gases, however, the effects are amplified by the greater density and larger quantity of carbon contained. The velocity and the escape being great, the flame never commences at the orifice, but an intervening obscure space is produced. If a tube be employed having an exterior opening 1 millimeter in diameter, the flame of compressed coal gas presents no obscure point near the pipe; for if the cock be opened too wide, total extinction of the flame follows. With petroleum or pine gas, the contrary is the case: a quite large non-illuminated space appears near the escape orifice, and at the same time an oscillation of the luminous jet in the direction of its axis is perceptible. If the flame be observed from the side of the tube, a hollow central space, from which combustion is absent, can be perfectly discerned. This, the author considers, confirms his explanation to the effect that the velocity of a gaseous current is greater at the center than at the surface of the jet, for the friction diminishes the velocity of the molecules of the exterior. The mechanical action of the current is also greater at the center; the flame is projected to a greater distance, and there is a stronger displacement of the air in the region near the axis of the jet than at the periphery.

Another experiment gives additional support to this theory. If through a bent tube a current of air be directed upon the flame of compressed pine or petroleum gas, in the direction and path of the gaseous current, the obscure space augments and the flame, drawing away from the orifice of the burner, may be projected so far therefrom as to be extinguished. In this case the air, it is believed, augments the mechanical action of the gas, in throwing the flame to a greater distance. If, on the contrary, a draft be applied to the jet in the direction of its axis but in a path opposite to that of the current, the flame approaches the orifice, diminishing the obscure space until the same disappears and the flame begins directly at the escape opening. By this means the gaseous mass is impressed with a movement contrary to that which it possesses on leaving the compressing apparatus, which diminishes the velocity of escape of the current and consequently its mechanical action on the incandescent portion. Again, if the air be injected transversely to the flame, the latter will deviate to the opposite side, through the composition of the motion which the jet had at the point of escape with that impressed by the draft; and at the same time the dimensions and form, both of obscure space and luminous jet, will vary.

Petroleum and pine gases having more carbon than coal gas, in order completely to ensure their consumption more air is required than is necessary for the combustion of ordinary illuminating gas; and thus for compressed gases it is necessary that the velocity of escape be greater for those derived from petroleum and from pine than from coal, in order to have the highest temperature and to cause the complete disappearance of the brilliancy of the flame. It is also for the same reason that the velocity of escape of the former gases should be greater than that of others less rich in carbon, to enable the spectroscopist to exhibit with clearness the spectra characteristic of the flame of compressed gas.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW SERIES OF AROMATIC HYDROCARBONS.

In the reaction of zinc powder on a mixture of benzene and chloride of benzyl, there are produced, besides diphenyl-methane (benzyl-benzene) some other hydrocarbons, which M. Zincke has recently succeeded in isolating.

After the distillation of diphenyl-methane, the temperature rises rapidly up to the limit of the indications of the mercurial thermometer, and a liquid is distilled which coagulates on cooling into a clotted and crystalline pasty mass. At the end of the distillation, a solid yellow body is passed and the residue cokes. The crystalline mass was treated with a little ether and pressed between sheets of paper to carry away the liquid portion. The etherized solution slowly deposited the crystalline crusts which were joined to the

solid portion, and by complete evaporation gave a non-solidifiable oil.

In boiling alcohol the solid portion is deposited in acicular crystals: the mother waters retain a liquid product and another hydrocarbon. The acicular crystals are a mixture of two hydrocarbons; one, which appears to predominate, crystallizes in boiling alcohol in fine and very brilliant layers, or, if the solutions are extended, in rhomboidal transparent tables. This substance is slightly soluble in alcohol, quite so in benzene, chloroform, and sulphide of carbon, though somewhat less in ether. It melts at about 187° Fah. and coagulates at 172° 4' into a transparent mass which becomes crystallizable by heat or friction. It does not combine with picric acid.

The second hydrocarbon is much less soluble than the first, crystallizes in fine needles, melts at 172° 3' Fah., and coagulates at 154° 4'. The separation of these hydrocarbons is very difficult, and ether is the best agent to employ. Their composition is sensibly the same, and the author regards them as isomeric di-benzyl-benzene, $C_{26}H_{22}$; one of them may, however, be tri-benzyl-benzene, $C_{26}H_{24}$. Their oxidation may give some indications on their molecular weights.

TO DESTROY FIELD MICE.

Smoke, it is well known, will soon destroy these little pests, but how to introduce it into their holes in an easy way may interest some of our readers. Professor Nessler, of Karlsruhe, has devised a sort of pellet which gives off great quantities of smoke when burning, so that it is only necessary to put some of these into the holes and ignite them in order to suffocate the mice. Their preparation is nearly as follows: Some fibrous substance, such as jute, is soaked in a concentrated solution of saltpetre, dried, then dipped in tar, and, when half dry, flowers of sulphur are sprinkled over it. When fully dry the jute fibers are cut into little pieces like pills and are ready for use. As soon as they are ignited they are stuffed into the hole, which is then stopped up with earth.

FLUORENE.

M. Berthelot announces, under the name of fluorene, a new and very fluorescent carburet contained in the portions of the tar of volatile oils between 300° and 340° C.

In order to extract the substance, instead of causing the portions of solid carburet which have passed the distillation between 300° and 305° C. to be crystallized in alcohol simply, a mixture of alcohol and benzene is used. By this means may be separated a small quantity of acenaphthene which remains in the mother liquor. The point of fusion of the mass, which is ordinarily 105° C. after the first distillation and crystallization in pure alcohol, increases to 112° after crystallization in alcohol mixed with benzene. The remainder of the purification consists in redistillation and crystallization in pure alcohol. The carburet possesses a quite pronounced violet fluorescence which, however, disappears promptly on its being exposed to the light. The chemical symbol is stated to be $C^{26}H^{10}$.

THE BRITISH ASSOCIATION.

We continue, from our last, abstracts from papers read at the late meeting at Bradford:

ON PEAT.—BY MR. F. HAHN DANCHELL.

The prime fact in relation to peat is that, in its raw condition, the combustible parts are combined with from 80 to 90 per cent of water, which, for the most part, must be removed before it can constitute fuel. The peat problem may therefore be defined as the economical separation of the two elements—the retention of the solid and the discharge of the fluid. The simplest mode of effecting this is by cutting the peat as sods or bricks, and leaving them to dry in the air and sunshine. To diminish labor, it is frequently suggested, why not dry peat by pressure? If peat were altogether composed of fibers, the water might certainly be squeezed out, as from cotton, or wool, or hair; but a large portion of peat is semi-gelatinous, which, when dry, serves to cement the whole together, and which, moreover, is good for combustion. When peat is compressed, this glutinous constituent escapes with the water, indeed as easily as the water, involving a serious loss. Drying by artificial heat is also frequently proposed; but when it is considered that to obtain 100 tons of dry peat it is necessary to find space for 500 or 600 tons of wet peat, which space must be so heated as to permit the evaporation of 500 tons of water, the economy of the proposition is seen to be highly questionable. But, setting economy aside, it is to be observed that peat cannot be artificially dried without deterioration in quality. The practice of maceration is so old that Pliny refers to it in his description of the inhabitants of North Germany; and yet ever and anon it is advanced as a novelty, and made the subject of patents. The reduction of peat to pulp is one of the easiest of operations. It may be done with the feet, or with any kneading or mashing machine. The most efficient mode of drying is by slow evaporation under roof. Drying goes on more rapidly in the open air if the weather be favorable; but in this country the sky cannot be reckoned upon, and with alternate exposure to wind, rain, and sunshine the quality of peat is much deteriorated. The difference in favor of peat dried under a shed is most marked, and, though the cost of production is greater, the quality affords ample compensation. How much drainage affected the cost of production may be seen from comparing the results from a drained and undrained bog. An undrained bog contains about 90 per cent of water, while a drained one contains 80 per cent. In the one case, therefore, we have 10 per cent of perfectly dry peat, and in the other double that amount.

The output will, therefore, be half the quantity from an undrained bog as from a drained one, while the labor is the same. In Holland, Westphalia, Hanover, Holstein and Schleswig, Denmark, Pomerania, and the whole northern part of Germany, Russia, and many parts of Austria, Bavaria, the North of Italy, Switzerland, and extensive districts in both the North and South of France, peat is a general article of consumption, and the inhabitants would, no doubt, hear with some amazement that what is matter of course with them is matter of inquiry with us, and that we want to know whether peat is applicable to iron smelting and other industrial purposes, when they from time immemorial have used little else.

ON THE EFFECT WHICH THE DEPTH OF IMMERSION HAS ON THE RESISTANCE OF A SCREW.—BY PROFESSOR OSBORNE REYNOLDS, M. A.

It has been stated by several writers on the screw propeller, and is, I think, generally supposed, that the resistance of the water to a screw increases with the depth of immersion below the surface. Improvements have been made by Mr. Rennie and Mr. Maudslay which appear to prove this, but I do not think that any theoretical reason has ever been given. Now this idea is so contrary to our fundamental notions of hydraulics that I thought it would be worth while to make experiments. These experiments show us that there is not any increase beyond a certain point, and that this point is that at which the screw ceases to break the surface and get air. In a paper read before the Institution of Naval Architects, I explained how the air getting down to the screw is the cause of racing. In the same way it may be shown that it was the air that was the cause of the diminished resistance near the surface, found by Mr. Rennie and Mr. Maudslay.

The conclusion is that, when a screw is once fairly down below the surface, depth of immersion is of no advantage. Experiments on the effect of immersion on the resistance of screw propeller were made June 8, 1873. The screw was 2 inches in diameter, driven by a spring, which, when wound up, caused it to make 240 revolutions. The resistance at the different depths was measured by the time taken for the spring to run down.

FIRTH'S COAL CUTTING MACHINE.—BY MR. WILLIAM FIRTH, OF LEEDS.

Enough has been said respecting compressed air as a motor to justify the expectation that it is the key to vast and important improvements upon the present system of working coal; and bearing in mind that the wealth, the power, and the greatness of this nation depend primarily upon an abundant supply of coal, it is hardly possible to over rate the importance or over value the advantage which this power places at our disposal. I now turn to the consideration of the machine for cutting the coal, which has for several years been employed at West Ardsley without any interruption. The weight is about 15 hundred weight for an ordinary sized machine; its length, 4 feet; its height, 2 feet 2 inches; and the gage, 1 foot 6 inches to 2 feet; it is very portable, and easily transferred from one bank to another. The front and hind wheels of the machine are coupled together in a similar manner to the coupled locomotive engines. The "pick" or cutter is double headed, whereby the penetrating power is considerably increased. The groove is now cut to a depth of 3 feet to 3 feet 6 inches at one course, whereas, by the old form of a single blade, we had to pass the machine twice over the face of the coal to accomplish the same depth. The points are loose and cotted into the boss, so that, when one is blunted or broken, it can be replaced in a few moments. It dispenses with the necessity of sending the heavy tools out of the pit to be sharpened, and is an immense improvement upon the old pick.

When all is in readiness for work, the air is admitted and the reciprocating action commences. It works at a speed of sixty to ninety strokes per minute, varying according to the density of the compressed air, the hardness of the strata to be cut, or the expertness of the attendant. As to the quantity of work in "longwall," a machine can, under favorable circumstances, cut 20 yards in an hour, to a depth of 3 feet, but we consider 10 yards per hour very good work, or say 60 yards in a shift. This is about equal to a day's work of twelve average men, and the persons employed to work the machine are one man, one youth, and one boy, who remove and lay down the road and clear away the debris. The machines are built so strong that they rarely get out of working condition. Some of those now working at West Ardsley, and other places, have been in constant use for three or four years. At that colliery there are about eight machines in use. One of the seams is so hard and difficult to manage that it could not be done by hand, and the proprietors had to abandon and did abandon it; but now, by the employment of the machines, it is worked with perfect ease. It is a thin canal seam with layers of ironstone, and the machines now "hole" for about 1,200 tons per week. The groove made by the machine is only 2 to 3 inches wide at the face, and 1½ inch at the back; whereas by hand, it is 12 to 18 inches on the face, and 2 to 3 inches at the back. In thick seams worked by hand the holing is often done to a depth of 4 feet 6 inches to 5 feet, and the getter is quite within the hole that he has made; and where the coal does not stick well up to the roof, or where there is a natural parting, there is great difficulty and danger from "falls of coal."

The consumption of coal for the purpose of gas illumination in Great Britain is estimated at fourteen millions of tons per annum, valued at sixty millions of dollars. The total annual production of coal in England is one hundred millions of tons.

FEEDING AND WATERING CATTLE IN RAILROAD CARS.

A London butcher has lately taken out a patent for a convenient device for feeding and watering cattle as they stand in the railway cars. The hay rack, *b*, and the water trough, *a*, are suspended at the end of a balanced lever, *c* (seen in both our illustrations, which we reprint from the *Practical Magazine*). Water is turned on at *g*, till the weight of the trough overbalances the counterpoise, *e*, and descends to the required level. When the animals are well refreshed, the cock, *h*, is opened, the remainder of the water flows away, and the troughs rise out of the way. Our engravings show the complete apparatus in use with an open car (Fig. 1) and a closed car (Fig. 2).

The inventor, Mr. W. J. Bonser, states that such apparatus need be put up only once in every two hundred miles of continuous railway.

In addition to the misery caused by the transit, as at present conducted, it is testified by experts that every bullock, from the moment it leaves the grazier's yard, will lose eight pounds a day in weight, besides loose fat. Professor Simmonds says: "There cannot be a doubt that the feeding and watering of animals on their journey to a fat cattle market would prevent, to a great extent, that waste of tissue which invariably takes place in the travelling of cattle, and would also tend to maintain that juicy and well known superior quality of the meat which is met with in animals killed at home. From a humane point of view, also, it is exceedingly desirable that animals should have both food and water on long journeys, the latter being especially required during the heat of summer."

The cost for apparatus to feed 30 cars of cattle at once is estimated, by a firm of engineers, to be \$4,260, a moderate outlay, considering the permanent value of the appliances, and the greatly improved condition of the stock. Such an arrangement is likely to be especially valuable in this country, where journeys of a thousand miles are every day matters, and where cattle suffer and lose in value proportionally to the territory over which they travel.

Wild Beasts and Snakes in India.

We have previously alluded to the remarkable stories which come to us from abroad of the destruction of human life in India by savage beasts and poisonous serpents. We could hardly credit the reports as true till we read, in the last number of *Land and Water*, the following, taken from official reports:

The number of human beings annually destroyed by wild beasts is one of the most extraordinary features of Indian life. In the recently issued official statement as to the condition of our Eastern Empire, we find the subject again discussed; and it is there remarked that, though rewards are offered by the Government for the killing of these animals, yet in some districts the loss of life is very great; and in others, where it is less excessive, the reason given is that goats are very abundant, and that wolves prefer kids when they can get them. Deaths by snake bites are also very frequent, no fewer than 14,529 persons having perished in that way during the year 1869; while in 1861, the total deaths caused by dangerous animals of all classes amount to 18,075. Dr. Fayrer is of opinion that, if systematic returns were kept, the annual number of deaths from snake bites (exclusive of all doubtful cases) would be found to exceed 20,000. The inhabitants of the border lands between jungle and cultivation are killed and eaten by tigers in such numbers as to require the immediate and serious attention of Government both in India and in England. The following are a few out of many instances: "A single tigress caused the destruction of thirteen villages, and 256 square miles of country were thrown out of cultivation." "Wild beasts frequently obstruct Government survey parties. In 1869, one tigress killed 127 people and stopped a public road for many weeks." "In January, 1868, a panther broke into the town of Chicola, and attacked, without the slightest provocation, the owner of a field; four persons were dangerously wounded, and one died." "Man-eating tigers are causing great loss of life along the whole range of the Nallai-Mallai Forest. There are five of them; one is said to have destroyed 100 people." "Writing from Nuyclunka in 1869, a gentleman says one tigress in 1867-8-9 killed respectively, 27, 34, and 47; total, 108 people. This tigress killed a father, mother, and three children, and the week before she was shot she killed seven people." "In Lower Bengal alone, in the period of six years, were killed by wild beasts 13,401. In South Canara, in July, 1867, forty human beings were killed by wild beasts." The Chief Commissioner of the Central Provinces in his reports shows the following returns of human beings killed by tigers: In 1866 and 1867, 372; in 1867-68, 289; in 1868-69, 285; total for three years, 946. It appears that there are difficulties in

the way of killing down these tigers. First, the superstition of the natives, who regard "the man-eating tiger" as a kind of incarnate and spiteful divinity whom it is dangerous to offend. Secondly, the failure of Government rewards. Thirdly, the desire of a few in India actually to preserve tigers as game to be shot with the rifle, as a matter of sport.

FIG. 1.

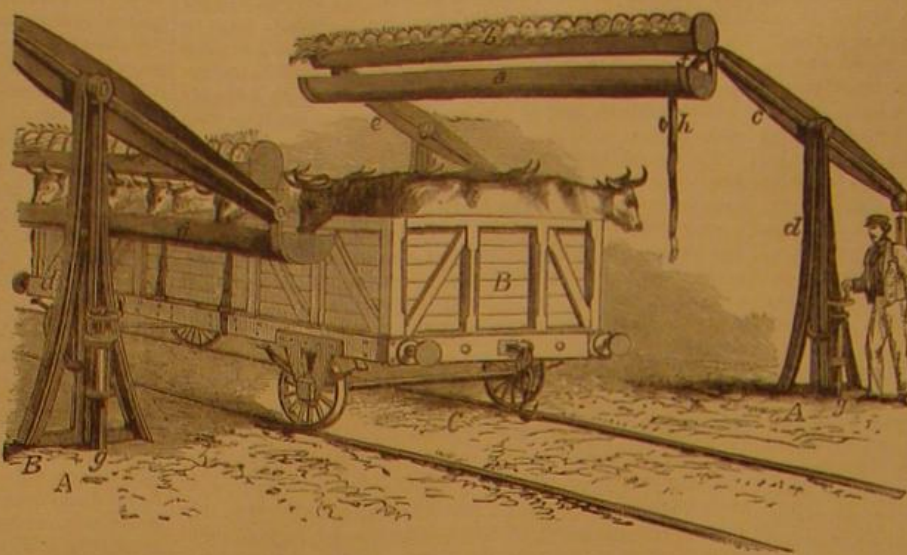
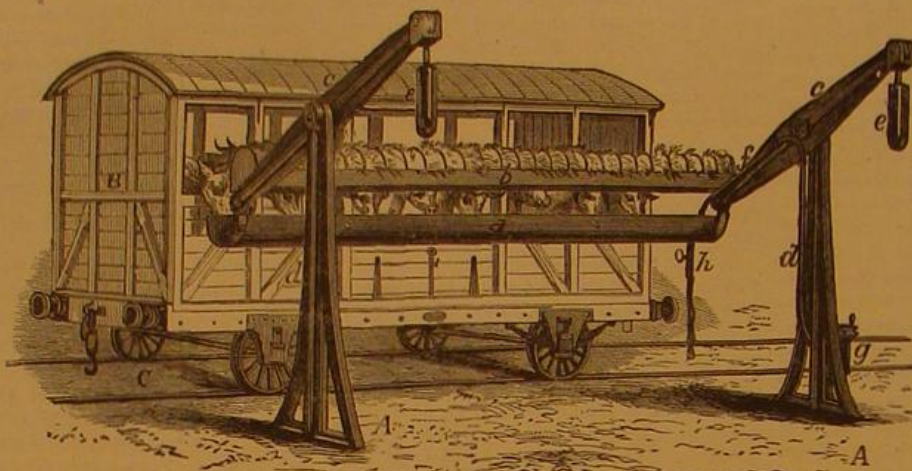


FIG. 2.

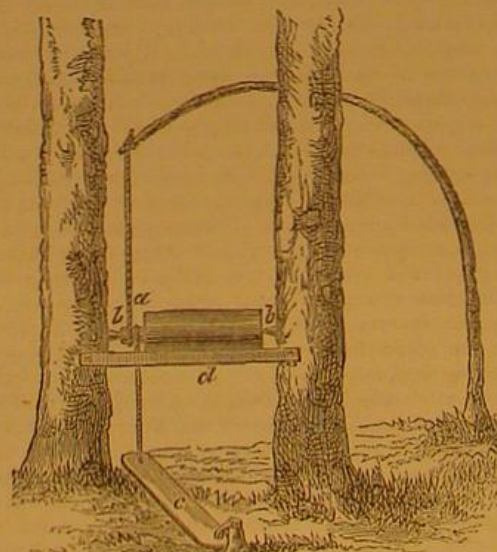


DEVICE FOR FEEDING AND WATERING CATTLE.

Mr. Frank Buckland suggests an organized destruction of the tiger cubs in the breeding season, and the attraction of fully grown tigers to traps, pitfalls, and other devices, by means of a drug of valerian, of which tigers, which are only gigantic cats, are exceedingly fond.

An Ancient Lathe.

At the Vienna Exposition we find turned objects of wood, such as wooden glasses, bottles, basins, etc., manufactured by the Huculen, the remnants of an old Asiatic nation which had settled at the time of the general migration of nations in the remotest part of Galicia, in the dense forests of the Carpathians. These people manufacture the articles named above, and the instrument they are using for turning them



is worth noticing, seeing that it has been employed unaltered since times immemorial. If a Hucule wants to manufacture a turned basin, bottle, etc., he arms himself with a chisel, a hatchet, and a rope, and enters the dense forest which surrounds all human habitations in his part of the country. After having cut the tree out of which he wants to manufacture the desired articles, he looks around for two trees of about one foot or two feet diameter, and sufficiently close together for his purpose. But it is an essential point in selecting these trees that a young maple or beech should also grow near at hand. Having found this necessary combination for the work to be done, the Hucule makes two holes

at a proper height in the two trees, and inserts in these opposite holes maple cones, serving as dead centers. One of these cones is fixed, and the other removable.

In the annexed sketch of this arrangement, taken from *Engineering*, these cones are marked *b b*. The wood blank to be turned is then prepared with the hatchet, so as to be fixed between the centers, and is fitted at one end with a small cylindrical part, *a*, to take up the rope for giving a rotary movement to the piece of work.

The rope is then taken two or three times round the small cylindrical part, *a*, and is attached to the top of the young maple, as shown in the sketch. The lower end of the rope is fastened to a piece of wood, *c*, which, at its other end, is attached to one of the roots of the trees, and thus serves as a footboard. After this the man fastens a crossbar, *d*, to the trees, and begins to turn with his chisel whatever he wants to produce.

Statistics of Paper Manufacture.

From the time when paper made from cotton was first brought to Europe from the deserts of Central Asia, its manufacture has increased steadily and has entirely supplanted the papyrus of the ancients. Paper is now manufactured from the most varied materials, such as wool, cotton, flax, hemp, jute, agave, straw, potato, mulberry, esparto, and rice fibers; and a recent Austrian investigator, Dr. Albinus Rudel, calculates the yearly production in all civilized parts of the world as amounting to 1,800,000,000 pounds. This quantity is manufactured in 3,960 factories, which employ 90,000 male and 180,000 female hands, besides 100,000 workmen occupied in collecting and assorting rags. The factories, when in full working order, represent a money value of not less than \$280,000,000 gold, and the value of the annual paper production is estimated at \$195,000,000 gold. The production of the United States, with a population of 39,000,000, reaches up to 374,000,000 pounds, but their consumption exceeds this quantity by 3,000,000 pounds, which are supplied by importation. Every American uses annually

10½ pounds paper, while Mexico, with Central America, consumes only 2 pounds, and British America 5½ pounds per head. The consumption in European countries is 11½ pounds per head in Great Britain, 8 in Germany, 7½ in France, 3½ in Austria and in Italy, 1½ in Spain, and in Russia but 1 pound. But these figures by no means justify us in drawing any rigid conclusions as to the literary occupations or mental acquirements of the respective countries, though they give us a general idea thereof. It must be remembered that one third of all this immense quantity of paper consists of paper hangings, pasteboards, shavings, and wrapping sheets, one half of all the production is printing paper, and the remaining sixth is writing paper. The consumption in civilized countries averages per head 5 pounds paper, 5 newspaper copies, and 10 letters; fifty years ago, 2½ pounds of paper were supposed to be the average. In round numbers, Dr. Rudel distributes the annual paper "crop" into the following departments: Government offices, 200,000,000 pounds; schools, 180,000,000 pounds; commerce, 240,000,000 pounds; industrial manufactures, 180,000,000 pounds; private correspondence, 100,000,000 pounds; printing, 900,000,000 pounds; total, 1,800,000,000.

A people consuming comparatively large quantities of paper will certainly occupy a high place in the scale of industrial and mental development, its use being co-extensive with commerce, manufactures, schools, and the printing press.

A VIRGINIA city (Nevada) man is said to have invented an ingenious plan of keeping his house clear of insurance agents and similar nuisances. On each side of the path leading to his door, he has fixed several sections of water pipe filled with small holes, and on the approach of a suspicious character a tap is turned, and instantly numerous jets of water enfilade the path in all directions, and effectually keep the invader at a safe distance.

At various points on the river Thames, between Woolwich and Erith, there are visible at low water the remains of a submerged forest, over which the river now flows. This fact has led geologists to conclude that the present outlet of the Thames to the North Sea is of quite recent origin.

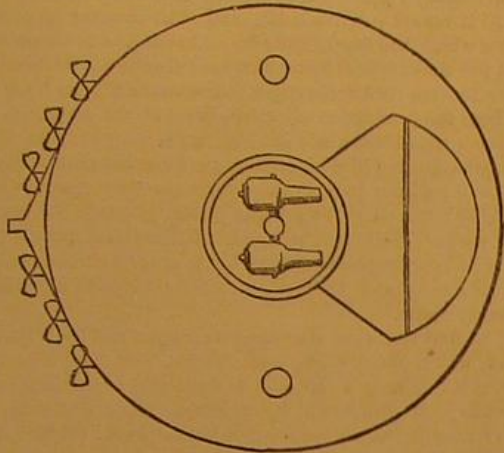
A. VOGEL has found nearly all specimens of fresh milk either neutral or slightly acid. In only two specimens, out of thirty, the alkaline action appears to have been due to traces of free ammonia. He ascribes the acid reaction of fresh milk to the presence of free carbonic acid, since litmus tincture colored red by fresh milk regains its blue color on shaking or boiling. No mention is made of the conditions of food, etc., to which the cows were subject.

CIRCULAR SHIPS.

The idea of circular vessels is not absolutely new. Probably the earliest practical suggestion was that of Mr. T. R. Timby, of Worcester, Mass., who, in 1843, filed in a working model of a revolving ship, together with specifications, in the Patent Office at Washington. His plan embraced circular ships and revolving ironclad forts and turrets, which have since come into use.

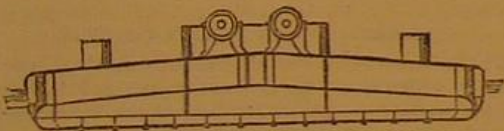
Admiral Popoff, of the Russian navy, has also adopted the idea, and quite recently two vessels, the Kiew and the Novogorod, have been successfully launched at Nikolaiief.

We lay before our readers, in the accompanying engravings, sectional and plan views of these curious ships, from the pages of *La Nature*. Each vessel is 99.2 feet in diameter and constructed of iron, planked with wood and sheathed with copper. The draft of water is 13.1 feet, and the spar deck is 2.1 feet above the water line. The displacement is 2,783 tons. The bottom is perfectly flat, and the sides are vertical, with an overhang aft, sheltering the rudder. In order to insure stability, twelve keels are affixed, each about three inches in depth.



At the center of the ship is a turret, 29 feet 6 inches in diameter and 7 feet high, containing two 11 ton steel guns (probably eight inch bores), breech loading and mounted *en barbette*. The turret has a hollow axis which serves as an ammunition scuttle, and on which pivot the supports of the guns, so that the latter can be pointed over an angle of from 30° to 35° with the fore and aft direction of the ship. The rest of the armament consists of torpedo arrangements.

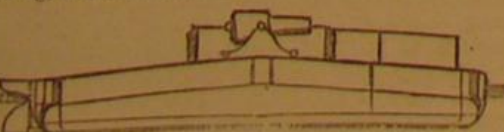
The lower portion of the hull is double, and there is a space of about 2.9 feet between the shells. The lower plating is .62 inch in thickness and the upper .23 inch. The hold is divided into a large number of watertight compartments. Parallel to the upper deck and about 6 feet below, is a second deck, both being united to the lower shell by bulkheads.



Forward of the turret is a light superstructure serving as a protection against the sea and as quarters for captain and other officers, eleven persons in all. The second deck comprises a forecabin for the crew of ninety men, and furthest aft the coal bunkers and boilers, each of the latter having a separate smoke stack. Amidships are other officers' quarters and a powder scuttle. There are six eighty horse power engines, built on the Woolf system, each driving an independent screw. Machines and boilers together cost \$222,000, about. Below the forecabin are storerooms; and under the officers' quarters, the powder magazine and shot lockers. Two steering wheels are also on the second deck.

The armor consists of two streaks of plating about three feet broad: the upper layer is 9.1 inches thick, and is backed by solid teak 6 inches through; the lower skin is 6 inches, with a backing of 9 inches. The turret is similarly constructed, with the exception of the plates having a uniform thickness of 9 inches. At a distance of about two feet inside the walls of the ship is a watertight bulkhead formed by .7 inch plating, dividing the battery into two parts, so that in case water should enter one of the exterior compartments, the vessel would still float.

The trial trip of the *Novogorod* was recently made at Nikolaiief in presence of the Grand Duke Constantine of Russia. Although the ship was hardly completed, or entirely ready for sea, it is stated that, with a steam pressure of 5.2 pounds, and a vacuum of 21.4 inches, with 62 revolutions, a speed of six knots per hour was obtained. The ship proved herself an excellent sea boat, obeying her helm readily, and turning almost squarely on her heel when the engines on either side were stopped or their speed slackened. With the port engines going ahead and the starboard engines backing, it is stated that she went about the first time in two



minutes, and on a second trial in one minute and nineteen seconds, without hardly changing her place. On reversing both machines, the ship stopped in a few seconds and turned in the opposite direction, also without altering her position.

Correspondence.

The Hair Worm.

To the Editor of the Scientific American:

The following, apparently cut from some book, was sent to me for solution: and, if agreeable to you, I will answer it through your columns. It reads thus:

"A CURIOSITY FOR NATURALISTS TO SOLVE.—Mr. J. H. Horsford writes us from Freedom, Ill., that a horse, owned in that country by a Mr. West, has a worm or snake in his left eye, from two to two and a half inches long, and, to appearance, of the thickness of a small oat straw, squirming with the active motion of a large snake. The horse, he says, has evidently lost the sight of his eye from his snake-like having taken up his abode there; and it is only about a week since there appeared any difficulty to the eye. He thinks it has been produced by a hair getting in by some means, and changed to a snake, as hairs are known to do in water. To know its wonders is to see it, as it can be plainly, a rod from the object, wriggling about as if too much confined. Query: How came it there and what will the result be? Let some of our veterinarians answer."

I hoped that the old notion that a horse hair will turn into a snake had been obliterated years ago. I am surprised that any one should advance such a theory, even in this Darwinian age.

The hair snake, so called, is frequently met with; I have taken them from grasshoppers, from an apple, from a head of cabbage, swimming in the gutter along the curb of our city. I have found them in our streams and in our spring water, of various lengths and shades of color. Indeed, it seems to me, everybody ought to be familiar with the *Gordius*, or hair worm, which, in my youth (as I was taught the common notion), I thought was a transformed horse hair. They are so perfectly hair-like in form that it is not very surprising that ignorant persons might so mistake them. Yet the two sexes are readily distinguished. In the male, the tail end is bifurcated, in the female trifurcated (at least in the American species). I have found the female coiled or indeed knotted up, suggestive of the Gordian knot. Could its name be derived from Gordius, king of Phrygia? If so, I am not aware that I ever met with the statement. After carefully unfolding, I discovered that it had within its folds a string of eggs, like beads, in a bail, and seemed tenaciously attached to them, gathering them up carefully, again to take them under protection. The female deposits millions of these eggs, connected in a string. These, in the course of three weeks, hatch; when the embryos escape from the eggs, they are of a totally different form and construction from the parents. Their bodies are only the $\frac{1}{40}$ th of an inch long and consist of two portions: the posterior cylindrical, slightly dilated and rounded at the free extremity, where it is furnished with two short spines; and the anterior broader, cylindrical, and annulated, having the mouth furnished with two circlets of protractile *tentacula* and a club-shaped proboscis. I am indebted for some of these details to the patient investigation of Mr. Joseph Leidy, M.D., of Philadelphia. He also says: "No one has yet been able to trace the animal to its origin, or what becomes of the embryo in its normal cyclical course," as those he had observed always died a few days after escaping from the egg. These *Gordii*, when developed, vary in their length from three inches to a foot; they occupy various positions among the viscera and even in the head, including the muscles, for their living habitation, analogous to the *trichina*. And so minute a larva can as well get into the eye of a horse as into the muscles of an insect or animal.

Among the known *entozoa* that infest man is the *monostomum lentis*, of Gescheidt, found in the crystalline lens, and the *distomum oculi humani*, in the capsule of the crystalline lens, others of this latter genus, *d. hamatobium*, in the tortal vein, and *d. heterophyes*, of Siebold, in the small intestines. To refer to the snake in the horse's eye, then. It is simply this: The minute animal just hatched (the *Gordius* is common in streams, where horses may drink or be washed in the water abounding with the minute embryos of the hair worm) could cling to and penetrate the crystalline lens of the eye, and develop into the *Gordius*, which may require some living tissues for its development, or if more carefully examined, might prove some other specimen of the *entozoa*.

I was more astonished to find a *Gordius* in an apple; true, it was worm eaten, but I can advance no theory how it got there unless it crept from a dead grasshopper into the apple or hatched in the blossom and developed with the fruit. A shower of rain could easily scatter the eggs or minute embryos.

J. STAUFFER.

Lancaster, Pa.

The Variable Star Algol.

To the Editor of the Scientific American:

The periodical fluctuations in the light of the star Algol have been accounted for in two different ways, first, by supposing that a non-luminous body revolves around this star, the plane of its orbit being directed toward our system, or nearly so, and secondly, on the hypothesis that Algol is a secondary body, revolving round a dark primary in an orbit situated as in the former case.

If the variations are really produced by the intervention of a dark body, and if, at the time of minimum brightness, their dark body is entirely projected upon the disk of Algol, it is evident, from the large proportion of light cut off, that the two bodies do not differ very greatly in size. It seems to me, therefore, that if we admit the existence of a dark companion, it would be more correct to say that both bodies revolve around the center of gravity between them, rather

than to say that either of the two revolves around the other.

There is a method of observation at our command, however, by which the truth of this theory of Algol's motion in an orbit, may be put to the test. I refer to spectroscopic observation. In case Algol moves in such an orbit, it is obvious that, at times, it must be approaching our system, and at other times receding from it.

If, therefore, the orbital velocity of the star be sufficiently great, displacement of the lines in its spectrum would result; and by observing the amount of their displacement at different times during the period of variation, the rate at which the star moves in its orbit could be determined, approximately. Of course, in these observations account would have to be taken both of the proper motion of the system from or towards us, and of the orbital motion of the earth.

Spectroscopic observations of Algol, and of other variable stars as well, if conducted in this manner, would, in all probability, lead to the most interesting results.

St. Catharine's, Ontario, Can.

J. M. BARR.

Mexican Water Coolers and Filters.

To the Editor of the Scientific American:

In your issue of June 14, you have given a drawing of an Australian water cooler. That is very good for the purpose; but herein you will find a sketch of those used in this country to stand on a table, which are far prettier and more convenient. They are made of red, white, or buff colored clay, with saucers and stopples to match. Many of them are ornamented with wreaths of ivy, or bouquets of flowers in colors. The necks, stopples, and saucers, are glazed; the bodies are left porous. The white and buff become discolored sooner than the red. The latter are very pretty when made of the finest clay.



In this country there is a stone which is used for filtering water for domestic use, and I am sure that it is better than anything gotten up in the United States for that purpose. It is indurated volcanic ashes. The stone is cut in the form of a hollow, inverted pyramid, the smallest size being about 15 inches at the base, 23 inches deep outside, and 2 inches in thickness, the last dimension increasing as it approaches the apex, with the exception of being cut away near the base on the outer surface to form an offset by which it is suspended in a frame. Beneath this, upon a shelf in the lower part of the frame, six or eight inches from the floor, is placed a very thin, unglazed, earthen jar to receive the water as it drops from the stone. This jar is covered with a plate having a hole in the center, upon which rests a small, unglazed pitcher.

Turbid water passes from the filter as clear as crystal, remains in the jar deliciously cool, and is much more wholesome than ice water. The latter article is rarely used here, as our only sources for the supply of ice in this valley are artificial, and the peak of Popocatepetl.

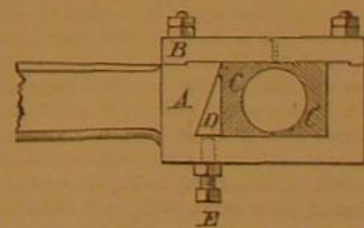
S. E. G.

City of Mexico.

Taking up the Wear of Journal Boxes.

To the Editor of the Scientific American:

In Mr. Crawford's suggestion, published in your issue of September 6, I see no way to take up the wear of the boxes, caused by the end strain that the rod is subjected to. I herewith send to you a sketch of a plan for which I am indebted to Mr. Charles Elms, of Chicago. I have used it, and find it a very convenient, cheap and substantial method of fitting up stub ends, answering all purposes of the strap, gibs, and key, and in some respects better to those, as there are no spring straps and battered keys to repair after a few years' use. The following is a description of the invention: A is the stub end; B, plate or cap fastened at each end by a stud, an offset fitting a corresponding one upon stub end A; C C are brasses; D is a steel wedge to take up wear of boxes or brasses, adjusted



by the stub set screw, E.

Having been benefited myself by many suggestions and much information received from your valuable paper, I submit this to you, hoping that it will be of some use to my fellow draftsmen and machinists.

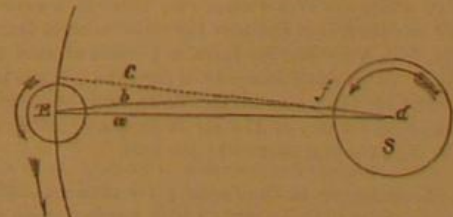
New York city.

ROBERT C. GRAY.

Planetary Motion.

To the Editor of the Scientific American:

I claim that the following is no mere hypothesis, but a logical deduction from known facts: The sun and earth



tend to approach each other, obedient to the laws of gravitation existing between them. This gravitating force is

instantaneous, and its direction is indicated by a right line drawn through the centers of the earth and sun. If it were not for an opposing force, they would approach each other with an accelerated velocity. Such a force exists in and is radiated from the sun in all directions, and is made manifest to us by certain well known physical phenomena.

This force is not instantaneous, but it requires time to act through space. The sun revolves upon its axis; consequently the direction of a force radiating from the sun and requiring time to act through space would not be indicated by a right line. For convenience of illustration, we will suppose that the planes of the earth's and sun's equators coincide. Let S and E, respectively, represent equatorial sections of the earth and sun; then a will be the line of direction of their attractive forces. If the sun be at rest, the direction of force emanating from the point, f, on the sun's equator would be indicated by the dotted line, c; but, as the sun revolves, this force, which requires time to act through space, will be deflected in the direction of the curved line, b. This line, b, is the center of direction of the force projected from the sun and acting in opposition to the attractive force. I should have said that the arc of the sun's equator, intercepted by the angle, a d c, is equal to the distance traversed by a point on the sun's equator during the time required for the transmission of this force to the earth. This curve will be increased by the amount of the earth's orbital motion for a like interval of time. Now with your knowledge of mechanics, you will see at a glance the inevitable consequences of this slight difference in direction of these two opposing forces. Slight as it is, it is more than sufficient to account for the movement of the planets, as it will explain other questions. Now lay down an axial section of the sun and project the curves caused by the centrifugal force: the axis and equator will be represented by right lines; but from the intermediate degrees all the lines will be deflected towards the equator, the curves shortening as we leave the axis. In this we have an explanation of the cause of the planets being confined to the zodiac. I have forwarded substantially the same communication to three eminent astronomers.

JOHN LINTON.

Baltimore, Md.

REMARKS BY THE EDITOR.—The nebular hypothesis finds general acceptance at present. The solar system is supposed to have been originally a nebula or vapor cloud of unequal density. Such a mass, in condensing by the mutual attraction of its particles, would rotate with increasing velocity. Rings of vapor thrown off, or rather left behind in condensation, formed the planets. The planetary nebulae themselves throw off rings, forming their satellites and, in the case of Saturn, a multitude of asteroids. As force is as indestructible as matter, and as light, heat, motion, electricity and chemical action are convertible terms, the planets, resisted by the ether of space, will fall to the sun, and the solar system will ultimately resume its original gaseous form.

A sphere of oil, supported in a mixture of alcohol and water of the same density, and set whirling by introducing a rotating disk near its equator, flattens at the poles and throws off rings which form revolving satellites, in a very instructive manner.

The Proper Length of Crank Pins.

To the Editor of the Scientific American:

In your issue of September 27, I find just the thing I have been looking for for years, namely the proper rule for the size of a crank pin of an engine, as laid down by Theron Skeels, C. E. I think the rule beautiful in the extreme, and so simple that any one ought to understand it. Yet there are one or two things that are not fully clear to me, but this is probably from a lack of education on my part. The last part of his rule says "multiplied by a coefficient which is determined by an experiment." If we are to find out, by experiment, this point, why not the whole thing?

It seems to me that there may be more causes than the one named. In practice, we first look to see if the box is not too tight, and second, if the pin is in line with the main bearing. Then we see that the cross head does not twist this connection on the pin, next that it is well lubricated, and that the oil or lubricant is strong enough to stand the work. After going through the whole of these and finding all right, then we look to see if it be of proper size, and this, I opine, is and always will be determined by experiment, for engines of equal indicated horse power will need different sized pins.

We have one engine running made by George H. Corliss, with cylinder 18 x 30 inches, shaft 8½ inches diameter, crank pin 4½ inches diameter, and 7 inches long. This runs, with steam at 125 lbs. at 100 revolutions per minute and comes to full stroke probably 500 times per day, then off to nothing, passing many strokes without steam at all. After two years, use, there is no appreciable wear and no heating. We are making another like it, thus using the last part of Mr. Skeels formula and not infringing his rights by using the first.

Syracuse, N. Y.

W. A. SWEET.

NEAR Delaware Water Gap, Pa., there is a cave in the face of Mount Minsi, opposite the river, whence issues constantly, with considerable force, a current of cold air. A small stream of water issues from the cave. It has been ascertained that the water trickles down from the roof of the cave, and the cooling of the air is supposed to be due to contact with the wet surface of the roof.

An advertisement in the special sixty thousand edition of this paper, soon to be published, will reach a class of persons not accessible through the ordinary channels of newspaper advertising. See announcement on another page.

The Great Oil Wells of the United States.

The committee sent by the prophet Moses to enquire into the resources of Canaan, reported that it was a land flowing with milk and honey. But even if that ancient country had been veritably blessed with natural deposits of the substances mentioned, it is questionable whether its richness could have equaled the wealth which this country enjoys in her natural oil wells.

The total oil product is now 34,560 barrels of 42 gallons each, every day.

The number of producing wells in the entire oil region of Pennsylvania is about 5,000, and the average daily product per well is 7 barrels.

A correspondent of the New York Tribune gives the following interesting information:

BOUNDARIES OF THE OIL DIGGINGS.

The northern extremity or rather the two northern extremities of the oil producing region are in the vicinity of Titusville and Tidioute, Pa., from which points it extends in a south-westerly direction along the Allegheny River, though not following its course strictly, down to Greece City and Millerstown, a distance in a straight line of about eighty miles. The "Old District" begins at the north, as given above, and ends at Parker's Landing, on the Allegheny River, and comprises most of the old famous wells, including those of Pithole, which have figured so conspicuously in times gone by. The "New District" begins at Parker's Landing and extends down to and includes the new wells of Modoc. The entire district is a rough farming country, and is traversed with lines of hills which, though no remarkable for height, are of mountainous character. Here and there are towns which, though of moderate size, are "cities," those of Titusville and Franklin being the finest.

THEORY OF THE OIL ROCKS.

The present accepted theory in regard to oil producing rocks is that they lie in series of belts, the general trend of which is from twenty-two to twenty-three degrees east of north and west of south. But there are minor belts that seem to run across the great belts, and even the most experienced oil men are not very certain of the accuracy of their theories. One who has never visited this country is apt to fall into the error of supposing that the number of wells that have been sunk is quite limited; but the fact is, that they may be numbered by thousands. They are seen everywhere, on hill and mountain, in valley, in mid river, in town and in country. And as most of these wells have gone to decay, and but very few are yielding enough oil to pay, and as it cost originally from \$5,000 to \$10,000 to drill each of them, some estimate may be arrived at of the amount of capital that has been dissipated.

HOW OIL WELLS ARE SUNK.

The business of drilling wells has now fallen almost entirely into the hands of professional drillers. When a man or a company has decided upon a well, and selected its site, the first step taken is to put up a derrick, or, as it is termed here, a "carpenter's rig." This is a framework, made mostly of plank, from 65 to 75 feet high, about 14 feet square at the bottom, and running nearly to a point at the top. The cost of a derrick is about \$800. The tools used in drilling are the bit, which is like any ordinary rock drill, but larger, being about three feet in length; above that is the auger stem; then two chain links called the "jars," and above that the "sinker bar." This is attached at the upper end to the rope which passes over a pulley at the top of the derrick, and thence down to a large windlass outside of the derrick. The drilling is done by a steam engine with a crank movement, which keeps the drill at work day and night, a man standing by in the derrick to give the tools more rope at proper intervals, and to turn the drill while it is operating. After the drill has reduced a certain quantity of rock to sand, it is drawn from the well up into the derrick, and the sand pump is lowered and the sand is brought out, when the drill is again inserted. The rope used must be of the very best quality, and in digging deep wells it requires two ropes, as the sand very soon cuts them out. The expense is a very considerable one, being \$400 for each rope. The tools for drilling that are now used weigh 1,800 pounds, those that were first used weighing only 90 pounds. A good set of drillers will put a well down in about 65 working days, provided they have good luck and no accidents; but it oftentimes takes six months to reach the oil sand.

ENORMOUS DEPTH OF THE NEW WELLS.

The rock in which the oil is found has a very decided dip from the north to the south, it being about sixteen feet to the mile. In the old or northern part, it is found at a depth of from four to seven hundred feet, whereas the new wells at Modoc are from fourteen to seventeen hundred feet deep, the expense of drilling one of the new wells being nearly double that of one of the old ones. The drillers generally know where they are by the kind of sand that they bring out.

CHARACTER OF THE SEVERAL ROCKS.

At Modoc, at a depth of about five hundred feet, they strike what is called the mountain sand rock, down to which they bore an eight inch hole. Here they know that they are below all fresh water, and they put in a casing, down to and resting on that rock, with an inside diameter of 5½ inches. From there they bore, through the casing, the remainder of the well with a diameter of 5½ inches, depending upon this shoulder of rock at the bottom of the casing to shut off the salt water, which is sometimes found in large quantities. The next sand rock of importance that is found is called the second sand, which lies at a depth of a little over twelve hundred feet and sometimes produces oil. This, however,

is not considered a good sign, and makes future drilling operations on the same well rather gloomy work, as a first class well cannot be expected. The fifty foot sand rock comes next; the next is the bowlder; then comes the corn meal sand, so called because of its resemblance to corn meal. From that you get five to ten feet of slate, and then you strike the oil sand, which is a sort of pebbly rock; and if the well is going to amount to anything, oil appears the moment you penetrate or even scratch this rock. Between these strata that I have mentioned, the space is filled up mostly with shells, slate, soap rock, sand, etc., the drilling being very easy. But in the sand rocks above enumerated, slow time is made by the drillers; and the mountain sand is so hard that it wears the drill, and the particles of steel from the bit are very perceptible among the grains of sand.

THE NEW WELLS AT MODOC.

The stream of oil from a flowing well is not continuous, but comes in pulsations, with occasional intermissions of entire stoppage of greater or less length. A good flowing well runs at first with great force, and the yield of oil is accordingly great, but it gradually decreases in production until it ceases to flow at all, and thus it must be pumped, after which the supply goes on decreasing until its yield will not pay the expense of pumping, and then it is shut down. It therefore requires ordinarily the constant drilling of 400 wells to hold the production up to the level of the demand. But at the present time all drilling must stop except in the neighborhood of Modoc, because nothing less than a 200 barrel well will pay back to the owner the first cost, \$8,000 to \$10,000, with oil at the present prices, 80 cents per barrel at the wells. Wells that will yield 200 barrels a day are found only at long intervals, Modoc being at present the exception to this rule, and the richest oil deposit yet discovered in Pennsylvania.

The first well that was sunk at Modoc was the Troutman well, which was struck last March. At first it averaged about 950 barrels a day, and it turned the attention of oil men in that direction. It, however, stood alone for over four months before any other wells were finished. Its present yield is about 300 barrels a day, and it is considered as holding out remarkably well. In July a number of other wells were struck, among which two of the richest were the Walt Thompson and the Dean & Taylor wells. Their yield is now estimated at 650 barrels each per day. There are at this place 16 wells, all lying within a square mile, which now average 500 barrels each every twenty-four hours. The reports that the new oil wells of Modoc are materially falling off are not correct. It is the opinion of good experts that the yield of oil is even greater than it is reported to be by the producers themselves. I saw wells that were said to be giving 500 or 600 barrels a day which had every appearance of yielding 1,000 barrels a day. As a large number of new wells are being drilled in this deposit, the producers, being anxious to keep the price of oil as high as they can, are evidently underestimating the capacity of their wells.

PRODUCTS OF THE VARIOUS DISTRICTS.

Of the 34,560 barrels of oil now daily obtained, the First District, which is the latest development and includes all the big wells, furnishes 18,560 barrels, the Second District 2,500 barrels, the Third District 4,500 barrels, and all the other districts, containing the wells that furnished all the oil previous to 1870, 9,000 barrels, making a total as above stated of 34,560.

THE PIPE COMPANIES.

As is well known, all the oil is delivered from the wells to the delivery tanks on the railroads through pipes. These pipes are laid generally upon the surface, and they run through valley and over mountain, and under rivers, the oil being forced through them by steam power. The longest pipe now in use is about 15 miles in length.

The Bridgeport Shirt Factory.—The Howe Sewing Machine Works.

A correspondent in the Commercial Advertiser gives the following interesting account of his visit to some of the extensive manufacturing establishments in Bridgeport, Conn:

Burlock & Co., large shirt manufacturers, the writer states, employ about six hundred hands, and make one hundred dozen shirts per day, consuming three thousand yards of muslin and seven hundred of linen each day, and \$9,000 worth of thread every year. One hundred sewing machines are constantly running, from seven o'clock in the morning until eight in the evening. These machines are worked by steam and managed by young girls, the majority of whom are skilled performers; some of these experienced hands earn as high as \$75 per month. Every part of a shirt is manipulated by different hands; each piece is finished in a room designed for the kind of work. It takes sixty women to make all the parts of a shirt, and yet it only requires two minutes to make this all important garment. From the time the cloth is first brought into the cutting room, there is no rest for the fabric; it is tossed about with lightning speed; the changes made from one to another are really marvelous, and, before you get over your surprise, the shirt is ready for the laundry, where it again flies about without stopping until it reaches the inspecting room, where it is allowed to rest a few minutes, when it is carefully looked over, and, if there is the slightest flaw found anywhere in its manipulation, back it goes to the department where the defect was made. We remained some time in the ironing room, and were much amused to see the way the women ironed the bosoms, collars, and cuffs. The irons are heated almost to a red heat; they

are passed over the linen with very great rapidity, which is no sooner dried, than the ironer again wets the linen and takes another red hot iron. This drying and wetting process is repeated several times before the linen presents the desired glossy appearance. We asked Mr. Perkins what the secret was of putting on this much admired polish. The gentleman smiled, and said: "It is nothing but elbow grease."

After seeing how much labor and scientific work it takes to make a shirt, we drove over to East Bridgeport, and were escorted through Howe's sewing machine factory. This building has a front of 1,256 feet; it is five stories high, and employs 1,500 workmen. They make 500 hundred machines per day. Every part of a sewing machine is a branch of work by itself, and is manipulated in a separate room under the charge of a foreman. We were very much interested in the needle department, which is under the charge of Mr. Thompson, a very pleasant and affable gentleman, who kindly gave us many points of information. Twenty thousand needles are manufactured in one day. One hundred and eighty men and women are employed in this department. From the wire steel coil up to the time when the needle is ready for use, it passes through fifty different hands.

LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 16.

PARIS, September, 1873.

Since the date of the previous letter, we have made an excursion into South France, visiting the immense iron works of Le Creusot, and the great and busy city of Lyons. Our trip has occupied only four days, but we have seen and learned a great deal and have experienced much pleasure in that short period.

During the year 1872, the total quantity of cast iron produced in France is reported as 1,181,262 tons, of which more than one million tons has been produced by the 113 blast furnaces which use coke fuel, and 178,571 tons were the product of 115 furnaces using charcoal. The production of steel is given as about 140,000 tons during the same year, the amount having doubled in the short space of three and a half years, and nearly trebled in about four years. This production is the result of the united labor of many establishments; but a single one, that of Le Creusot, is sending into market one third of the whole, and we should hardly have been justified in leaving France without visiting this place, even had it compelled far greater expenditure of time, money, and physical energy than it has demanded. We were also bound by our acceptance of the courteous invitation of its hospitable proprietor, M. Schneider, whom we had met as a colleague at Vienna.

The day before leaving Paris on this expedition, we visited the locomotive engine building establishment of

CAIL & CO.

on the Quai de Grenelle, near the Champ de Mars. We found there a fine collection of shops, employing between three and four thousand men in the manufacture of locomotives and of general work. We were received here with the utmost kindness and courtesy, as we have been at all of the great manufactories that we have desired to visit, with the single marked exception of that of Krupp, at Essen. The workshops of Cail & Co. cover an immense extent of ground just outside the city of Paris. They are all of one story in height, the roofs are supported by iron columns and girders, and the interior is generally well lighted and ventilated by windows in the roof.

The transportation of material from one part to another of the works is effected by cars upon a railroad track leading to all the workshops, the traction power being obtained from several light locomotives. In the setting-up shops, traveling cranes are well placed, and are in constant use. The work is generally very good, although some pieces were hardly as well finished as was the average of that which had passed inspection, and it would not have been passed as satisfactory in our own leading shops. The boiler work was quite good. We noticed one riveting machine here, but it would not compare favorably with those that we have seen elsewhere. In the forge shop the work was good. The heaviest steam hammer was said to have a drop weighing 800 kilogrammes—1,760 pounds. Judging from the fact that there were a hundred draftsmen employed, we should conclude that work is not as well systematized as it should be in such a place, or as it is in our own establishments of this kind, and that alteration of designs must absorb a heavy percentage of the profits. It is possible that the variety of work done by Cail & Co., which includes sugar mill work and every variety of machinery, may be good cause for the employment of so much profit-consuming labor. We were pleased to find here a neat chemical laboratory, an auxiliary too seldom appreciated by iron works proprietors.

Taking the 11 A. M. train from Paris, an express running through to Marseilles, we enjoyed a very pleasant ride through the heart of France, arriving at Le Creusot at 9:30 P. M. Our route, almost from Paris to the end of our journey, lay through the beautiful and rich wine-growing districts, of which the produce is sent to all parts of the world. From Verrey to Dijon and Chagny, we were delighted with the beautiful scenery of the

CÔTES D'OR,

where are raised the finest wines of Burgundy, and which district is given its name from the exceptional value of the product of its vineyards. The common table wine of this country, which would, with us, be considered a good wine,

sells for about twenty sous a bottle, while the price of the finer brands of the *Côtes d'Or* is ten francs here, and probably nearly as many dollars in New York, if it is possible to obtain them at all in all their native purity and strength. Both red and white wines are raised, but the red are generally most liked and are best known abroad. Their delicate and delicious flavor and their exquisite bouquet are considered, by connoisseurs, to be beyond rivalry.

The level lands of the valley through which the line of railroad passes, and the beautiful sunny hillsides on either hand, are covered, apparently, by one immense vineyard. This whole district, with an area of 250,000 acres, is devoted to wine culture, and the annual production has an estimated value of fifty or sixty millions of francs—ten or twelve millions of dollars.

We dined at Dijon, the name of which town is familiar to all as one of the places which obtained some celebrity during the late war. Here we met a veteran who had been partially disabled in a skirmish with the Prussians in 1871, and a bright young French student with whom we enjoyed a pleasant and instructive conversation until our change to the branch line leading to

LE CREUSOT.

Long before reaching the latter city, we could see, away across the country, great masses of smoke rising slowly from the valley and floating across the hills, like heavy thunder clouds, obscuring large tracts of the country which was elsewhere beautifully illuminated by the bright light of the moon, then just past the full. As we finally skirted the town and rushed toward the station, a sight burst into view such as we had never before witnessed, and to which no verbal description can do justice. The vast clouds of smoke which we had been watching, miles away, were issuing from the tops of myriads of chimneys and from the midst of numbers of great blast furnaces, which rose, like so many towers of Babel, far above the surrounding buildings. The long structures, covering the rolling mills and the forges, were plainly seen through the gloom, lighted up by a ruddy glow from great masses of hot metal passing through the rolls, or by the brighter glare of scores of forge fires; and on the hill above and behind the works, barely revealed by the light of the partly obscured moon, we could see the populous town which has grown up here, founded and supported by this marvelous example of recent industrial progress. A dull intermittent roar of escaping steam, the loud clatter of gearing from the rolling mills, and the rumble of the rolls, with the unceasing concussions of many steam hammers, the sound of loud voices now and then rising above the noise of machinery, and the barking of the numerous dogs in the city beyond, mingled and produced almost as novel and exciting an impression upon the ear as did the strange and interesting scene upon the eye.

A frugal and truly French repast of bread and delicious native wine was furnished at the humble inn at which we stopped for the night; and we retired early, sleeping soundly in beds as clean and comfortable as we ever found at an English country tavern, or in our own New England. Before we had finished our breakfast, our kind friend, the proprietor of this wonderful establishment, who had already been informed of our arrival, called to take us in charge, and we spent the day in its exploration.

A century ago, this busy valley was a deserted and sparsely inhabited spot, forming part of one of the least productive estates in France. The discovery of its mineral wealth at that period was the commencement of its development, by the erection of an ironworks, in 1782, which was supplied with coal from the beds beneath it and with iron ore from the neighborhood. The machinery was driven by one of Watt's earliest engines, which is still preserved at Creusot as an interesting relic. The early prosperity of Creusot, then called Charbonnières, was seriously checked by the French revolution, and by the subsequent uncertainty in political matters; but, recovering, acquired such extent, when purchased in 1837 by M. Schneider, that its value was fixed at 2,700,000 francs, and its production was stated at 40,000 tons of coal and 6,000 tons of iron. The number of workmen was not more than 1,200 to 1,500, and the population of Creusot was not much above 3,000. To-day we find 15,500 people employed in the mines and mills, two thirds of whom are engaged in the latter. The establishment produces 50,000 tons of steel rails annually, and the new works, the construction of which is already begun, will, in a few months, largely increase this figure. Of iron rails, 20,000 tons are turned out this year. A hundred locomotives and an immense quantity of other machinery are also included in the annual out-put of Creusot.

There are twelve blast furnaces making ordinary and Bessemer pig metal. The later furnaces are 20 meters—65 feet—high, while some of the older ones are 25 meters. The maximum efficiency seems to have been found at an altitude which has been found best also in some portions of our own country.

The Whitwell and the Cowper hot blast stoves have both been used here, and the new furnaces have a stove which M. Schneider calls a hybrid "Whitwell-Cowper." The temperature of blast is carried at about 600° Centigrade=1,080° Fah. The fuel is coke, from native coal raised on the premises or at St. Etienne, where are mines which have the same ownership. The ores of the neighborhood make very good iron, but, for the Bessemer process, iron is made from ores imported from Africa. These ores are as pure and rich as the English Cumberland, and our best Missouri or Lake Superior ores.

Here we saw, for the first time, the molten iron tapped from the blast furnace into ladles, which were drawn at once to the converters and the iron converted into steel with-

out intermediate casting, cooling, and reheating. The economy thus effected is an important item in these days of close competition, and, in part, accounts for the success of these inland ironworks in competing with English makers of steel and in exporting the rails produced here to the United States. It is a matter of wonder that this cooperation of the furnace with the converter is not oftener met with, since there is no difficulty in making the arrangement, as a matter of engineering, and there must be many localities where the requisite capital may be obtained to take advantage of the natural facilities existing for such an economical combination.

The steel rails made here contain four tenths per cent of carbon, and are as strong and tough, and as resilient, as any made in Europe. They are of Bessemer metal. Where a softer steel is required, the Siemens-Martin process is adopted. I think that it was at Le Creusot that this method was first made successful.

In the magnificent Creusot exhibit at Vienna were some fine samples of the product of this process, but we found the finest specimens here that we had ever seen. Such wonderfully ductile metal is precisely what is wanted to take the place of the weaker and less homogeneous metal, iron, for thousands of purposes. These samples were said to contain one fourth of one per cent carbon.

Eight new Siemens furnaces are in course of construction. The rolling mills are very large and are unusually well arranged. The buildings are neat and substantial and the machinery strong and well proportioned. The driving engines are not what we should, in the United States, consider the best possible design, but are well built and are strong and serviceable. The workshops contain much old machinery and some that is new and exceedingly creditable. The forge contains steam hammers of all sizes up to fifteen tons weight of drop; and here, as well as in every other department, we saw evidence of good management and of intelligent supervision.

We visited the offices and drawing rooms, and found them well constructed, pleasant, and comfortable, with every possible facility for doing work and for communication with the various departments of the works. The telegraph is used very extensively for correspondence. Before leaving, we looked into the houses where the locomotives, used by the works for their own transportation, were kept. There are sixteen now in use, and they are not fully equal to the work. They are plain, powerful machines of the common continental type of freight engine, and exhibit no specially noticeable peculiarities.

The working people here seem to have a more efficient character and more industrious habits than is usual with French workmen, and impress the visitor very favorably by the contrast which they present to the sluggish, inactive, workmen generally seen in Europe.

After a very thorough examination of this greatest of all the French ironworks, after enjoying the generous hospitality of our host, and after a stroll about his pleasant grounds, we took the evening train for

LYONS.

We have not space in which to describe this fine city, or to give even the merest abstract of the memoranda gathered here in the great center of the silk manufactures, where 70,000 looms, in 10,000 establishments, support 140,000 persons, and produce a value of \$80,000,000 per year. The permanent Industrial Exhibition, which was visited with the expectation of learning much that would prove of interest, is a sad failure, although it opened so short a time ago under such encouraging auspices. We saw there some fine castings, in Siemens-Martin steel, from the "Société Anonyme de Charente," and a six inch armor plate from Marvel Frères, doubled up without crack, as stated, cold. Chevalier & Grénier exhibit a compound portable engine and boiler with removable tubes and firebox, as at Vienna. The engine governor was of the parabolic class, and the whole was a good piece of work. The immense buildings look barnlike and empty, and we came away disappointed.

Before taking the train back to Paris, we visited the observatory on the heights of Fourvières, and spent an hour or more enjoying a splendid panorama embracing many miles of the valleys of the Rhone and the Saône, which have their confluence at Lyons, and, a hundred miles away, over the eastern hills, taking in the hazy outlines of Mont Blanc. Then, after an uneventful all night ride, we were back in Paris, ready to leave the continent and to spend a few days in Great Britain.

R. H. T.

THE ATLANTIC CABLE.—The attempt of the Great Eastern steamer to lift and repair the Atlantic ocean cable of 1868 has failed, owing to stormy weather, and the great ship has returned to England. The work is postponed until next year. The fault has been located at a point not far eastward of the banks of Newfoundland. The cable was successfully grappled and lifted several times. A portion of the original cable, that of 1858, was brought up during the grappling operation and found to be in a fair state of preservation.

THE Preece block system of electric railway signaling is worked on the principle that the trains are to be kept a certain unvarying distance apart. No train can advance until the signal is given that the line for the specific distance ahead is absolutely clear.

THE passengers carried by the railways of Great Britain in 1872 reached the enormous total of 423,000,000. The total number carried in 1850 was only 78,854,422. The increase is mainly owing to the construction of underground and other suburban lines leading out of the large cities.

AUTOMATIC CAR COUPLING.

The invention illustrated in our engravings is a new form of car coupling, which, while it connects the cars automatically as they are brought together, allows of the uncoupling of the vehicles from either their tops or sides. The device is claimed to operate perfectly on the sharpest curves and steepest grades, and to bring the cars as closely together as the ordinary drawheads now used. It is attached to the carriages in the usual manner, with perhaps somewhat more up-and-down and sideways play.

From Fig. 1 the construction will be readily perceived. A is the drawhead of one car, made with a cavity of sufficient size to receive the connecting drawhead, B. Fitting into a recess in A, so that its lower and hook shaped end may project down into the hollow portion, is a steel coupling block, C, which engages with another steel block, D, dovetailed and bolted to the drawhead, B. The block, C, is provided with a ring or handle at its upper portion to admit of its being readily lifted out by hand, when it is so desired, to uncouple the cars, while its movement is limited by a pin or screw, E, working in a suitable groove on its surface. When raised, the coupling block, C, may be held up by a pin placed in a hole therein and above the drawhead.

Pivoted in a slot in the upper part of the latter is a bent lever, F, of which the forward arm enters a slot in the coupling block, so that, by suitably operating the lever, said coupling block may be easily lifted up, and the cars thus uncoupled. This is effected by a chain, G, attached to the upright arm which, passing over suitable rollers, connects with one lever near the top of the car and with two other levers attached to the sides of the vehicle.

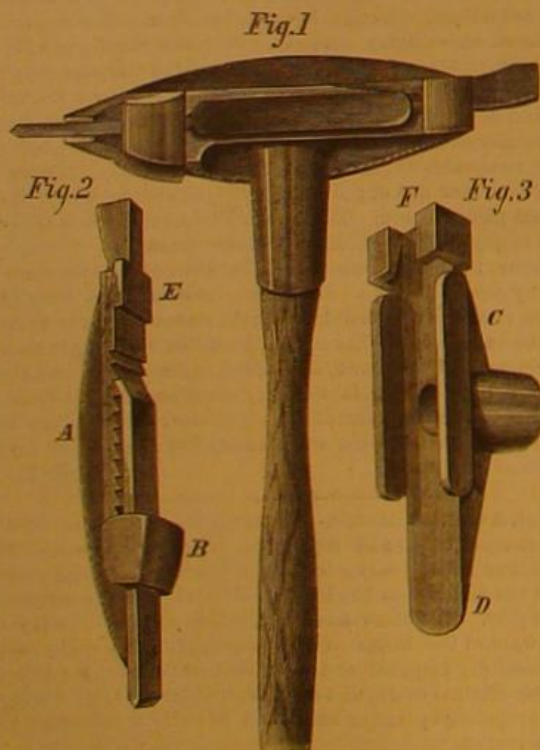
The draw bar, B, has a collar, H, to prevent its being forced too far into the opposite drawhead when the cars are brought together.

A point claimed as of considerable advantage in the invention is the facility with which it may be adapted to connect with and in the same manner as the common form of drawhead. In the forward part of the bumper, A, is a hole for a coupling pin which secures one end of the link. The other extremity of the latter slips over the coupling block, D, where it is held in place by a square angle bar, I. One portion of this bar drops into a square though somewhat inclined hole in the drawhead, B, at J, and its lower extremity, being notched, locks itself in. This will be more clearly understood from the section shown in Fig. 3. The horizontal portion of the bar, I, simply rests along the top of the drawhead, B, and terminates in an end angled to fit the corner of the block, D, thus securely confining the link.

Patented through the Scientific American Patent Agency, September 2, 1873. For further particulars regarding purchase of interest in the patent, etc., address the inventor, Mr. Franklin E. Howard, Genesee, Livingston county, N. Y.

CUMMINGS' IMPROVED MILL PICK.

The invention herewith illustrated is a small pick, designed for both furrowing and cracking, or for light and

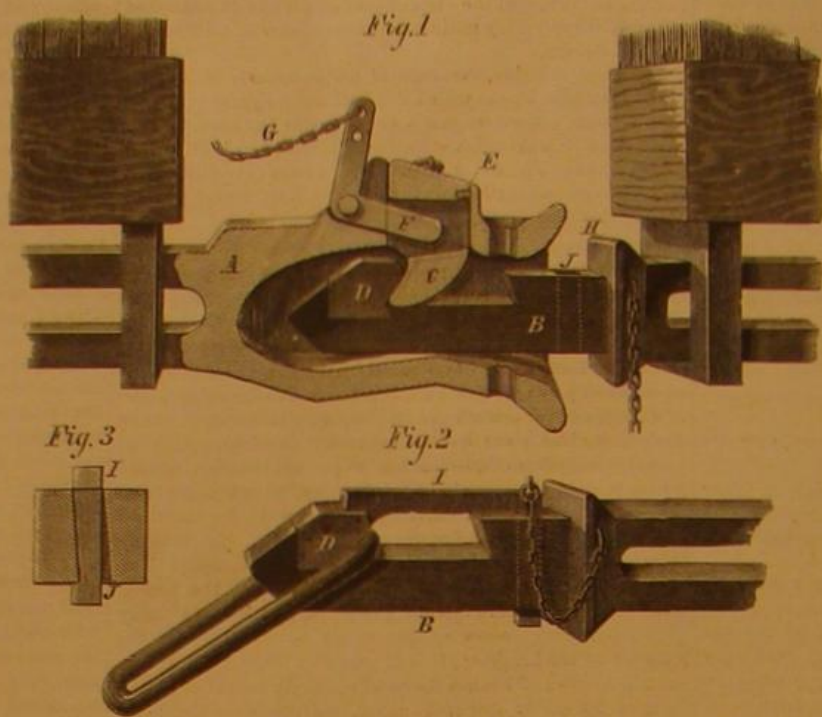


heavy stone dressing. The principal advantages are the firmness with which the blades are held, the manner of letting the same down, to compensate for wear, and also the facility with which they may be changed. The latter is an important feature, as it is often necessary to remove blades for sharpening as many as one or two hundred times in dressing a mill or a run of stones. Two sizes of the implement are made, one for furrowing and the other for cracking.

Fig. 1 represents the entire pick ready for use. Fig. 2 is a stationary stock bearing the handle, and Fig. 3 is a detachable clamp plate. The latter is a thin metal plate, having a

ratchet on its inner surface, a convex rib, A, on its rear side, and a loop or socket, B. The pick or blade is a thin steel plate of even thickness, with its upper end bent to fit the notches in the clamp plate.

In adjusting for use, the blade is placed upon the clamp plate, its sloping end entering one of the notches, when both are applied to the stock, C. The lower wedge-shaped end, D, of the stock, enters the loop or socket, B, of the clamp plate, and the wedge-shaped lips, B, of the clamp plate fit into corresponding channels formed in the ears, F, of the stock. It will be seen that a blow upon the cutting edge of



HOWARD'S AUTOMATIC CAR COUPLING.

the blade will force the clamp plate and blade upward, and cause them to embrace the stock with great power. The more powerful the blows upon the stone, the more firmly, it is claimed, is the blade confined in its place. To remove the blade the implement is reversed, and the opposite end of the clamp plate struck on any solid substance, when both clamp plate and blade will be instantly released.

As the blades are abraded by use, they can be let down in the ratchet until worn out. They are tempered along the entire length, and only require grinding to sharpen.

Patented June 24, 1873, by Mr. Jotham Cummings, of West Charleston, Vt., by addressing whom further particulars regarding sale of rights, etc., may be obtained.

The Effects of Worry.

That the effects of worry are more to be dreaded than those of simple hard work is evident from noting the classes of persons who suffer most from the effects of mental overstrain. The casebook of the physician shows that it is the speculator, the betting man, the railway manager, the great merchant, the superintendent of large manufacturing or commercial works, who most frequently exhibits the symptoms of cerebral exhaustion. Mental cares accompanied with suppressed emotion, occupations liable to great vicissitudes of fortune, and those which involve the bearing on the mind of a multiplicity of intricate details, eventually break down the lives of the strongest. In estimating what may be called the staying powers of different minds under hard work, it is always necessary to take early training into account. A young man, cast suddenly into a position involving great care and responsibility, will break down in circumstances in which, had he been gradually habituated to the position, he would have performed its duties without difficulty. It is probably for this reason that the professional classes generally suffer less from the effects of overstrain than others. They have a long course of preliminary training, and their work comes on them by degrees; therefore when it does come in excessive quantity, it finds them prepared for it. Those, on the other hand, who suddenly vault into a position requiring severe mental toil, generally die before their time.—*Chambers' Journal*.

HAMILTON'S CONTINUOUS SELF-FEEDING PERMEATOR.

The object of the device herewith illustrated is to inject tallow, oil, or similar material, into the steam in an engine cylinder, and thus, by thoroughly permeating, to lubricate the vapor and, consequently, the machinery with which the same comes in contact. The invention is an ingenious application of the needle principle, the supply orifice being not over one thousandth of an inch in diameter, so that the lubricant is driven in, in the shape of fine mist or spray. Probably the most important advantage claimed is that the apparatus will continue to supply oil even after steam is shut off, as in cases of locomotives on down grades, etc. How this is effected will be noted as we progress, in the description which follows:

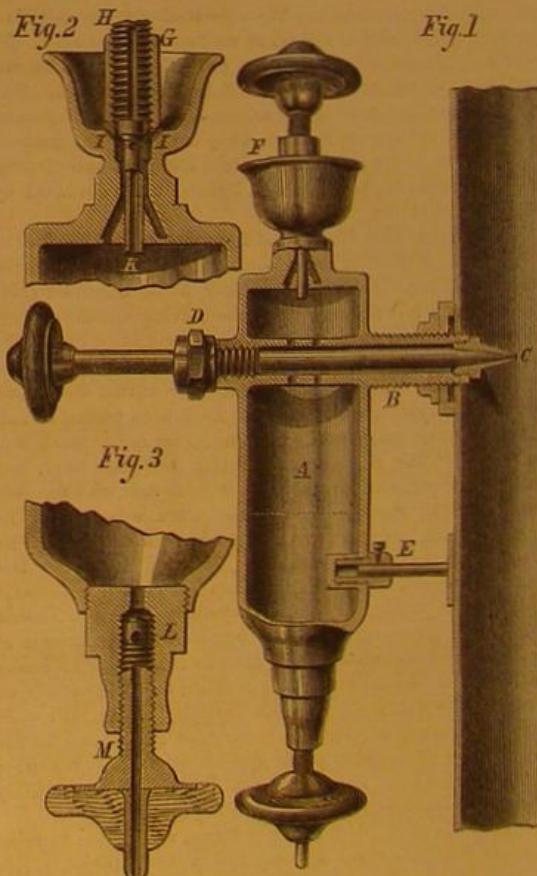
The chamber, A, and distributing bolt, B, Fig. 1, are cast in a single piece of any suitable metal. In the bolt are orifices through its wall, leading to the channels formed by the intermediate space between the needle, C, and its interior. At the end of the bolt is arranged a conical discharge orifice,

in which is the steel pointed valve spindle or needle. The relative diameters of the needle and opening are such that, when the former is screwed down so as to shut off all further flow of the lubricant, its point projects beyond the hole and into the cylinder, so that the orifice is, by this means, always kept free from incrustation. The needle spindle passes through a stuffing box, at D, and is rotated by the hand wheel shown. At E is a socket bearing, to which is secured, by means of a screw, a bearing plate for retaining the cup in proper position beside the steam chest or cylinder.

The oil is poured into the cone-shaped vessel, F, in the center of which is cast a vertical tube, E, shown in section in Fig. 2. The interior of the latter is threaded to receive the screw, H. In the bottom of the receptacle are made annular supply channels, I, and along said screw, H, is cut a groove, as shown, to serve as an air passage. The screw, H, forms a screw plug valve, and terminates in a hollow spindle, K. The surface of the female thread in tube, G, extends below the discharge orifices, I, of the supply chamber, and also below the inlet or escape openings of the air passages, so that each can be opened and closed at pleasure by simply turning the plug valve. The tube, L, of the sediment cock (Fig. 3) is screwed into an opening at the base of the chamber, and is formed, with a female thread, within a small valve chamber into which the oil flows through the short passage shown. The valve plug, M, is conical at its end, and has a passage, throughout its length, opening by branches into the valve chamber.

The apparatus being secured to the cylinder or steam chest, oil or other lubricant, is poured into the cup, the valve plug, H, being elevated to such a position as to leave the lower orifices of the channels, I, and air passages open. The air then will escape as the liquid flows in, a point of advantage, as it is claimed to give the engineer control over the cup, whether the engine is in motion or not, and with no risk of his getting scalded with boiling oil or tallow.

When the chamber, A, is filled, the plug, H, is screwed down, thus cutting off the supply. The needle spindle, C, in bolt, B, is then caused to open the orifice leading into the cylinder. The lubricant passes into the bolt, B, through the orifices in its walls, and is discharged, as before stated, in spray-like form. The steam also enters the chamber, A, through the same orifices, but, becoming condensed, falls to the bottom, and, lifting the lighter lubricant, keeps the latter in condition readily to flow to the tubular section of the bolt, B. It is stated that when the cup is emptied the amount of oil drawn off is just equal to the capacity of the chamber, and that the lubricant must, consequently, be always



above the bolt and in condition to be fed through the openings. The mere action of the valves, therefore, when steam is shut off from the cylinder, it is claimed, is sufficient to bring the oil away, so that the lubricant is supplied just when the facings become dry and cutting begins.

To draw off the contents, it is only necessary to turn the valve plug, M, and thus allow the sediment, etc., to escape through the opening through its center.

Patented June 24, 1873, to Mr. William Hamilton. For further information address William Hamilton & Co., Box 379, Erie Pa.

IMPROVED LUBRICATOR.

We illustrate in the accompanying engraving a new lubricating device, claimed to ensure a continuous and economical flow of oil or similar lubricating material into the cylinders of steam engines, and, besides, to possess many improvements and advantages in general construction.

The oil is poured into the cup, A, Fig. 1, and descends by the glass tube, B, into the circular receptacle shown. At C, the apparatus is attached to the cylinder, the steam from which, when the valve, D, is opened, passes up the tube, E. This tube is movable in the direction of its length and is held tightly in stuffing boxes, as indicated in the sectional view of its upper portion, Fig. 2. G is the condensing surface, so that the steam, emerging from the end of tube E, fills the intermediate space between said tube and the inner periphery of G with water. It is clear that, by moving tube E up or down so as to bring its upper end nearer or further from the cover of G, the condensing surface will be decreased or augmented so that less or more water will pass by pipe H, and mingle with the oil in the reservoir. The effect of this addition of water is to displace the oil, raising the latter back through glass tube B and pipe H into G, and thence down tube E into the cylinder at C. The glass tube, B, affords a convenient means for the engineer to perceive the amount of oil in the apparatus, and also to know when the water entirely displaces the lubricating material in the reservoir, a fact indicated by its appearance at the bottom of the tube. There is an opening in the lower part of the reservoir which communicates through pipe I and valve J with the bent conduit shown, thus allowing the contents to be drawn off at will. The valves at J and at A are provided with screw thread collars, which secure them in place and through which their stems freely work. This is designed to obviate the difficulty, which arises when the thread is on the valve stem, in screwing the plug down on its seat in case of any foreign material stopping the way. With the present arrangement, the collar is the securing portion, while the stem may be turned around so as to grind the valve into its seat.

The inventor informs us that he has had this device in use for some time past and has experienced uniform success. The flow is constant and unobstructed, while the expenditure of oil is reduced to a minimum. The construction is strong and durable, and the apparatus generally appears to us as showing considerable ingenuity as well as being well adapted for its purpose.

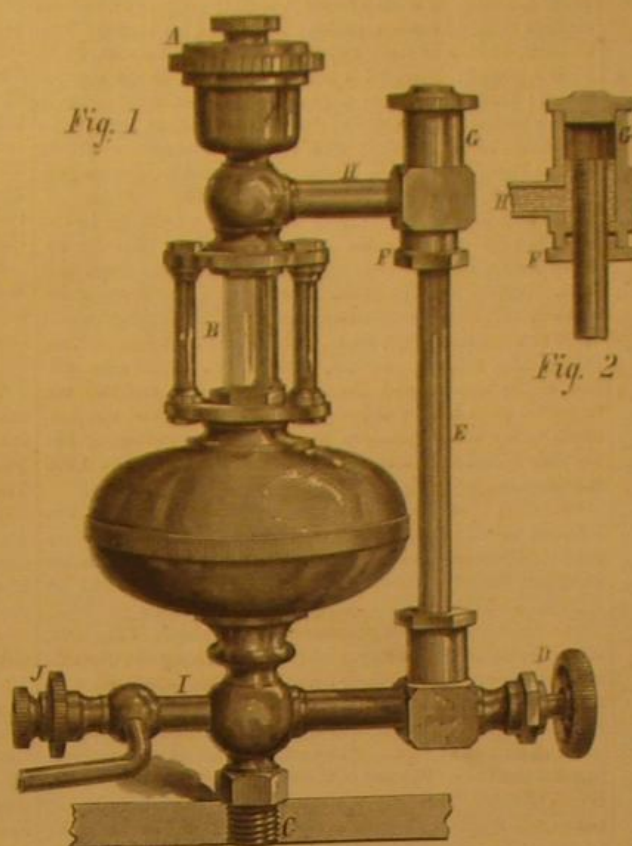
Patented through the Scientific American Patent Agency, January 7, 1873. For further particulars address the inventor, Mr. James McL. Power, Port Townsend, Washington Territory, or at Warren, Trumbull county, Ohio.

Testing Alcohol.

It is customary to obtain the percentage of absolute alcohol and water in mixtures of alcohol by taking the specific gravity with a hydrometer especially adapted to the purpose and called an alcoholometer. When a liquor contains sirups and extractive matters, the specific gravity fails to indicate the amount of alcohol present. In such cases it has been necessary to distill off the alcohol and then measure it.

In these cases, and also where no alcoholometer is at hand, or the quantity of the liquid is too small to float one, Vogel's method may be employed. He found that, when dry starch paper was dipped into a solution of iodine in alcohol of 66.8 per cent or over, the starch was not turned blue. If the spirits contained less than 66.8 per cent absolute alcohol, the paper is immediately blued. To apply the test to weaker alcohols, it is only necessary to add

absolute alcohol until the reaction no longer takes place. From the quantity added it is easy to calculate the percentage. If the spirit tested is above 66.8, water is added from a graduated measure until the starch paper turns blue, and the percentage calculated from the quantity of water added. If potassium be thrown upon alcohol of specific gravity 0.830.



POWER'S IMPROVED LUBRICATOR.

it takes fire; but with spirits of specific gravity 0.823 and under, it will not take fire.

THE JAPANESE DEPARTMENT AT VIENNA.

Among the most interesting displays of Oriental productions at the Vienna Exposition is the Japanese department.

Here are exhibited the choicest articles of workmanship, embracing those forms of art which, for ages, have satisfied the popular tastes of Japan, but which, under the rapidly improving ideas of her people, will soon for ever disappear. Remarkable sea monsters of grotesque form, birds, vases, globes, etc., having the appearance of solid materials, elaborately adorned, but in reality composed of paper, stretched and supported on bamboo, surprise and interest the visitor on every side. The display of Japanese trappings for horses, vehicles, saddles, bridles, and equestrian equipments is quite extensive and includes many peculiar forms. For example, instead of a stirrup like ours, the Japanese use a piece of wood bent at a sharp angle, to one end of which the stirrup strap is attached, while the foot rests on the portion below, which hangs horizontally. The stirrup is beautifully decorated. The wealthy Japanese, when they ride, present a gorgeous appearance, the animal being covered with gold-plated straps, bridles, and fringes, while the dress of the rider is adorned with golden emblems, and his belt filled with costly swords.

The show of Japanese arms is very fine, especially the collection of swords. These are of curious forms and elaborate workmanship, great pains being taken in the ornamentation of the hilts. The steel is of splendid quality.

In their mental power and readiness to appreciate the ideas and appliances of modern nations, the Japanese are decidedly in advance of other Eastern peoples; and now that the government is so fully committed to the re-education of the people, on the basis of Western civilization, the nation will soon take a high rank. Large numbers of Japanese young men, from the prominent families of the Empire, are now being educated in Europe and this country. At the Vienna Exposition a special delegation of Japanese students and officials are employed to copy and procure information about everything which they consider to be useful for introduction into Japan.

POTATO BLIGHT AND ROT.

Dr. Thomas Taylor, of Washington, D. C., communicates to *The Lens* the result of experiments upon potatoes, for the examination into the chemical and structural theories of Dr. Lyon Playfair and the fungoid views of several leading mycologists. Among other tubers, one half of a potato brought from Santa Fé, New Mexico, was placed in water with a diseased specimen and the other half

in water to which sugar had been added. An Ohio potato was similarly arranged, and the effect of allowing it thus to remain for a considerable period noted. On the twentieth day, the Ohio specimen had entirely dissolved, while the Santa Fé potato was uninjured. Comparing the portions in the sugared water, the Ohio tuber appeared a mass of infusorial life, mycelium, and budding spores, with a strong odor, no starch cells being discernible.

The New Mexican specimen showed few infusoria, and the starch granules arranged in cellulose, between which bundles of mycelium and budding spores appeared in profusion. No liberated granules were visible. Since the experiments, other northern and eastern varieties have been tested by fungoid solutions in contrast with some of the New Mexican varieties, giving like results, clearly demonstrating the superiority of the Santa Fé potatoes, over all others thus far examined, in respect to their powers of resisting fungoid and infusorial action.

We note that the government is about to test, by samples



THE JAPANESE DEPARTMENT, AT THE VIENNA SHOW.

of every variety of potato from the above mentioned locality, their anti-fungoid qualities in the open field and in contrast with the usual varieties grown in that section of the country.

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.—UP THE AMAZONS.

No. 2.

A THOUSAND MILES ON THE GREAT RIVER.—SCENERY.

A voyage on the Amazons is excessively monotonous. A vast volume of smooth, yellow water, floating trees and grass, low, linear-shaped islets, a dark, even forest, the shore of a boundless sea of verdure, and a cloudless sky with occasional flocks of screaming parrots, these are the general features. No busy towns are seen along the banks; only here and there a palm hut or Indian village, half buried in the wilderness. No mountains break the horizon, only a half a dozen table-topped hills; and while many bluffs of red and yellow clay are visible, they are exceptional, the usual border being low alluvial deposits, magnificently wooded, but half the year covered with water. The real grandeur, however, of a great river like this is derived from reflecting upon its prospective commercial importance and immense drainage. A lover of Nature, moreover, can never tire of gazing at the picturesque grouping and variety of trees with their mantles of creeping plants; the wild, unconquered race of vegetable giants; the "reckless energy of vegetation," compared with which the richest woods on the Hudson are a desert; the dense canopy of green, supported by crowded columns, branchless for fifty or eighty feet; the parasites and undergrowth struggling for life; the broad-leaved bananas and gigantic grasses; the colossal nut and pod-bearing trees; and above all the hundreds of species of palms, each vying with the other in beauty and grace. Through such a densely packed forest flows the Amazons with all the grandeur of an ocean current.

In giving our voyage up the great river to its source among the Andes, we shall touch only at representative points, and confine ourselves mainly to such commercial and industrial facts as will be likely to interest the practical man. From Pará to Santarém, the first town of importance, is 543 miles. The passage can be made by steamer once a week, sometimes oftener; fare, \$25; time, four days. Twenty hours after leaving the capital, the steamer stops at the little village of Breves on the southwest corner of the great island of Marajó. Rubber is the chief article of export. Here begins a labyrinth of narrow channels connecting the Amazons with the Pará; and as the forest is usually luxuriant, the sail through the Great River is the most memorable part of the whole voyage. Here the palms are seen in all their glory; the slender assai and jupatí with their long, plumelike leaves, the miriti with enormous fan-like leaves, and the bussú with stiff, entire leaves, some thirty feet long. The banks are frequently bordered with heart-shaped arums and waving arrow grass, or with plantations of the cacao tree and mandioca shrub.

The first view of the Amazons is disappointing, as it is nearly filled up with islands, but where the Xingú comes in, it shows its greatness, being ten miles wide. At the mouth of this tributary is situated the pretty village of Porto de Mos, now numbering but 800 souls, but destined to be an important center in the rubber trade, while the country up the Xingú is admirably adapted for coffee. Passing the singular hills of Almeirém and the rightly named village of Monte Alegre, famous for its cattle, we reach

SANTAREM

at the mouth of the Tapajós. This ambitious but, to an American, sleepy looking city is the half-way station between Pará and Manaus, and is now aspiring to become the capital of a new province, to be called Baixo-Amazons, extending from Obydos to Gurupá. It is not thriving, however, barely maintaining its old number of 2,500 souls. Of these about 2,000 are Indians, Negroes, and mixed, including two hundred slaves. The situation is beautiful, lying on a green slope facing the clear Tapajós, with undulating campos and flat-topped hills in the rear. Three or four long rows of low, whitewashed, tiled houses, with less than half a dozen two-storied buildings and one Jesuit church, make up the city. There is a "Collegio" for boys and girls, the former department having fifty students varying in age from eight to sixteen, and a course of four years for the study of grammar, arithmetic, geography, history, French, Latin, algebra, and geometry. Just now there is a conflict between the Jesuits and the Masonic order, the government siding with the latter. The priest declared from the pulpit he should obey Rome rather than Rio. The climate of Santarém is delightful, the trade winds tempering the heat (which is seldom above 83°) and driving away all insect pests. The chief diseases are syphilis and fevers. Dr. Stroope, an immigrant from Arkansas, is the sole physician. The soil in the immediate neighborhood is sandy and poor; but inland, especially, where the

AMERICAN COLONISTS

have located, it is exceedingly fertile, rice, for example, having a yield of seventy-five bushels to the acre, and tobacco, one thousand pounds. The great want is a laboring class; there are too many shopkeepers and too few workers. Yet such as are willing to work can be hired for fifty cents a day. One paper, a foot square, is published weekly. The following prices will give some idea of living at Santarém: Wheat flour (mostly from Harper's Ferry, U. S.) costs \$16 a barrel; and New York goods generally sell at three times their original value, the chief addition being made at the custom

house at Pará. Agricultural implements are at double their price. Butter (all from England and the United States), 80 cents a pound; Holland cheese, 75 cents; Newfoundland codfish, 20 cents a pound; Lowell domestics, from 25 to 40 cents a meter; sawn lumber, \$20 a hundred. Of home productions, cacao sells in the city from \$2.10 to \$2.20 an arroba (32 lbs.); coffee from 16 to 24 cents a pound; sirup (no sugar is made), 40 cents a frasca (5 pints); maize, \$2 a bushel; cachaga rum, 50 cents a gallon; peanuts, \$2 a bushel; Brazil nuts, \$1.50 a bushel; farina, \$5 a bushel; tobacco, \$1 to \$1.25 a pound; lime, \$3 a barrel; pork, 35 to 40 cents a pound; beef, 7 to 9 cents a pound; hides, at the ranchos, 5 cents a pound, at Santarém, 7 cents a pound, at Pará, 12 to 14; cattle, at the ranchos, \$15 to \$20, at Santarém, \$25 to \$28, at Pará, \$35 to \$50; horses, at the ranchos, \$35 to \$40, at Santarém, \$40 to \$50, at Pará, \$50 to \$100.

The best paying business at Santarém would be in the manufacture of brick, leather, and lumber. The only articles manufactured are café wine, cachaga, soap, and lime. Nearly all the following exports, given in the order of their valuation, come down the Tapajós: Rubber (about 7,000 arrobas annually), cacao, hides, dried beef, fish, farina, salsaparilla, tobacco, guaraná, copaiba oil, Brazil nuts, tal low, cattle, horses, and lime. Coffee, sugar, and rice are imported from below, although hardly any part of the Amazons valley would produce more. Rubber gathering has not only killed agriculture, but drained the district of 2,000 inhabitants.

Santarém is of interest to the American reader as it was selected for colonization by emigrants from the Southern States. Most of the colonists have left, only six families remaining; but these contain nearly all the enterprise and intelligence of the motley party that left Mobile in 1867. These have chosen their plantations on the slopes of the hills, six miles south of the city, and are astonishing the Brazilians with the results of their industry. The land is rated at 22 cents an acre; but practically the colonists enjoy "squatter sovereignty," pre-empting a square mile, and paying no taxes except on exports. They can sell their improvements, but not the land. The soil is black and very fertile. It beats South Carolina, yielding, without culture, 30 bushels of rice per acre. Sugar cane grows eight feet high, or twice the length of Louisiana cane, and fully as sweet. Sweet potatoes grow naturally; indeed it is impossible to exterminate the plant. Broom corn and cotton grow luxuriantly. Indian corn does not mature well; turnips grow finely, but do not come to seed; grapes do well, but the ants devour them. The following

VALUABLE VEGETABLE PRODUCTS

about at the American settlement: abio, ata, pine apple, pikiú, papaw, aracá, ingá, abacati, bread fruit, orange, banana, cocoa nut, peach palm, cupuassú, café, cará (or yam, four or five kinds), three kinds of mandioca, tomato, pepper, ginger, Brazil nuts, tonka bean, sugar cane, sweet potato, squash, Lima bean, rice, tobacco, indigo, and pita; while in the dense forest we find the following trees, many of them unknown to commerce, but furnishing the richest cabinet woods or timber: itaúba (often 60 feet high and 4 feet through), cedar (specimens of which occur 100 feet high and 7 feet in diameter), jataí (a very hard, dark wood, used for sugar mill rollers, etc.), sapucaia (resembling hickory, the clear trunk of which is often 50 feet high), loira (the pine of the country), moira-pushúva (similar to black walnut), cumará, sapupéra, macacaúba (very close grained), acariúba (very durable), jarvina, rosewood, pracuúba (very hard), pao-mulatto, pao-prito, pao-d'arco, and andiróba. With Nature so generous, with a healthy location at the outlet of the rich Tapajós, and, though 500 miles from the sea, accessible to Atlantic vessels of heavy tonnage, Santarém is sure of a brighter future. From Santarém to

MANAOS

the capital of the upper province of Amazonas and the second city in magnitude on the river, is 460 miles. Three villages of importance are passed in this voyage: Obydos (seated beside a bluff on the "narrows," where the river, contracting to a strait not a mile wide, has a depth of forty fathoms and a current of 2-4 feet per second) exports considerable cacao and Brazil nuts. Villa Bella, insignificant in itself, is the outlet of a large and rich inland district, exporting cacao, guaraná (from Manés), piraracú fish, bast, Brazil nuts, tonka beans, tobacco, coffee, caferina, copaiba oil, hides, and beef, but importing almost every necessary of life. And Serpa, built on a high bank of variegated clay, nearly opposite the entrance of the Madeira, has a deep water frontage, where vessels might easily dispense with lighters, montarias, etc. But wharves and piers are yet to be on the Amazons. The excuse for not building them is that the great difference between high and low water (50 feet) precludes their construction. We think any experienced mechanic from the North could easily show that piers on the river are among the possibles, and at the same time reap a fortune for himself. One is greatly needed at Manaus, where sometimes twenty-five steamers unload every month.

On the left bank of the dark Rio Negro, ten miles from its junction with the Amazons, stands the St. Louis of Brazil, the city of Manaus. The site is admirably located for either residence or commerce. It is uneven and rocky, twenty feet above high water mark. The river in front is deep enough for the Great Eastern, and its banks for hundreds of miles are packed with a luxuriant forest of valuable trees. The soil is fertile in the tropical sense; and the climate is Neapolitan, Nature having left little to be desired in this respect. We did not see the mercury rise above 93° at mid-day, and the nights are invariably cool, with but few mos-

quitos. The country around is quite romantic for the valley, being undulating and covered with picturesque vegetation; while the igarapés or canoe paths winding through the forest are among the most beautiful features in the Amazonian landscape.

The city, for a long time stagnant, is now rapidly improving. As we saw it in 1867, it was meanly built, without a show of enterprise, without a hotel, and not 3,000 inhabitants. It now numbers 5,000 souls, with 17,000 in the district, a mixture of Brazilians, Portuguese, Negroes, Indians, Italians, Jews, Germans, and English; it has a fine cathedral, to cost, when completed, \$200,000, and a President's palace in process of construction; two hotels and a market, beside many elegant private houses. The city is lighted with 500 kerosene lamps, has day and night schools, with an Episcopal Seminario, three newspapers, one daily; and one two horse carriage, which is advertised "to let, rain or shine." But there is neither bank nor book store.

Agriculture, as everywhere on the Amazons, is dead; even farina, the bread of the land, is imported from Pará, although this is the mandioca country. In fact, there is a constant lack of food in the city.

PRICE OF LABOR AND PRODUCTIONS.

The only productive industry worth mentioning is seen in one steam saw mill, one brick and tile establishment, and one soap factory. Masons and carpenters get from \$2.50 to \$5.00 a day; pilots \$100 a month; and physicians \$5 a visit. The daily "Comercio de Amazonas" costs \$10.00 a year. Hotels, \$2 per day. The following prices, current the present month (August), will serve to illustrate life a thousand miles up the Amazons: Cacao, \$2.20 an arroba; tonka beans, 20 cents per kilogramme; puxuri (nutmeg), 90 cents per kilogramme; guaraná, 68 cents per kilogramme; Brazil nuts, 5 cents per kilogramme; copaiba oil, 70 cents per kilogramme; fish glue, 90 cents per kilogramme; dried meat, 21 cents per kilogramme; dried piraracú fish, 23 cents per kilogramme; vanilla, 45 cents per kilogramme; indigo, \$2 per kilogramme; salsaparilla in bundle, 80 cents per kilogramme; tucum thread, \$1.00 per kilogramme; tallow, refined, 90 cents per kilogramme; rubber, from 56 cents to 85 cents per kilogramme; rubber, in liquid, \$2.53 per kilogramme; aguar-dente (cane rum), from 15 to 20 cents a liter; tapioca, 20 cents a liter; piassaba in the rough, 12 cents per kilogramme; piassaba cord, 50 cents a centimeter; piassaba brooms, \$1.60 a dozen; estopa or bast, 9 cents per kilogramme; hides, 26 cents per kilogramme; cotton hammocks, from \$5 to \$14 each; tucum hammocks, feathered, \$45; cedar logs, \$1 per meter; cedar or itaúba boards, sixteen feet long, eight inches wide, unplanned, \$18 a dozen; cabinet wood in boards, 45 cents a meter; steamer fuel, \$20 a thousand sticks, each weighing on the average fifteen pounds; native brick (8x6x2 inches) and tiles, from \$50 to \$75 a hundred, at Pará \$35; the ordinary red sandstone rock, which abounds in the vicinity, unworked, 75 cents a cubic foot.

DUTIES AND FREIGHTS.

The provincial duty on liquors is 25 per cent; on rubbers, 12 per cent; on fish, 5 per cent; on all other articles, 10 per cent. If exported, 5 per cent extra is collected at Pará, besides fees. Rubber collected in Peru and Bolivia pays no duty. Steamer freight between Manaus and Pará, on rubber, 25 cents an arroba; on coffee and cacao, 24 cents an arroba; on Brazil nuts, 35 cents a bushel; on brick, \$20 a thousand; cotton, 30 cents an arroba; hides, 20 cents each; crude piassaba, 25 cents an arroba; salsaparilla, 30 cents an arroba; tobacco, 25 cents an arroba; boards, \$3.50 per dozen; beeves, \$7.50 each; horses and mules, \$10 each. Freights between Manaus and San Antonio on the Madeira; on rubber and salsaparilla, 40 cents an arroba; cacao, coffee, dried beef and tallow, 32 cents an arroba; Brazil nuts in sacks, 35 cents a bushel; hides 25 cents each. To Hyutana-han on the Purús, the tariff is about the same.

The produce of the Rio Negro and Solimões does not stop at Manaus, but goes directly to Pará, and must be purchased there. This is owing to the fact that Pará merchants have put the producers under obligation, so that producers up the river cannot sell at an intermediate place. But Manaus is determined to become independent of Pará; and the project of a through line of steamers from Manaus to Europe is on foot. With a healthy climate and fertile soil, a situation near the mouths of four great rivers, the Madeira, Negro, Purús and Juruá, and having water communication with two thirds of the continent, this city has commercial advantages unsurpassed. What it wants is an even and generous legislation and an industrial class.

JAMES ORTON.

Honors to Operatives and Foremen.

The Society of Arts and Manufactures, Vienna, has issued 134 silver medals, with diplomas, to operatives and foremen, recommended for the honor by employers who were exhibitors at the Exposition.

The distribution is as follows:

United States of America.....	5
Great Britain.....	10
France.....	18
Germany.....	13
Italy.....	9
Switzerland.....	5
Belgium.....	5
Holland.....	4
Portugal.....	5
Denmark.....	4
Sweden.....	7
Russia.....	5
Greece.....	3

*Cutting wood for the steamers is very lucrative. Many will soon go into the business with steam or horse power and make fortunes. The forest is free to all. The great difficulty in ascending high up certain tributaries is not so much the lack of water as the lack of fuel, there being no one to cut it.

Trial of Steam Canal Boats on the Erie Canal, in Competition for the State Reward of One Hundred Thousand Dollars.

The trial of steam canal boats on the Erie canal, in competition for the \$100,000 prize, came off between Syracuse and Utica, N. Y., on October 15 and 16.

The members of the State Commission present at the trial were Van R. Richmond, George Geddes, John D. Fay, E. S. Prosser, Daniel Crouse, W. S. Nelson, and George W. Chapman; also D. M. Greene, engineer in charge, and H. A. Petrie, Secretary of the Commission.

The boats were required to be able to carry 200 tons of cargo, besides their motive power, and to make an average of three miles an hour. But none of the boats made this time, and none can claim the reward.

The following is a brief description of the five competing boats, their machinery, etc.

THE WILLIAM BAXTER

was built especially to compete for the prize. She is 96 feet long and 17 feet beam, and has much sharper lines than the ordinary canal boats. Her bottom is perfectly flat, and her sides, stem, and stern, vertical. The outlines of the immersed portions of her bow and stern are the same. She has an overhanging deck at the stern to protect her propellers, and with 200 tons of cargo she draws 5½ feet water. Her machinery consists of a Baxter upright boiler, and a pair of Baxter compound condensing engines, 7x12 and 12x12. Her boiler is 6 feet high, 46 inches diameter, and has 152 two inch flues, and a grate surface of 7 feet. She is propelled by 2 three bladed twin screws, of 4½ feet diameter and 4 feet pitch. The amount of coal consumed in running from Syracuse to Utica, a distance of 56 miles, was 830 lbs.

THE PORT BYRON.

This is a full sized canal boat of the ordinary outlines, but with a recess or trunk, extending along the center of the bottom of the boat and terminating in an opening, cut in the stern for the reception of the paddle wheel. This paddle wheel is 10 feet in diameter and has eight feathering paddles made of boiler iron. The wheel is driven by two 12x24 horizontal non-condensing engines, which are set on the quarter. The amount of coal consumed from Syracuse to Utica was 4,450 lbs.

THE CENTRAL CITY.

This boat is built somewhat sharper at the bow than the ordinary boats. She is 96 feet long and 17 feet 4 inches wide; and she is driven by two common paddle wheels, placed in recesses cut in the stern. These wheels are of 9 feet diameter, and are driven by a 10x17 horizontal engine. The boiler is 16 feet long and 4 feet diameter. The peculiarity of this boat consists in an arrangement for raising and lowering the paddle wheels and machinery, so as to obtain an uniform immersion of paddles without regard to the draft of water. This adjustment is accomplished by means of four vertical screws, on which the entire machinery, engine, and boiler, rest. The amount of coal consumed from Syracuse to Utica was 7,280 lbs.

THE C. C. POPE

is a regular canal boat of the largest size, to which the screw propeller and machinery are attached without any cutting away of the hull of the boat. A common screw is placed on the outside of the stern in a triangular frame, and an upright shaft and gearing connect this with the engine. The propeller wheel is raised and lowered by means of a screw to suit variable depths of water. The engine is 10x12, and, with the boiler, occupies but 12 feet of the length of the boat, at the stern. This boat has a steam windlass attached, which is used in hoisting cargo and pulling the boat in and out of locks. The amount of coal consumed from Syracuse to Utica was 3,454 lbs.

THE WILLIAM NEWMAN

is on about the same model as last year, but has a Hubbard hydraulic propeller in place of her old screw. She has an horizontal tubular boiler, 8 feet long and 44 inches in diameter, and a grate surface of 13 feet; and she is driven by a single 12x12 upright engine. The propeller is 4 feet 8 inches in diameter and 3 feet long. The amount of coal consumed from Syracuse to Utica was 4,500 pounds.

The boats left Syracuse, October 15, as follows:

William Baxter.....	6:23 A. M.
Port Byron.....	9:15 "
Central City.....	10:16 "
C. C. Pope.....	11:00 "
William Newman.....	11:19 "

They arrived at Rome as follows:

William Baxter.....	9:26 P. M., October 15.
C. C. Pope.....	5:30 A. M., " 16.
Port Byron.....	6:00 " " "
Central City.....	6:55 " " "
William Newman.....	8:53 " " "

The boats left Rome as follows:

William Baxter.....	9:45 P. M., October 15.
C. C. Pope.....	8:40 A. M., " 16.
Port Byron.....	9:00 " " "
Central City.....	9:10 " " "
William Newman.....	9:50 " " "

The boats arrived at Utica dock, October 16:

William Baxter.....	2:30 A. M.
C. C. Pope.....	1:22 P. M.
Port Byron.....	2:15 "
Central City.....	2:18 "
William Newman.....	2:31 "

The detentions of the various boats along the way were very great, the total detentions of the Newman alone being about five hours.

The Syracuse Journal gives the following conclusions, drawn from remarks made by several of the commissioners:

1. That it is quite impossible to invent any machinery that will propel a boat carrying two hundred tons at a less cost than when moved by horse power, with the present dimensions of the canal.

2. That boats, as now constructed, are too large for the capacity of the canal, their progress being retarded by natural and well known laws relating to space for the displacement of water.

3. That as the law requires that inventions shall be of a character making them practical for superseding horse power, an award is not likely to follow the test.

4. The law requires a speed of at least three miles an hour; and as none of the boats made that time, an award cannot be legally made.

SEE announcement on another page for a special edition of the SCIENTIFIC AMERICAN. Sixty thousand copies to be mailed gratuitously, postage prepaid, to manufacturers, machinists, contractors, and others engaged in industrial, scientific, and mechanical pursuits. Parties having machinery or new inventions to sell will find this an unusual medium to advertise their cases.

ERRATUM.—The address of Mr. Dittenhaver, the inventor of the wood filling described on page 186 of our current volume, is Napoleon, Ohio, and not Chapaleor, Ohio.

Recent American and Foreign Patents.

Improved Check Runner.

John Haggerty, Corry, Pa.—This invention consists in providing the base portion of the loop or runner with projections, to prevent the same turning on its axis, and in combining therewith a screw and disk (or washer) which are applied to the opposite side of the strap or head piece of the bridle.

Improved Car Coupling.

William F. Senfor, Ripley, Ohio.—Two arms are placed in the cavity of the hopper-shaped coupling box. The forward ends of the arms are rounded off, and rest against concave shoulders formed in the forward parts of the sides of the box, where they are securely pivoted to said box, the said shoulders projecting inward sufficiently to prevent the forward ends of the arms from being struck by the entering coupling bar. Springs are placed between the rear ends of the arms and the sides of the box, and are designed to hold the rear ends of the said arms pressed inward or toward each other. The ends of the coupling bar are rounded off, and have shoulders formed upon their sides, so as, when pushed in, to force the inner ends of the arms apart. As the shoulders of the end of the coupling bar pass the ends of the arms, the springs force the arms inward, so that the shoulders of the said coupling bar may rest against the ends of the arms, which thus sustain the draft. In the cavity of the box is formed a recess to receive the coupling bar and center it, so that it may bear equally upon the arms. Upon the inner ends of the arms are formed projections, between which is placed a block, so that the arms may be forced apart to release the coupling bar, by turning the said block, which is thus protected from being struck by the entering coupling bar. The block is attached to the end of a crank which passes up the platform of the car, so that the arms may be forced apart to release the coupling bar by turning the same. When the crank is released, a spring brings the block parallel with the projections of the arms. With this construction, when the cars are being run together, should the end of the coupling bar drop too low, it may be raised and held in proper position by the attendant from the platform of the car by means of a rod having a hook formed upon its end, or from the top of the car, by using a longer rod. The cars may thus be coupled without danger. By suitable construction, the cars can be readily uncoupled when under headway.

Improved Nut Lock.

Howard C. Lowe, Northeast, Md., assignor to himself and John B. Haley, of same place.—This invention is an improvement in the class of nut locks in which a metal plate is placed in a recess of the washer of the nut, and its ends bent up against the sides of the latter. The improvement relates to the combination of a washer provided with projections on its under side, and two straight grooves in its face (the same crossing each other at right angles), and a sheet metal locking plate, whose form is that of a Latin cross, to adapt it to fit in said grooves, and thus form a double lock for the nut.

Improved Stamp Mill for Ores.

Giles S. Olin, Deer Lodge, Montana Ter.—The object of this invention is to improve the machines now in use for crushing quartz in the process of mining. The cam shafts are supported in boxes on the uprights. There are rubber springs on the stamp stems, which are compressed by the cam as the stamps rise and react to give the stamp a quick downward movement. The stamps are placed on the hypotenuse of the triangular bed, and the coarse quartz is fed through a hopper under the most elevated stamp, which has the coarsest screen. After undergoing the stamping process within this screen, the quartz is spouted under the next stamp, whose screen is finer, and from this it is spouted under the last stamp, and when it passes from the last and finest screen it has been reduced to powder. The quartz falls by its own gravity from one stamp to another through the spout. This is what is called spouting the quartz from one stamp to the other. The screens not only increase in fineness as the quartz descends, but also in speed, and are reduced in lift from the first to the last stamp. By reducing the lift and increasing the speed of the lower stamps, the latter are made to work nearer the dies.

Improved Head Band.

Daniel McKinnon, Wappinger's Falls, N. Y., assignor to Elias Brown, of same place.—The band is made in one piece, in the form of a bow, of horn, rubber, or any other suitable material, and its extremities are provided with hooks the office of which is to hook into the hair of the wearer, so as to bind and ornament the same.

Improved Chandelier Center.

Joseph Kintz, West Meriden, Conn., assignor to himself and F. J. Clark, of same place.—The first feature of the invention consists in a construction of the center in such manner that the lower part can be readily lowered away from the upper part, and the center thereby opened to allow the arms to be put in without entirely removing the lower part, although the lower knob, which, together with the rod and upper knob, secures the parts together, be removed. The second part consists of the arrangement of the hooks on the inner ends of the arms by which they are secured to the center. The third part consists of openings in the lower part of the middle portion of the center, in connection with the contrivances for securing the hooks of the arms to facilitate the connection of them, and so, securely hold them when connected. The fourth part consists of a bearing flange projecting from the under side of the top part of the center to secure the upper hooks of the arms; and the fifth part consists of a connection of the suspending rod to the center, so as to prevent it from turning when screwing the knobs.

Improved Can for Paint, etc.

Oliver E. Walker, Cincinnati, Ohio, assignor to himself and Charles F. Stites, of same place.—This invention consists of a paint can composed of a metal cylinder with wooden heads at each end, secured, by a flange of the cylinder end turned over the outside and a bead raised on the inside of the cylinder against the inside of the head, by impressing a groove in the outside of the cylinder. One of the heads has a large opening through it to allow of putting in and removing the paint, and a plug is used to close the hole.

Improved Revolving Fire Arm.

William H. Philip, Brooklyn, N. Y.—This invention relates to the combination of a sliding pawl bar and a series of pawls with a series of revolving cartridge cylinders arranged on the same axis, and provided with spiral and straight grooves to enable them to be turned in succession, whereby, when one cylinder is exhausted, it sets the next one in motion, and ceases itself to rotate. The invention also consists in connecting the pawl bar and series of pawls with the hammer.

Improved Spring Rocking Chair.

Franklin Chichester, Milwaukee, Wis.—This invention relates to the construction of that class of rocking chairs which have the stationary legs or stands, with which the seat is connected, by springs, which allow it to have a rocking motion; and consists in the peculiar mode of applying a plate spring to the front of seat at the rear, and to the middle of back.

Improved Reel for Skeining Silk.

Robert Simon, New York city.—For crossing the threads of "grèges," thrown, raw, and soft silks, and other threads or yarns, in skeining them, to prevent the threads from mixing and knotting together, and thus save much loss of time and waste of material in winding from the skeins upon bobbins, in consequence of the breaking and snarling common to the ordinary mode of skeining, it is proposed to have a wide reel with, say, six arms and as many longitudinal bars, in the outer sides of which are small transverse grooves. In combination with said reel there are one or more traversing guides to lay the thread on the reel, the guide being operated so that it will cross the threads at intervals between some of the bars—say, every second pair—and lay them parallel, or nearly so, between the others, and at the same time shift at each revolution of the wheel by a slow forward and backward motion, independent of the crossing motion, so as to lay the threads parallel and not directly upon each other, and thus construct flat skeins with crossed threads.

Improved Centering Chuck.

George H. Miller, Binghamton, N. Y.—This is an improved chuck for centering shafting and other work to be turned in a lathe, and consists in a frame formed of arms crossing each other, and provided with slots to receive the clamping dogs, a crank and pulley and ratchet mechanism for moving the dogs toward or from each other and holding them at any point and of a central tube and a punch working through the same.

Improved Cotton Press.

Paul Williams and Robert A. Williams, Winona, Minn.—This invention consists of joints in the screws which work the follower, whereby the latter can be swung conveniently away from over the case, to allow of filling the case with the cotton or other material to be pressed.

Improved Cock for Drawing Beer.

John Moffet, New York city.—The drawing cock is fitted into the head from the inside, and a plug is fitted in the inside extension. The outside extension is shorter than the chine of the barrel. The ventilating cock is fitted in the side of the barrel directly over the drawing cock, with its plug also inside of the barrel. There is a vent passage through the cock, and a corresponding passage through the plug, also an extension of the plug out through the cock, for the application of a wrench for turning the plugs. A rod connects the two plugs, for turning one by the other. Said rod is capable of a slight endwise motion in the plug, and a spring is arranged with it and said plug to keep both plugs tight on their seats. By turning the plug one way to open the drawing cock, the ventilating passages will be brought into line, so as to admit the air; but by turning them the other way the passages will remain closed while the drawing cock is opened, so that ventilating passages may be opened or not, at will.

Improved Water Cooler.

Thomas Smith, Brooklyn, N. Y.—The object of this invention is to so improve the water cooler in common use that pure water or other liquids may be cooled and drawn off for use without the admixture of ice water and its impurities. It consists in arranging the receptacle for the liquids as a casing around the ice chamber of the cooler, providing it with an inclined bottom and a tap at the lowest point thereof. A feed opening or funnel at the top admits the liquid.

Improved Griddle.

Samuel Kennedy, Allegheny City, Pa.—This invention consists of a griddle for baking pancakes having a hoop or flange projecting downward from the edge of the lower side, to elevate the griddle above the stove top and inclose a hot air space for equalizing the heat throughout the whole area of the griddle. The invention also consists of a damper, in combination with this elevated griddle and hoop or flange, for regulating the heat within the flange by opening or closing passages through it.

Improved Wheel for Vehicles.

Charles W. Spayd, Wilkesbarre, Pa.—This invention consists in the combined spoke socket and felly clip of a wheel, having one end of the socket circular, but gradually changed in shape to an oval toward the felly to allow the spoke to be wedged.

Improved Brush Washboard and Roller.

Isaac Hussey, Ironton, Ohio.—This invention relates to the application of bristle brushes in the operation of washing. A roller is employed that is made both to rotate and reciprocate over the clothes, which are themselves spread upon a stationary subjacent brush. In using the machine, the article is spread upon the brush, and the roller brush moved gently up and down upon it, said brush being immersed in the suds between each downward and upward movement.

Improved Washing Machine.

James H. Hill, Boone, Iowa.—This invention consists of a rectangular tub with corrugated or ribbed bottom and sides, mounted on trunnions at the sides on a suitable stand, so as to oscillate in its longitudinal plane, with several loose balls of wood placed in it on the clothes to act in conjunction with the water to effect the washing of the clothes. The tub is oscillated or swung on its trunnions by the attendant to cause the necessary motion of the water, balls, and clothes.

Improved Sewing Machine Power.

Alfred W. Cochran, Eufaula, Ala.—This invention consists of a sewing machine mounted on the operator's rocking chair, and having its pitman connected to the wall or other stationary object, so that, by rocking the chair, the pitman gives rotary motion to the driving wheel of the machine. The sewing machine table, divested of the stand ordinarily used, is mounted on the arms of the chair in front of the operator, and swings forward and backward in unison with him, so that no inconvenience in managing the work arises from the rocking motion. The pitman is, by preference, attached to the stationary support on the horizontal plane of the crank shaft; but it may vary from it either way to some extent without material effect. The crank shaft is arranged at the front of the chair and parallel with it.

Improved Means of Adjusting Paddle Floats.

Juan B. Baptista, New York city.—The novelty of this frame and arrangement of the paddles consists of the upper and lower parallel cross bars for supporting the paddles vertically between them, and the fastening of the paddles in them by keys, or other equivalent devices, driven or screwed in holes in the paddles above and below the cross bars, the paddles having several holes at different heights. By simply taking out the keys or bolts, shifting the paddles up or down, and putting said key or bolts in again, the paddles may be readily shifted to any required condition. Thus the paddles are adapted to be changed with special facility, as often as may be required, in the navigation of rivers, bays, and other water courses having numerous sand bars and other shallow places.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From September 22 to September 21, 1873, inclusive.

- BOAT REEL STIFFENER.—J. W. Hatch, Rochester, N. Y.
- CAN WHEEL, ETC.—J. K. Sax, Pittston, Pa.
- FEAT FUEL.—W. S. Tisdale, New York city.
- PURIFYING SUGAR, ETC.—J. M. O. Tams, New York city.
- ROLLING STEEL AND IRON.—D. J. Morrell, Johnstown, Pa.
- SILVERING MICA.—W. M. Marshall, Philadelphia, Pa.
- SWITCH, ETC.—W. Wharton, Jr., Philadelphia, Pa.

Business and Personal.

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

Protect your Buildings with Patent Liquid State Roof Paint. Fire Proof and Elastic and very Cheap. Send for Circular of Prices and Certificates. New York City Oil Co., 116 Maiden Lane, New York, Sole Agents.

Root's Wrought Iron Sectional Safety Boiler. 1,000 lbs. in use. Address Root Steam Engine Co., 34 Avenue and 26th Street, New York.

Lane's Monitor Turbine Water Wheel at the Fair of the American Institute. See advert., p. 284.

The Jitz Well Auger is the best thing in the world for prospecting for coal and ores and boring wells. Address Well Auger Company, St. Louis, Mo.

Wanted—Manufacturers for the Best Combined Hay Rake and Tedder in use. Light, simple, durable and cheap. Principle new. Has taken First Premiums wherever shown. Testimonials, Illustrated Circulars, &c., sent by C. L. Dow, So. Galway, N. Y.

Wanted—A Second Hand No. 3, Fowler Press. Address Iron, Room 19, No. 430 Walnut St., Phila.

See the Barnes Foot and Steam Power Scroll Saw, at Fair American Institute, New York, and Chicago Industrial Exposition.

For Sale, cheap—A vertical resawing machine, in good order, Roff and Huntington's make, price \$300. Enquire at 15 Cortland St., in trunk store, N. Y.

An Inventor of fine Steam Engines to propel and steer present N. Y. & Erie Canal Boats, will show model to a party who might take chief or sole interest, low. Address, with references, Walter King, Richmond, Missouri.

Stationary and Portable Steam Engines and Boilers. Send for Circular. Chute Brothers & Co., Schenectady, N. Y.

Woodburytype—or Photographs in permanent ink, on paper and glass. Specimens on exhibition at the Fair of the American Institute. Used largely by Machinists and Manufacturers. Send for Price list to Am. Photo-Relief Ptg. Co., 1032 Arch Street, Philadelphia, Pa. J. Carbutt, Manager.

One of Root's No. 4 Rotary Blowers for Sale. Used two years. J. H. Sternberg, Reading, Pa.

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

Patent on a powerful popular Microscope for Sale. Address James H. Logan, 12 Cedar Avenue, Allegheny, Pa.

Chicago Exposition—See Abbe's Bolt Forging Machine and Palmer's Power Spring Hammer, there on exhibition. S. C. Forsyth & Co., Manchester, N.H.

Nobody will buy the metal Truss with its pitiless Iron Finger. The New Elastic Truss, 603 Broadway, New York, holds the rupture easy till cured. Pressure all around the body.

Engines, Boilers, &c., bought, sold and exchanged. All kinds constantly on hand. Send for circular. E. E. Roberts 52 Broadway, New York.

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

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

Sewing Machine Needle Machinery—Groovers, Reducers, Wire Cutters, Eye Punches, &c. Hendey Brothers, Wolcottville, Conn.

Buy Band Saws and Saw Benches of Gear, Boston, Mass.

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 50c. a gallon, 116 Maiden Lane, New York.

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.

Horizontal Engines, the Best and Cheapest, at Gear's, Boston, Mass.

We sell all Chemicals, Metallic, Oxides, and Imported Drugs; also, "Nickel Salts" and Anodes for Plating, 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, 35 Cedar Street, New York.

Belling—Best Philadelphia Oak Tanned. C. W. Army, 301 and 303 Cherry Street, Philadelphia, Pa.

Mercurial Steam Blast & Hydraulic Gauges of all pressures, very accurate. T. Shaw, 513 Edge av., Phila.

For patent Electric Watch-clocks, address Jerome Bedding & Co., 30 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.

Tool Chests, with best tools only. Send for circular. J. T. Pratt & Co., 53 Fulton St., New York.

Lathe, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

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

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

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 hand-dies. 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.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mfg. Co., 30 Cortlandt St., N.Y.

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

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 49 Grand Street, New York.

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

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

A Partner Wanted—In the manufacture of Lines & Oil; also, Oil Machinery. Address Box 139 East Des Moines, Iowa.

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.

2 to 8 H.P. Engines, Twiss Bros. N. Haven, Ct.

At American Institute and Chicago Exposition—Boulton's Unriveted Pressing, Variety Molding and Dovetailing Machine. Manufactured by Battle Creek Machinery Company, Battle Creek, Mich.

Wanted—Some good Stove Patterns, and a first class Moulder. E. Q. Dutton, Cato, Cayuga Co., N.Y.

Wanted—A Reversing Oscillating Engine, cylinder about 6x12. Address, with description and price, Box 239, Owego, Tioga Co., N. Y.

ANSWERS TO CORRESPONDENTS

S. R. should paint his iron fence according to the directions on p. 295, vol. 25.—R. R. R. should correspond with a boat builder.—A. D. B. will find the manufacture of collodion described on p. 171, vol. 25.—C. C. D. & Co. should write to the inventor, whose address we gave on p. 407, vol. 25.

I. N. P. asks: What does the word *bacteria* mean, and what is its origin? Answer: *Bacteria* are vegetable forms of life of the lowest order. They are mere points of organized matter, liable to appear in any solid or fluid substance containing vitalized matter. The Greek *bacteria* means a staff or support, but the etymology of the word as applied to organic life is unknown to us.

E. N. M. asks: 1. What meaning have the small capital letters placed on the four corners of the postage stamp of Great Britain? 2. How many volumes were there in your old series? 3. What is the difference between a sulphide and sulphate? Answer: 1. They are merely for the guidance of the engravers of the plates. 2. Fourteen. 3. A sulphate is a compound of sulphuric acid with a base. A sulphide is one of hydro-sulphuric acid with a base.

C. H. G. asks: How can I make an elastic clear varnish? Can India rubber be dissolved in alcohol, and how? Answer: India rubber cannot be dissolved in alcohol. Its proper solvents are, ether, chloroform, or, better, bisulphide of carbon. An elastic varnish can be made by dissolving 1½ ozs. India rubber, cut as small as possible, in 1 pint of bisulphide of carbon.

S. P. & Co. ask: How can we deposit bright copper on unpollished cast iron by dipping? Answer: Use a solution of sulphate of copper 3½ ozs., sulphuric acid 2½ ozs., and water from 1 to 2 gallons. Small articles can be conveniently coated by jerking them about in sawdust or bran soaked in the above described solution.

P. S. asks: 1. How can I get hazel nut stains out of a linen shirt bosom? 2. Is there such a thing as a miner's compass? Answer: 1. Soak the spots with a strong solution of oxalic acid, and then throw the acid away, as it is a poison. 2. You can get a miner's compass at any optician's store. Very small samples of any substance can be sent by mail.

A. R. G. says: We are having some trouble in taking the oxide off sheet iron. We are working now with a lead tank, ½ inch thick, placed in a wooden tank; but it continually leaks. We use the oil of vitriol and water heated by a jet of steam; but when we solder the cracks, it eats the solder off. Is there any other material that will do to make boxes? We have tried wooden boxes, but cannot keep them tight. What is the best process to take the oxide off sheet iron, so that it will answer for tinning and galvanizing? Answer: You are using a good material and process for removing the oxide from the surface of the iron. The trouble with the lead lined tank can be removed by burning or melting the edges of the sheet lead together by the blowpipe, instead of soldering. This is done in the erection of sulphuric acid chambers by men called "lead burners," with some one of whom you should communicate. There is consequently no necessity for casting so expensive a contrivance when ordinary sheet lead, enclosed in wood, can be made to answer.

N. O. A. asks: How can I tell gold from other metals? How can I ascertain the fineness of gold? Answer: Metallic gold can be almost invariably distinguished by an experienced eye by its rich yellow color. Touch it with a drop of strong nitric acid and notice whether any oxidation, effervescence, etc., takes place. If no effect is produced, the article may be considered as gold on the outside. This test is, of course, only a very partial one, as the gilded sham jewelry may withstand it. To ascertain the fineness of gold, that is, how much real gold there may be in or on a gilded metal or alloy, the specimen must be analyzed by a chemist. This can be done by dissolving the gold material in aqua regia, and afterwards precipitating the gold by a solution of protosulphate of iron (copperas). The precipitate (washed, dried and gently heated) is weighed as pure gold.

B. F. D. asks: Is there anything that will take the stain of nitrate of silver from the hands as well as cyanuret of potassium, and be less poisonous? Answer: Try a solution of the hyposulphite of lime, potash, or soda.

J. W. asks: How can I get rid of the unpleasant odor arising from new feathers? They have been thoroughly washed in hot water, sun dried, and well dried. Answer: Wash the feathers with a weak solution of carbonate of soda, or water to which a little solution of chloride of lime has been added, then rinse in clean water and dry thoroughly.

B. asks: Can you inform me what liquid Professor Tyndall used (in his lectures last winter) to blow his large soap bubbles with, and (2) how hydrogen soap bubbles are blown? Answer: 1. As far as we know, he used a very strong solution of hard soap. 2. Hydrogen bubbles are blown in the same way as air bubbles, hydrogen gas being delivered into the bowl of the pipe instead of air. Hydrogen is easily made by pouring dilute sulphuric acid upon scraps of zinc.

J. D. B. asks: How are transfer pictures put on, and what are the ingredients? Answer: Dissolve 2 ozs. glue, ½ lb. starch, 4 table spoonfuls glycerin in ½ gallon water. Put two coats of this on the paper to be printed, and then print in colors. Transfer the picture by damping the print, and then placing it on the object to be ornamented, the surface of which should be previously varnished.

R. B. B. asks: How can I dissolve isinglass? Answer: If you mean isinglass, a species of fine glue, it is soluble in water. If you mean mica, the transparent mineral used in stove doors, and which some people call isinglass, it is insoluble.

D. P. W. asks: Will discharging the exhaust steam into the chimney injure the same? Answer: Yes; eventually it will soften and disintegrate the bricks and mortar.

B. C. M. C. says: Please give best process for annealing small steel forgings, from ½ lb. to 10 lbs. in weight? Answer: Heat them in a muffle or sand, and allow them to cool slowly.

J. E. E. says: In your issue of October 11, page 225, under the heading of "Scientific and Practical Information," there is an account of the instantaneous lighting of the Jewish synagogue on Lexington avenue, New York city. Was the light produced by a pre-conceived plan? If so, please explain the *modus operandi*. Or was it involuntarily produced by the electrical influence upon the audience? Answer: It was produced by electrical influence upon small bits of platinum wire placed over the orifices of each gas burner. Series of these bits of platinum were connected by ordinary copper wires with a galvanic battery. On closing the circuit, the electricity passed through the wire and through the platinum, which, being very small, offered so much resistance to the passage of the electricity as to become heated white hot; and the gas, being at the same moment turned on, was instantly ignited.

W. A. says: It is a well known fact among practical men that no rule for width of belts is reliable, as no two rules give the same results. The greater the width of the belt, the greater is the error. If a 1 inch belt at a velocity of 750 feet per minute is right for a horse power, why do we not use a belt 50 inches wide to transmit 50 horse power? It seems that the experiments upon which the formulas have been obtained have been from small belts of single thickness. Practical results show that the power of a belt to transmit force is more nearly as the square of the breadth. "I will cite a few cases as examples, the pressure being taken in the cylinders: 1. Engine 5 x 12, pressure 70 lbs., 50 revolutions, with 5 feet driving pulley to 21 inch one on line shaft; belt 9 inches wide, of double thickness, and 41 feet long.

50-26 x 70 x 160 feet = 562912 foot pounds
speed of belt 15-70 x 50 = 1256 feet per minute
49-77 lbs. per inch of belt. 2. Engine 13 x 30, pressure 60 lbs., 62 revolutions, with 5 feet driving pulley and a heavy fly wheel, 15 inch double belt driving on to a 32 inch pulley on line shaft; distance between centers of pulleys, 17 feet.
132-73 x 60 x 310 = 246575 foot pounds
speed of belt 15-70 x 62 = 973-40 feet per minute
169-05 lbs. per inch. 3. Results from an elevator strap 21 inches wide, single belt, driving pulley 18 inches diameter, 124 revolutions; driving on to a 14 inch pulley without slipping; between centers of pulleys, 10 feet. Effect, 1000 lbs. raised 31 feet per minute.
31000 foot pounds
speed of belt 4-712 x 124 = 53-05-21-42 lbs. per inch. This weight was the utmost capacity of the belt, and more would cause it to run off.

Many cases to the contrary, where bad judgment had made the results quite insignificant through the slipping of the belts, might be cited. Answer: In case proper constants are obtained by experiments with small belts, there seems to be no good reason that they should not apply to large ones. The driving power of a belt depends upon the friction between it and the surface of the pulley, which is proportional to the pressure or tension of the belt, and independent of the width. Hence, if we could make a belt one inch wide strong enough, it might transmit as much power as another belt 20 inches wide. The last example cited by our correspondent is a reliable one, giving observed results; and it is experiments of this kind which we would desire our readers to forward to us. The other examples, in which the power is calculated, do not seem to be so reliable. The calculations take no account of the back pressure in the cylinder, of the loss of pressure between the cylinder and boiler, of the expansion and cushion, if any, and of the friction of the moving parts. The judges at the Fair of the American Institute may have an opportunity to make tests of the value of pulley coverings in comparison with the ordinary method of transmitting power on smooth pulleys; and we hope that if they do investigate the matter, they will determine some rules that will be of value to the engineering community.

H. B. says: I commenced ferrotyping, but I get nothing but more or less foggy pictures. I am sure the fault lays in the nitrate bath. Whenever I make the bath, as soon as the silver dissolves in the water, it gets a milky appearance and gradually comes to a chestnut brown. If I leave it to stand for 24 hours it gets clear, and a brown precipitate forms. I use common well water, filtered through paper. Can you tell me what causes this brown precipitate in the nitrate silver solution? Answer: Your trouble is due to bad water. You should always use distilled water for a photo bath. You can easily make distilled water by placing a tin funnel over a water pot and boiling the water. The inner edge of the funnel should be turned up so as to form a ledge to catch the condensed water, and there should be a spout to lead off the drip. The steam that rises is condensed by contact with the funnel, runs down into the ledge and out at the spout. A common iron pot, used in the kitchen on the stove, will do.

J. G. asks: 1. What would be the best way to stop a leak in a gas pipe, where there is great expense incurred in getting at the leak? Is there any chemical composition that I can pump through the pipes to rust the leak up without injury to the pipes, as the leak is small but very troublesome? 2. Why does lightning sometimes tear and splinter trees from the ground upwards, and at other times downwards? Answer: 1. You might coat the interior of the pipe with hot coal tar, and then you could inject some rusting composition which would be drawn to the hole; after it had set, the remainder could be washed out. 2. It may be that in one case the tree is struck directly, and that in the other the stroke is communicated from the ground.

C. H. H. asks: Is there anything with which I can produce a white color on iron or brass, except by painting with ordinary white paint? Answer: You can apply a white enamel, such as you see in some iron pots. See page 149, volume XXVIII.

A. A. F. asks: 1. What makes it dangerous to load a cannon without thumbing it? What causes the powder to catch fire? 2. What particular properties have flint and steel, that fire is seen when they are brought together with quick rapid strokes? Answer: 1. The vent is closed to prevent the admission of air. 2. The friction between the two substances raises the particles that are broken off to a red heat.

W. & L. ask: What do you think of petroleum as an agency for the removal of scales from boilers? Would not an agent which is sufficiently powerful to remove or decompose a substance formed upon the flues and plates of the inside of a steam boiler also destroy the iron, as the scale is harder than iron? Petroleum possesses the property of removing the hardest scales in any steam boiler that I have yet seen. It has been brought into general use here in our locality, and more explosions have occurred here than ever before. Engineers are competent, water seemingly good, and our boiler iron has stood a tensile strain of sixty thousand pounds to the square inch. Answer: So far as we know, the petroleum does not injure the iron. It is quite possible that the boiler you speak of may have been much corroded, and that the removal of the scale revealed the defects.

C. H. S. asks: How can I make a dip for cleaning brass rough castings, so that they will look bright and retain their color when exposed to the weather? Answer: Brass, however highly polished, will not retain its bright surface long when exposed to the weather. We would therefore advise you to use a simple lacquer or varnish for the brass after it is well polished. This you can make by dissolving 5 ozs. of shellac in 1 quart of strong alcohol, and using the clear portion, applied by a fine brush on the polished brass. A good polish for brass is rottenstone made into a paste with sweet oil. You can give brass a fine color, by washing with a strong lye of red alum (1 oz. alum to 1 pint water), then rinsing with clean water, and finally finishing with fine tripoli.

J. A. asks: How many horse power have I in a stream of water with a fall of nine feet? Answer: You do not send enough data to enable us to answer this question. Probably if you communicate with water wheel manufacturers, you can obtain such information as you desire. Send them the height of the water over the bottom of the opening, or the mean velocity with which it flows through the opening.

C. F. B. asks: How can I lay out a small bracket from a large one so as to have them both of the same pattern? Answer: You can do it by means of the pantograph, described and illustrated on page 99, vol. XXVIII.

K. F. asks: Can galena be roasted in the open air by staking, as the ordinary sulphurets are? Answer: We have never heard of the process of roasting galena being practiced. From the fact that galena melts before the blowpipe, owing to the large percentage of lead (86 per cent), if its roasting were attempted in the way indicated it would be apt to fuse and run together, thus defeating the object in view.

A. Q. N. asks: What course shall I pursue in order to become a civil engineer? What amount of education is requisite, and how can I get into the business? Can I teach myself drawing; if so, what are my best aids? Answer: It is possible for any young man with energy and talent, to educate himself, but of course there are many difficulties in the way. A good civil engineer must understand mathematics and the principles of natural philosophy; and there are many other things, which he can only acquire by experience. Try and get some position in the surveying party on a railroad, to make a start. Professor Warren's elementary works on drawing are well suited to those who wish to instruct themselves.

G. W. C. asks: 1. How can I melt brass and copper? 2. What kind of molds should be used? Will wooden ones do? Answer: 1. Use a crucible made of fire clay or black lead. 2. Molds can be made of sand or plaster of Paris. Wood will not answer.

W. asks: 1. Will you please give me a rule for finding the diameter of a wheel when the circumference is known, and vice versa? I have two arithmetics, one of which gives 3-1416 or 3-1415 as the divisor or multiplier, and the other, 3-1416. Which is right? 2. In making calculations for spur gear wheels, should I draw the circumference to the base of the teeth or calculate from the outer circumference? 3. In a process as that described on page 194, present volume, does the water evaporate or lose its bulk by expansion and condensation when there is no escape by leakage? 4. Will you name some good book that will aid me in making patterns for models? 5. Will you please tell where I can get the book that is to be issued monthly at the Patent Office? Answer: 1. The number 3-14159265 is the approximate value to be used. More commonly, we employ 3-1416, which is sufficiently correct for general operations. 2. Calculate the circumference at the pitch line, between the points mentioned. 3. The water evaporates, and has its bulk increased. The steam is then condensed, thus restoring the original bulk. 4. We do not know of any single work that will give you the desired information. 5. We suppose you refer to the weekly volume. This is not sold to private individuals.

C. C. T. asks: How far will a siphon draw water? Answer: The water will rise in a siphon to a height due to the pressure of the atmosphere, or nearly to 34 feet.

L. H. asks: How can I construct a force pump? Does it make any difference whether I put the air chamber between the two check valves? I want it to lift water about 2 feet. I tried a ¼ inch receiving valve and a ½ inch discharging valve. Answer: We get very little idea from your letter as to what you wish to accomplish. Place the air chamber beyond the delivery valve of the pump.

A. W. F. says: In your issue of August 23, 1873, on the "Manufacture of Oil of Vitriol," by J. F. Gesner, M. A. I find sulphuric acid described as H₂SO₄, and in another place as SO₃ H₂O, and water as H₂O. My knowledge of chemistry would make the former H₂SO₄ or SO₃ H₂O, and the latter H₂O. Please inform me which is the correct way. Answer: The writer of the article referred to has followed the best and most recent authorities. Chemists differ as to the symbolic notation of water, but whether we write it H₂O or H₂O, no difference is implied in the relative weights of the combining elements. When water is submitted to electrolysis, it is well known that hydrogen is given off at one pole and oxygen at the other. The relative weights of the gases thus evolved always remain the same, that is 8 parts by weight of oxygen are given off to 1 of hydrogen, 9 parts of water always yielding these proportions. But there are two volumes of hydrogen to one of oxygen, and the question is: Shall we regard these two volumes of hydrogen as 1 equivalent and the volume of oxygen also as 1, and regard water as a binary compound, or shall we call the 2 volumes of hydrogen, 2 equivalents, making equal volumes the equivalents of each element and regard water then as a ternary compound? Under the first supposition water is written H₂O, and under the second H₂O; but in H₂O, oxygen is regarded as having twice the atomic weight of the oxygen in H₂O, thus preserving the atomic weights. Under this system the atomic weights of several other elements are also doubled, as those of carbon, sulphur, etc., hydrogen being taken as the standard.

H. H. T. asks: Are cast iron sectional boilers as safe as wrought iron boilers? Answer: In regard to sectional boilers a committee of the American Institute Fair, in 1871, made the following remarks: "Your committee feel confident that the introduction of this class of steam boilers, will do much toward the removal of the cause of that universal feeling of distrust that renders the presence of a steam boiler so objectionable in every locality. The difficulties in thoroughly inspecting these boilers, in regulating their action, and other faults of the class, are gradually being overcome, and the committee look forward with confidence to the time when their use will become general, to the exclusion of the older and more dangerous forms of boilers."

H. P. M. asks: 1. In building a chimney 75 feet in height, which would create the most draft, one started at 2 feet square on the inside at the base, and spreading out to 3½ or 4 feet at the top, or one 2 feet square all the way up? What is the theory? 2. What is the best method of brightening up small castings in a mill? Answer: 1. Probably it would do better if made of the same size all the way up. 2. The castings may be dipped into sulphuric acid, and then placed in a revolving cylinder, or polished on a wheel.

W. S. asks: Which will sustain the greater weight, a solid stick of timber sawn 10 inches square and 30 feet long, with the ends resting upon blocks without any other support, or the same amount of timber in three separate pieces, each of 3½ inches in thickness, set up edgewise, side by side? If there is any difference, please give the principle. Answer: If all the sticks are of the same quality, the same amount of weight can be sustained in both cases.

F. E. P. asks: In electroplating sewing machine attachments, I find it very difficult to deposit the silver on the solder at the joints. I have tried several dipping compounds, but with poor success. I have tried copper plating; but the copper will not stick firmly enough. Can you give me any information on the subject? Answer: To prepare your articles for plating: first boil them in a solution of caustic potash to free them from grease. Then dip quickly in red nitrous acid to remove any oxide from the surface, and afterwards wash well to remove every trace of acid. Then dip into a solution of mercury in cyanide of potassium (not too long), and afterwards wash in water as before. The amalgamation of the surface effected promotes the adhesion of the film of silver.

M. A. P. asks: What can I use to cement the joints of vitrified pipe for conveying strong acetic acid? Answer: Mix equal parts of pitch, resin, and well dried plaster of Paris. This is used for the masonry of chlorine chambers and vitriol works.

H. F. asks: Are there three rails used on the track of the Big railway? Answer: Yes, and the central rail is a rack into which a toothed wheel of the locomotive gears.

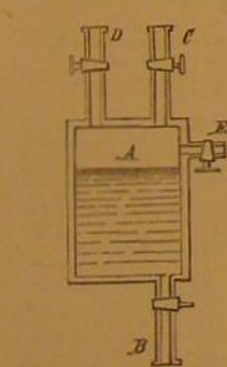
T. H. asks: What is an anemometer? Answer: The usual instrument for measuring the velocity of the wind is formed of two wires crossing at right angles, at each end of which is a cup-shaped vane, placed with its concave side to receive the current. A counter is employed to register the number of its rotations; and it must be nearly free from friction, or its indications will be valueless.

J. H. M. asks: Can you give me a recipe for staining butternut wood in imitation of black walnut? Answer: The following is highly recommended: Water 1 quart, washing soda 1½ ozs., Vandyke brown 2½ ozs., bichromate of potash ¼ oz. Boil for 10 minutes and apply with a brush.

L. C. asks: 1. What book contains the most accurate tables of the number of bricks required for walls and cisterns; the quantity of lime and sand for a certain number of bricks; the day's work for bricklayer; and the cubic yards to be excavated for a cistern, tank or cellar? 2. How is puddling for bottom of water reservoir made, and how thick should it be? Answer: We know of no book that can be relied on to give you this information. Consult a good mason, or builder. 3. Read our articles on page 260, current volume.

U. T. K. asks: Can a low pressure single cylinder marine beam engine be worked with one cylinder head broken out? If it can, what course can be taken to form a vacuum in the condenser? Would it be necessary to take any buckets off the wheels? Answer: In King's work on the steam engine, page 98, this matter is referred to as follows: "Disconnect the steam and exhaust valves from the damaged end of the cylinder. If the engine be fitted with poppet valves, and let the atmospheric pressure force the piston in one direction, the steam being used for the opposite direction. Should the engine be fitted with a slide valve, close up the opening into the damaged end of the cylinder by fitting in, steam tight and in a substantial manner, a block of soft wood." In such a case, it would probably be necessary to remove some of the paddle floats, or to reef them.

T. L. B. says: In answer to my inquiry as to how I could supply a small boiler with water, you say: By the direct pressure of the steam, using an arrangement like an equilibrium oil cup. Will you please give a more definite description of the article? The appended sketch will probably enable you to understand the arrangement. A is a vessel of suitable size, connected by a pipe, B, to the check valve of the boiler, by C to the steam space, and by D to the water supply—each of these pipes having a cock or valve, so that it can be closed at pleasure. E is an escape pipe and valve, opening into the air. The operation is as follows: Close valves in pipes B and C, and open those in pipes D and E. The water will then run into the vessel A. When it is full, close valves in pipes D and E, and open valves in pipes B and C. The vessel A being above the boiler, the water will run into the boiler, as the steam pressure on top of the water in A is the same as the pressure on top of the water in the boiler.



H. C. P. asks: What weight will a flat bottomed boat, with perpendicular sides, 16 feet long x 5 feet wide x 14 inches, carry? The weight of the boat is 200 lbs. How much weight will it carry when drawing 6, 8 and 10 inches of water respectively? Can you give me a formula for it? Answer: You do not send enough dimensions to enable us to make the calculations, but we will give you the method and you can apply it. Find the area of the bottom of the boat, in square feet. Suppose that it is A square feet. Then the boat, when drawing 6, 8 and 10 inches of water, respectively, will carry the following loads: When drawing 6 inches, $A \times \frac{6}{12} \times 62.5 = 200$. When drawing 8 inches, $A \times \frac{8}{12} \times 62.5 = 200$. When drawing 10 inches, $A \times \frac{10}{12} \times 62.5 = 200$.

G. S. T. asks: Will sulphur water affect a boiler injuriously, and to what extent? Is there any way of counteracting its effect, or of purifying the water? Answer: We do not think the sulphur water will injure your boiler; and we do not know of any method you can employ, to purify the water, that is sufficiently practicable for general use.

A. B. asks: How can I dissolve rubber so as to mold it into any required form? Answer: Immerse the rubber in a mixture of bisulphuret of carbon, 90 parts, and rectified spirit 5 parts, until it swells into a pasty mass. It may then be molded into any desired form.

H. J. W. says: 1. Are the fumes from hot aniline dyes injurious? 2. Where can I find some account of the manner of preparing aniline colors? 3. I want small steel wire in the coil, cut into lengths of three inches; what is an ordinary and cheap process for straightening the latter? Answer: 1. We think not. 2. Helmann's work on "Aniline and its Derivatives," will give you the desired information. 3. Draw the pieces through an opening in which they bear at three points. Such an arrangement can readily be made with three nails.

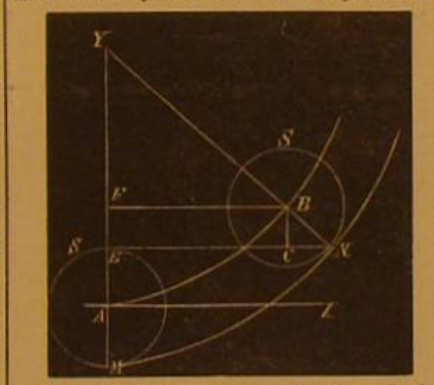
E. A. P. asks: 1. Is there any known law by which to determine the amount of pressure per square inch required to compress common atmosphere to any desired volume; that is, to reduce two volumes to one, three to one, etc.? Answer: Mariotte's law is: The temperature remaining the same, the volume of a given quantity of gas is inversely as the pressure which it bears. Therefore a pressure of two atmospheres will reduce the volume to one half, of three to one third, etc.

J. M. B. says, in reply to R. A. C., page 27, current volume: "I have made an entire destruction of willow swamps by chopping the trees around at any convenient height, and stripping the bark to the ground and letting it remain; when the sap is in flow, in July or August, is as good time as any. Do not chop them down for a year or two. A certain cure for nose bleeding is to extend the arm perpendicularly against a wall or post or any convenient object for a support. The arm on the side from which the blood proceeds is the one to elevate."

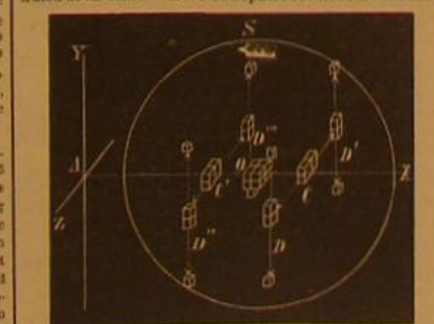
C. A. D. says: C. M. N. can precipitate nitrate of silver and sal ammoniac by adding to a solution of the former salt a solution of chloride of sodium or hydrochloric acid, which immediately precipitates the silver as a white flocculent precipitate, the new compound being, in the language of the chemist, AgCl (chloride of silver). Sal ammoniac can be precipitated by bichloride of platinum; the precipitate is of a light yellow color. These are also characteristic tests for the above named salts.

J. B. W. says: C. H. A. (page 87 of your current volume) can find the solution of his problem in Smith's "Mechanics." Of course the surface of the revolved fluid may be replaced by a rigid paraboloid, and a material particle without friction will remain at rest upon any part of the surface. The case of a ball rolling on a surface is, however, different. I will assume (and afterward prove) that the centrifugal force generated by a revolving ball is the same as if the mass were concentrated at the center of the ball. This true, the ball will be at rest when its center is confined to a parabola, whose equation, referred to the axis of revolution and a tangent at the vertex, as the axis of x and y , is $x^2 = \frac{2g}{\omega^2} y$, where g = force of gravity = 32 ft., or no. of feet per second passed over by a point one foot from the axis, ω = the abscissa and y the ordinate of the curve; Proposition: If the center of the sphere S is confined to the parabola AB

by means of the curve MN, on which the sphere rolls, the curve MN is not a parabola. Let F be the focus of the parabola and draw FB its semi-principal parameter. Draw also NBY , a normal. From the nature of the parabola, we shall there have: $FB = 2FA$ and angle $NYM = 45^\circ$. When the sphere has its center at B , the resultant pressure of the centrifugal force and gravity is in the direction BN ; BN is therefore a normal not only to the parabola but also to the curve MN . But the curve at N being perpendicular to the normal, it makes an angle of 45° with YM . If it is a parabola, NE , perpendicular to YM , must be its semi-principal parameter, and E , its focus; and we must have $EN = 2EM$. But $EN = EC + CN = EC + \frac{1}{2} \sqrt{2} BN = FB + \frac{1}{2} \sqrt{2} AM$, and $2EM = 2(FA - FE + AM) = 2(FA - \frac{1}{2} \sqrt{2} AM + AM) = 2FA + 2AM - \sqrt{2} AM$. $\therefore FB + \frac{1}{2} \sqrt{2} AM = 2FA + 2AM - \sqrt{2} AM$. But $FB = 2FA$. Substituting, $\frac{1}{2} \sqrt{2} AM = 2AM - \sqrt{2} AM$. Dividing by $\frac{1}{2} \sqrt{2} AM$, we have $1 = \sqrt{2} - 1$, or $1 = \sqrt{2}$, which is not true. $\therefore MN$ is not a parabola. Proposition: The centrifugal pressure of a revolved sphere is the same as if its mass were concentrated at its center. Let S be a sphere revolved around AY ,

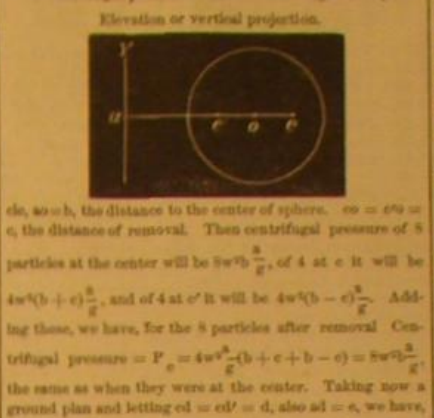


and consider 8 particles at its center. Let OA be the distance to the axis. Remove 4 of the particles to C and 4 to C' , so that $AC = AO = AO = AC'$. Then place 2 each at D and D' , equally distant in front and behind AX . Finally separate each pair by raising one particle and lowering the other a certain distance. We have now taken the 8 particles from the center and placed them in correct position in the sphere; and as this figure is symmetrical with respect to a line parallel to AY through its center, all the particles, supposed to be concentrated at the center, may be removed



by the centrifugal pressure. Let a be the weight of a particle at the center will be $8w \frac{a}{r}$, of 4 at c it will be $4w \frac{c}{r}$, and of 4 at c' it will be $4w \frac{c}{r}$. Adding these, we have, for the 8 particles after removal Centrifugal pressure = $P_c = 4w \frac{a}{r} + 4w \frac{c}{r} + 4w \frac{c}{r} = 8w \frac{a}{r}$, the same as when they were at the center. Taking now a ground plan and letting $cd = cd' = d$, also $ad = a$, we have,

for the centrifugal pressure of 2 particles at d : $P_c = 2w \frac{d}{r}$, but this pressure is in the direction ad , and we must resolve it into 2 parts, one in the direction cd , which will be destroyed by the opposite component of the pressure produced by the 2 particles at d' , and the other in the direction ad' , which, combined with the corresponding component of d' , will result in a pressure in the direction ac , the same as if the particles were at c . Resolving, we have for the pressure in dcd' : $P_c = 2w \frac{d}{r} \cos \alpha = 2w \frac{d}{r} \frac{a}{c} = 2w \frac{d}{r} \frac{a}{c}$; and as there are 2 pairs of particles the whole pressure is $P_c = 4w \frac{d}{r} \frac{a}{c}$, the same as if the 4 particles were at c . Lastly, it is evident that there can be no change of centrifugal pressure produced by moving the particles parallel to the axis, and therefore the pairs may be separated in this manner. Therefore the particles being moved from the center of the sphere into position in its body, no change is produced in centrifugal pressure.



P. K. D. says, in answer to C. C.'s query as to press power: I would suggest that to give the amount of pressure exerted against W , it will be necessary to know the distance from B to the center of track roller. If the power was applied at the center of the track roller, then the amount would be obtained thus: Divide the length of lever E (measuring from center) by the distance from center of track roller to a perpendicular line drawn from the point of lever attachment (to W) to the track. Multiply this by 8 (the power obtained by the line) and the result thus obtained by the 1600 lbs. This will give about 73024 lbs. Now to solve the problem given: Diminish this result in proportion to the distance that B is moved up the lever from center of track roller.

F. A. W. says, in reply to P. T.'s query as to the consumption of water by engines in cold as compared with that in hot weather: A few years ago three boilers were situated on the higher floor of a building, and were heated by gas that would otherwise escape. This gas was admitted to the boilers and regulated by means of sliding gates. The speed of the blowing cylinders was governed of course by the velocity of the engine, and the latter by an ordinary governor; but this not being sufficiently accurate, it was necessary to throttle the engine to drive it at the required number of revolutions per minute. Much practice enabled us to admit just sufficient gas to the boilers to maintain a pressure of 60 lbs. with hardly the variation of a pound in a week, and sometimes in a longer period. Nearly a year of such experience showed us that, in cold, damp weather, it was necessary to admit more gas, and in warm, pleasant weather to admit less. Of course, difference in charging would make a change in the quantity and quality of the gas, and perhaps augment the resistance of the air that was being forced into the furnace; but a long continued series of experiments, such as we were obliged to make, eventually established the fact. The boilers were supplied with a constant stream of water, regulated arbitrarily by a cock, and so accurately as not to require moving sometimes for days together. "I do not apprehend that the cold damp weather had any appreciable effect in requiring the admission of more heat to the boilers, except by the increased condensation of steam, which was not more than in ordinary engines. This same condensation will undoubtedly account for the difference, if there is any, between the effect of steam and air in a locomotive."

D. M. says, in answer to the question proposed by C. H. A. (page 187, vol. XXIX): Let there be a system of rectangular axes, having c for their origin, b being the axis of X . Since the number of revolutions of the ball is a constant, a line equal to its distance from the axis of X and perpendicular to the same axis, may be taken to represent the centrifugal force, the force of gravitation being represented by a constant line parallel to the same axis, and which I denominate by g . Therefore at any point, $x' y'$, of the curve, the resultant of the two forces will pass through the point, $x' y'$, and also through a point whose equations are $x = x' - g$, and $y = 2y'$. Therefore the equation to the resultant is $y - y' = -\frac{y'}{g}(x - x')$ which is evidently the equation to the normal of a parabola having $2g$ for its parameter. (See Davies' "Analytical Geometry.")

G. W. says, in reply to H. H. J., who asked as to making a combined reaper and thresher: It cannot be done. At the time grain ought to be cut, it is not dry enough to thresh; and if left standing until it is dry enough to thresh, it will shatter out so as to lose half the crop, especially if the grain be oats. It was this which made useless a harvester in the western states. It cut the heads off and left the straw standing; the heads were to be stored in cribs or bins, like corn. But the heads proved to contain so much moisture as to cause mold and rot.

W. W. H. says, in answer to T. M. Jr., who asks how to preserve grapes in the bunch, fresh as when taken from the vines: When the grapes are fully ripe, clip the bunches from the vines carefully, and get a water tight keg or box. Place in the bottom of the box a layer of dried grape leaves, half an inch thick, then layers of grapes and leaves alternately until the vessel is filled; nail a board on top, and bury the vessel in the ground, where water will not stand, out of reach of frost. Grapes put up in this way will keep fresh and sound until April.

J. W. B. says, in reply to C. P. T., who wants a heavy foam on a tonic beer: Use the whites of a dozen or more eggs in a 10 gallon keg.

J. M. B. says: "I think the blistering of varnished cement tiles, which D. U. R. complains of on page 171, current volume, is caused by the expansion of the moisture contained in them when varnished. A remedy would be to drive the moisture out."

COMMUNICATIONS RECEIVED.

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

On the Million Dollar Telescope. By W. M. R.
On Canal Navigation. By T. K.
On Hatching Eggs. By B. F. S.
On Spectroscopic Manipulation. By C. A. D.
On Perpetual Motion Seekers. By F.
On Financial Science. By J. E. E.

Also enquiries from the following:

H. C. B.—C. G. T.—M. W. K.—A. V. L.—J. S. P.—G. M.—J. W. S.—W. H. B.

Correspondents in different parts of the country ask: Where can I get a cross-cut saw for getting out trunks of large trees? Where can I obtain cotton seed oil machinery? Who makes shoe peg machinery, and what does it cost? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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

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September 30, 1873,

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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:

26,674.—CLOTHES DRYER.—B. B. Hawes. Dec. 17.
 26,669.—PIVOT BEARING.—F. C. Lowthrop. Dec. 17.
 26,345.—WASTE COCK.—G. W. Robertson. Dec. 24.
 26,301.—BOOTS, ETC.—F. D. Ballou. Dec. 24.
 24,451.—SPRING COVERING MACHINE.—J. T. Loft. Feb. 25.

EXTENSIONS GRANTED.

25,540.—STEAM BOILER.—J. Harrison, Jr.
 25,562.—CONSTRUCTION OF PRISONS.—E. May.
 25,573.—LASTING BOOTS, ETC.—J. Parinton, Jr.
 25,602.—HYDRANT.—C. L. Stacy.
 25,602.—SEWING MACHINE.—K. Vogel.
 25,591.—SEWING MACHINE.—J. Draper.

DISCLAIMER.

25,603.—LASTING BOOTS, ETC.—J. Parinton, Jr.

DESIGNS PATENTED.

6,795.—CALL BELL.—C. S. Barnard et al., W. Meriden, Conn.
 6,796.—BOOT JACK.—O. F. Fogelstrand, Kensington, Conn.

6,897.—LAMP SHADE.—W. Mayers, New York city.
 6,898.—TEA POT BAKER.—E. B. Manning, Middletown, Conn.
 6,899.—LAMP FOOT.—N. L. Bradley, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,473.—WINDMILL.—Atwood et al., San Francisco, Cal.
 1,474.—PACKED OYSTERS, ETC.—Barnes & Co., Balt., Md.
 1,475 & 1,476.—FERTILIZERS.—G. Dugdale & Co., Balt., Md.
 1,477.—ADZE CURR.—H. Van Iper et al., New York city.
 1,478.—PREPARED FISH.—Dodd & Co., Gloucester, Mass.
 1,479.—BRANDIES.—M. Doherty & Co., Boston, Mass.
 1,480.—CHEESE.—Webb & Co., New York city.

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; enable 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 in 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 1871 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the inventor, 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.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Design Patents.

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.

A patent for a design may be granted to any person whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto, relief, or bas relief; any new and original design for the printing of woolen silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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.

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 drawing and specifications, may be had by remitting to this office \$1.

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Referring to the individual instance of that class of cotton or other presses, in which a steam piston is made to act upon a rack work, ing between cog segments, connected by rods to the follower of the press in such a manner that the leverage will be increased as the follower is drawn up, it is hardly necessary to point out that, toward the end of the stroke, an immense force may be developed. But it has been found equally true, owing to the difference of sizes of articles of the same nature, to be compressed, bales of cotton, for example, that besides, from other causes, the power of the press is hardly sufficient to perform the work or to reach so near the end of its stroke as to render the gain by this increase of leverage available. It is, therefore, common, in order to attain the latter result, to employ a cylinder of larger size than is necessary at the beginning of the motion or with bales of comparatively small dimensions.

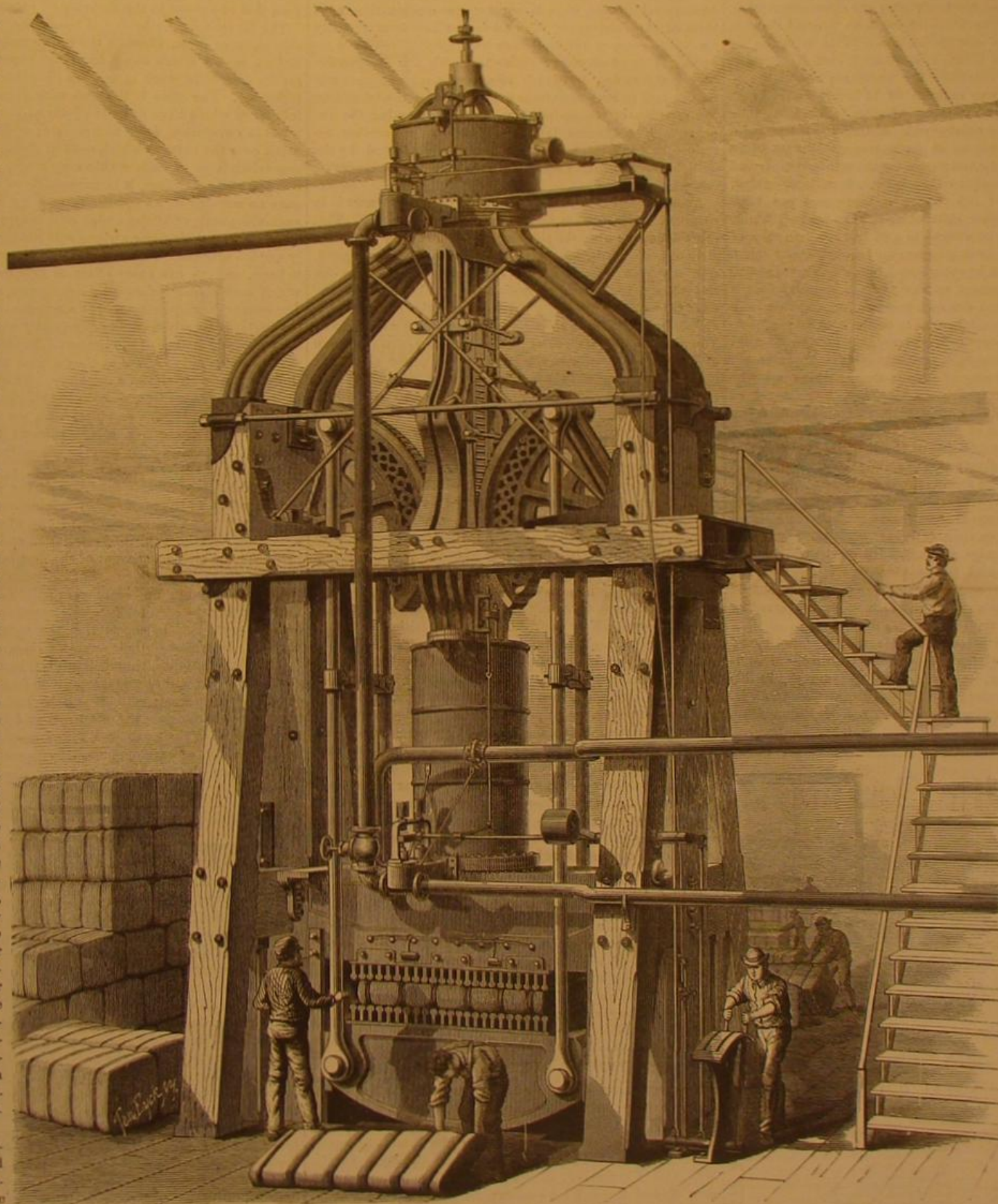
In the invention represented in our engraving, while the general plan above noted has been adhered to, two engines, instead of but one, are employed, and these are so arranged that a cylinder of comparatively small diameter applies the first and, consequently, the less powerful pressure. When this has reached the limit of its capability, the second engine comes into action and, by means of a large piston surface and short stroke, develops sufficient power to insure the completion of the pressure, and thus brings into effect the advantageous leverage already alluded to. By this means, it is claimed, steam is not only used in the most economical manner, but the construction affords four distinct gradations of the power, to be applied at will, as follows:

First, by employing the smaller cylinder alone; second, by introducing steam into the larger cylinder in addition and causing it to work expansively therein; third, by cutting off steam in the smaller cylinder, so that it may there work expansively in connection with the steam in the large engine; and, fourth, by using steam direct from the boiler in both.

It is not considered necessary to enter into any detailed

description of the mechanism, as a reference to the engraving will clearly indicate the quite simple construction of the invention. The points to be more especially noted are the mutual operation of the two engines and the results gained by actual practice. The machine from which our illustration was taken occupies a floor space of 14 by 18 feet, and an idea of its height is readily obtained by comparison with the figures represented beside it. The lower single acting cylinder is 48 inches in diameter, and the upper one 60 inches; their strokes are, respectively, 9 and 4 feet. To afford a better

notion of the operation, we need only describe the same exactly as we saw it a few days since. The material to be compressed was cotton, and a single bale, taken as a sample, weighed in the neighborhood of 500 pounds, and measured, before pressing, 52 inches. This was placed on the follower of the machine, and the engineer threw over one of the hand levers, shown at the right of the engraving. The effect of this was to vibrate a rock shaft, the lower one represented, and so open the steam valves of the lower cylinder. These valves, as well as those on the upper engine, are balanced as nearly as possible, and are claimed to possess all the advantages of both cylindrical and double puppet valves, as they work with little friction and are held on their seats with slight steam pressure. As steam entered the lower engine, the piston of course rose, and the rack upon it, engaging with the teeth of the segments and thus acting on the massive wrought iron rods, quickly raised the follower. This motion continued until very near the end of the lower engine's stroke, when the upper end of the piston rod entered a simple clutch formed by gibs, resting at their upper ends in bearings in a crosshead upon the lower end of the downwardly projecting rod of the upper cylinder. The gibs are hooked at their free lower portions, and are controlled by arms provided at their outer ends with rollers which work in grooves in the stationary frame. These grooves are so formed that, when the crosshead and clutch are in their lowest position, the hooks at the lower ends of the clutch jaws are drawn outward from the head of the rack; but, as they rise, are pressed in-



GRADER'S STANDARD COMPRESS.

ward and, by the shape of the frame, clearly shown in our engraving, kept in contact with the head of the lower piston rod. This clutch, acting automatically, coupled the ends of the two piston rods together, and at the same moment its gibs, as they expanded, actuated a bell wire and sounded a gong close beside the engineer, who, rapidly moving a second lever, admitted steam into the upper cylinder. At this point, the various gradations of power above noted may be employed in accordance with the nature of the work to be accomplished. The second and more powerful engine being now in operation, further compression of the bale followed. Six

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inches of stroke, we noticed, corresponded to one inch of movement of platen; and with a steam pressure of 125 pounds, this would develop a pressure of two thousand tons.

Finally the limit of stroke was reached, and the follower had risen to a distance of between 7 and 8 inches from the immovable portion above it. Here the bale was held until the straps were passed and the ends secured, and then steam was allowed to escape from the upper cylinder, allowing the follower to drop.

It will be noticed from the drawing that the piston rod of the upper and larger engine projects up through the cylinder and terminates in a flanged collar. Beneath the latter is a rubber buffer, so that, as the piston descended, the falling weight was met by this elastic support taking against the top of the cylinder, and all jar is thus avoided. When the widened portion of the guides was reached, the clutch of course uncoupled, leaving the piston of the smaller engine to continue its descent, cushioning slightly on the contained steam. The rack and segments necessarily resumed their position as at the beginning of the operation.

So quickly is the work performed that, probably during the time the reader has devoted to perusing the above description, a dozen bales of cotton would have been pressed, banded and removed. In the case of the bale referred to in the beginning as 52 inches through, we found that it occupied about 5 seconds to complete the pressure; and within 50 seconds, the bundle was reduced to 14 inches in thickness and securely tied. The economy of space in shipping thus gained need hardly be pointed out. Estimating cotton bales pressed by other means as of an average thickness of 33 inches at the beginning, and supposing them to be compressed to the uniform dimension of 18 inches, here is a saving, we are informed, of 175 tons admeasurement per 1,000 bales, while it is further claimed that, thus packed, 24,000 pounds of cotton can be stowed in a 28 foot car. In case of hay, the economy is even greater; for two bales, standing 6 feet 2 inches high, can be compressed into a single bale of 20 inches. A fair statement of the average capacity of the machine (judging from our own examination, together with the claims of the inventor) seems to be about 60 bales of cotton per hour. There are other advantages incident to thus compressing cotton into such perfectly compact form, in addition to that of economy of space; among which may be mentioned its greater facility in handling, less danger of being permeated by fluid or moisture, and also greater immunity from the peril of fire.

As regards the construction of the machine, we may add that it appears exceedingly strong and durable. Its weight is about 100 tons. The follower rods, as already noted, are of wrought iron, while the segments, rack, crosshead, etc., are of gun metal. The cogs are cast from templates and claimed to be more perfect even than cut gear, while their strength, we are assured, precludes all possibility of their stripping. There are also powerful braces placed so as to meet the strains in the most advantageous manner; and rubber buffers are applied at the various points which might be jarred by sudden or too heavy impact.

The invention was patented by Mr. G. W. Grader, and may be seen in operation at the works of the Standard Compression Cotton Company, Nos. 108 and 110 Morton street in this city. Further particulars may be obtained from Mr. C. H. Close, of the latter address, or from Mr. J. H. Edmundson, Memphis, Tenn.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year	\$3 00
One copy, six months	1 50
CLUB RATES	
Ten copies, one year, each \$2 50	25 00
Over ten copies, same rate, each	2 50

VOL. XXIX., No. 19. [NEW SERIES.] Twenty-eighth Year.

NEW YORK, SATURDAY, NOVEMBER 8, 1873.

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MR. R. A. PROCTOR, the distinguished British astronomer, has recently arrived in this country. He proposes, we believe, to give an extended series of popular lectures, for which purpose he has brought with him a series of paintings illustrative of astronomical problems and discoveries.

THE ELECTRICAL CONDENSER.

In the working of the steam engine, the office of the condenser is to assist the power and economy of the machine, by rapidly removing the back pressure of the exhaust steam and converting it into water for re-use in the boiler. In a somewhat analogous manner, the employment of the electrical condenser appears to facilitate and improve the working of certain kinds of telegraphs. When a battery current is sent through an insulated telegraph wire, there is produced another current, termed static induction, which interferes with the operation of the battery current.

On the ordinary pole telegraph with the ordinary instruments, the static induction gives little trouble; but in the case of subterranean and submarine cables, the induced currents prevent the rapid working of the instruments.

The electrical condenser consists of tin foil, separated by sheets of insulating material, such as paraffin paper; and when the metal of the condenser is connected with the telegraph wire, it absorbs the electricity of induction, and changes it so that it acts to assist instead of retard the transmission of telegraphic signals by the instruments.

The various submarine cables could hardly be worked with commercial success, were it not for the combination with them of the condenser. The condenser has been recently applied to some of the land lines with greatly improved results. It is employed in connection with the Stearns duplex instruments, by which messages are simultaneously transmitted in both directions over one wire; thus doubling the capacity of transmission without augmenting the expenses. The Stearns invention has been heretofore described in our paper. It has lately been adopted by the British government, in accordance with the recommendation made by us.

Another recent application of the electrical condenser is in connection with what is termed automatic telegraphy. This consists in operating the sending key by drawing under it a strip of perforated paper, each perforation, of given length, representing a given signal. At the opposite end of the line the message is received upon chemically colored paper, the color of which is instantly changed and the signals made visible by the passage through it of the electrical currents. The great trouble with the practical working of this system of telegraphy always has been that the static electricity operated to string out the electrical waves, producing tail-logs, making the signals to run into or overlap each other, and render them illegible, upon the receiving paper. This was especially the case if a certain limit of rapidity in the transmission was exceeded. This limit of transmission was 100 words per minute over a line of 250 miles extent; which is about the speed of the common Morse instrument.

Mr. George Little, who is well known for his indefatigable efforts and ingenuity in connection with automatic telegraphy, has applied the condenser to his instruments with marvelous results. He states that it enables him to transmit 5,000 words, or 30,000 signals per minute, over one wire, with perfect legibility, and that the instruments of the Automatic Telegraph Company are now working the system at this rate between New York, Philadelphia, Baltimore, Washington, Mobile, and other cities.

This discovery promises to be of much importance in the business of electrical transmission. It will enable people to do their correspondence in full by telegraph, instead of by brief sentences, as at present. It will assist to prevent blunders in transmission, for which at present there is no remedy, except by double payment. It is well known that the Western Union Company will not otherwise guarantee the correct delivery of any messages sent over their lines. The successful introduction of the automatic system will, however, put an end to this extortion. The facility of transmission is so great that the Automatic Telegraph Company is now enabled to send twice as many words, for the same money, as the other lines; and thus the sender may make sure of a correct delivery of his message, without loss of time or payment of extra charges.

Another striking advantage of the electrical condenser is its use in connection with subterranean wires. It permits the transmission of signals with as much facility when the wires are placed underground as on the pole lines, and will enable our city authorities to pass ordinances requiring the removal of the many poles which now disfigure and encumber our streets.

PROGRESS OF SCIENTIFIC EDUCATION.

Two more munificent gifts have been made in aid of scientific education: one in the shape of a bequest of the sum of \$200,000, by Mr. William Wheelwright, of Newburyport, Mass., lately deceased in England, for the establishment of a scientific school in his native place, and the other by Mr. Mr. Ario Pardee, of Hazelton, Pa. The latter gentleman, finding through his own experience the necessity of increased facilities for technical instruction throughout the country, some time since selected Lafayette College, in Easton, as the object of his donations. Although the aggregate amount thus bestowed had, up to some sixteen months ago, already reached a large sum, Mr. Pardee determined to found a complete scientific department, and to this end began, within the college grounds, the erection of the edifice, which quite recently has been formally presented to the authorities of the institution. This magnificent gift, while forming a fitting culmination to the series of benefits already rendered by its donor in furtherance of scientific learning, brings the total pecuniary value of his endowments to the large sum of half a million dollars.

The building, which has been named Pardee Hall, is five stories high, 256 feet in length, and is constructed of brown stone. It contains chemical and metallurgical laboratories,

geological and mineralogical cabinets, large and elegantly fitted up lecture rooms, besides a spacious hall. The laboratories are said to be the most complete in their appointments in the United States. Accommodations are provided for 250 students. Pipes throughout the building convey gas, oxygen, hydrogen, sulphuretted hydrogen, steam, and blast, to all points where the same may be required. There is an elaborate set of chemical apparatus, together with a valuable stock of chemicals, besides models of machinery for mining operations and various industrial purposes.

The formal ceremonies of donation consisted in an address by Mr. R. W. Raymond, lecturer on mining geology in the college, on the "Necessity for Scientific Education," together with speeches by Mr. Pardee, the Governor of Pennsylvania, and Dr. Cattell, President of the Faculty.

THE STATE OF THE IRON TRADE.

There exists at present a general feeling of depression in the iron trade, and this more especially among the smaller firms. We do not share in the gloomy apprehensions of its permanency, however, throughout the winter, and it seems to us that there is ground for a much more hopeful feeling than that expressed in the majority of cases.

The railroad supply firms and locomotive works have probably suffered most, through the countermanding of orders. But the money which would have been expended in payment for the completed work is not out of existence, but simply locked up. The same is the case with regard to all other industries which have felt the effects of the crisis. Funds, if not in circulation, must accumulate; and when they once break over the barriers which confine them, there will be a superabundance of cash within easy reach. How soon this reaction will take place, it is impossible to say. The panic gave no warning of its approach, and we believe that the anomalous state of affairs which now causes the people to so closely guard their purse strings will disappear in an equally sudden manner. The only counsel to be given is simply to hope, and to use every effort to tide over the interval which may elapse before the resumption of easier times. The country is unquestionably in a prosperous condition, and industries generally are doing excellently well. Hence, as to the temporary nature of the present difficulties there is not a shadow of a doubt; and that they cannot much longer continue, we consider almost a certainty. Those houses which, by careful management, succeed in bridging over the chasm without making serious sacrifice, will, we further believe, when the reaction comes, clear sufficient to wipe out the record of the losses they may have incurred, and, besides, show a fair profit for the year.

Regarding the probable condition of the workmen, due to the reduction of force in many establishments, we notice with regret that the sentiments of one of our most prominent firms breathe a spirit of retaliation and a lack of sympathy for the men, on account of the part taken by the latter in the strikes of a year ago. Such expressions tend but to re-open old wounds, and employers will find that, instead of thus planting the seed for future feuds, they will serve their own interests best by considering the welfare of their employees. By assisting their men in a time of trouble, to the extent of their ability, they will engrain in them a feeling of gratitude which will serve materially to diminish the chances of future dissensions; while it will be but ordinary charity to endeavor to alleviate the condition of fellow beings who, from no fault of their own and for an indefinite period, are thus forced out of employment and compelled, as best they may, to face the hardships and miseries of the coming winter.

ELASTIC PROFANITY.

At a summer festive gathering on one of the Thousand Isles of the St. Lawrence, last summer, the Rev. Dr. Pullman, of Peoria, playfully gave, as a complimentary toast, "The health of the inventor of Elastic Profanity," in allusion to Dr. S. C. Barnum, of this city, who happened to be present, and who is well known in the dental profession as the author of the rubber dam. This is a device now in common use, for keeping fillings dry during the operation of tooth plugging, and is almost as indispensable for good success in dentistry as chloroform is in surgery.

The rubber dam is nothing more than a piece of sheet rubber, which is punctured and stretched over the necks of the teeth, serving to hold up the gums, and wholly prevent the access of saliva at the point where the filling is being introduced. It is not only a marvelous convenience for the dental operator, but affords great relief to the patient; for it in no way interferes with the natural functions of the tongue, muscles, and glands of the mouth. It enables the dentist to perform with ease and certainty a class of most necessary operations which were previously counted almost among the impossibilities by leading practitioners. In thousands of cases, teeth which before were condemned for extraction are now readily saved and filled.

The rubber dam was invented in 1865, by Dr. Barnum, and presented by him as a free gift to the profession, at the Dental Convention held in this city during that or the following year. Previous to the discovery of this device, dentists were obliged to resort to all sorts of curious contrivances in the attempt to keep their fillings dry. Among these was the duct valve, a round disk which was placed in the mouth of the patient, upon the orifice of the salivary gland, and there pressed by a clamp, to prevent the escape of the saliva. This was painful to the patient, as well as injurious, as it caused an unnatural engorgement of the gland.

Then there was the saliva pump. While the dentist was engaged in filling the tooth, an attendant stood by and worked a hand pump to draw off the saliva from the patient's mouth.

Sometimes the dentist had to take plaster casts of the defective tooth and adjacent parts, and by their aid manufacture temporary bulwarks of gum mastic, to fit the mouth, with a view to shut off the water from the designated tooth. This preliminary operation involved much more time and trouble than the filling of the tooth.

Then there were the tongue clamp, the gum clamp, the gag, the iron presser, and other special tormenting devices, which were brought into operation for the one purpose mentioned; to say nothing of sponges, blotting paper, and cloth napkins, with which it was deemed necessary to stuff and torture the patient's mouth. All of these relics of what may be termed the dark age of dentistry have been superseded by Dr. Barnum's rubber dam. The author occupies a high place in the estimation of the profession, by whom he is justly regarded as a benefactor; while every dental patient, who remembers the old instruments, gives honor to the inventor, and rejoices with elastic profanity.

THE LATE DR. NELATON.

To Nélaton, the greatest of modern French surgeons, recently deceased, it is said that the medical profession owes the perfection and simplification of an immense number of the most difficult surgical operations. Although he wrote but little, he manifested a wonderful genius for devising tools and apparatus, and for imparting clinical instruction to others. "Give him a piece of wood, some iron wire, and some chisels," says a biographer, "and he will invent and construct an instrument to suit any requirements."

He detested display, and particularly avoided spreading out cases of implements during the course of an operation. "Surgery à grand orchestre," he called such exhibitions; and it seemed as if he managed to do far more with his fingers than many other surgeons with the most elaborate of tools.

His coolness equaled his dexterity, and some of his sayings will doubtless pass into proverbs. "When you have made a correct diagnosis and know what you are about, you risk nothing," was a favorite remark. "If you have the bad luck, while operating, to cut a man's carotid artery, remember that it takes two minutes' time to cause syncope, and four minutes will elapse before he bleeds to death. Now four minutes is just four times as long as is necessary to place a ligature on the vessel, provided you do not hurry"; and "You are working too quickly, my friend; remember that we have no time to lose," were other now famous observations made during the course of difficult operations.

Nélaton attained very general celebrity from the fact of his treating the Prince Imperial and the wounds of Garibaldi. He died of a lingering malady of the heart, continuing his teachings and practice to the last.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW GALVANIC BATTERY.

Abbe Fiehol, says *Les Mondes*, has recently constructed a new battery, using a Spanish mineral which is probably a kind of pyrites. Within a glass jar is placed a zinc cup, 7 inches long, 3 inches deep, and 2 inches broad, into which the mineral is packed. Above is a piece of copper, and the interstices are filled with pulverized coke, mixed with ten per cent of chloride of sodium (common salt) and moistened with water. Four elements, united with isolated copper wires, copper to copper and zinc to zinc, it is stated, gave a current of surprising energy, fully equal to that of five Bunsen couples. The battery is constant, and it has been found that, after eighteen months continuous use, it operates as well as when first employed. The only condition seems to be that it should be kept thoroughly moistened.

A NEW TEXTILE PLANT.

The jury at the recent Exposition, at Lyons, France, awarded a medal for the utilization of the fiber of a marsh plant, commonly known as the *marsette*. It is of the *typha* family, and three varieties, namely, *typha latifolia*, *angustifolia* and *minima*, yield the fiber. The plant grows in a wild state in great profusion in streams of water, ponds, etc., and reaches a height of some ten feet. Heretofore it has been employed for seating of chair bottoms and thatching of cottages, and occasionally in place of straw as bedding for animals.

The mode of extracting the fiber from the leaves after the latter are cut and dried consists simply in boiling them for several hours in an alkaline solution and afterwards dressing them in a mill or under rollers. Washing terminates the process. A yellowish paper is made, worth about \$16 per 220 pounds. The fiber, it is believed, may be used for fabrics and for cordage, and is considered equal to hemp, flax or jute.

AMERICA NO LONGER A CUSTOMER FOR BRITISH STEEL.

The excitement produced in Sheffield by the rise in coal has been intensified by a rumor that one of the largest firms engaged in the manufacture of steel—mainly for American customers—is about to transfer its business to the United States. For a long time past these makers have been producing steel from Bilbao ores, but have at last found them selves (overweighted by the cost of freight and the high prices of fuel and labor) unable to compete with American makers, who import the ore direct, and manufacture upon the spot. If confirmed, says *Iron*, this report will only tend to prove more clearly than before that, although we need not—*for a while*—dread the American as a rival, he is gone for ever as a customer.

THE MANUFACTURE OF MAGNESIA.

The Washington factory, near Newcastle, England, manufactures the greater part of the magnesia used in the world. The principle of the process employed consists in treating

dolomite with gaseous carbonic acid, under a pressure of 5 or 6 atmospheres. The dolomite is first dried, then finely pulverized, and afterwards placed with cold water in a cylinder which constantly revolves on its horizontal axis. The carbonic acid gas formed by the action of hydrochloric acid upon carbonate of lime is, by a powerful pump, driven into the vessel at the pressure above noted. The solution of bicarbonate of magnesia thus produced is carried into a vertical cylinder and submitted to steam (the consequent elevation of temperature regenerating the neutral carbonate,) and then led into canals beside the last mentioned receptacle. Lastly, the substance is gathered into masses, from which are cut the parallelepipeds which, after desiccation, are supplied to commerce. Caustic magnesia is obtained by heating the carbonate in red hot muffle furnaces.

ANALYSIS OF TEA.

Zöllers analysis is as follows:

Potash.....	30.22
Soda.....	0.65
Magnesia.....	6.47
Lime.....	4.24
Oxide of iron.....	4.38
Protoxide of manganese.....	1.03
Phosphoric acid.....	14.55
Sulphuric acid.....	trace
Chlorine.....	0.81
Silica.....	4.35
Carbonic acid.....	24.30
	100.00

THE BRITISH ASSOCIATION.

We continue, from our last, abstracts from papers read at the late meeting at Bradford:

HEAT-CONDUCTING POWER OF ROCKS.

Professor Herschel and Mr. Lebour have been experimenting in this subject. Twenty-eight specimens of rocks were reduced to uniform circles of 5 inches diameter and $\frac{1}{4}$ inch thickness, carefully gaged. Out of six specimens that had been tried, slate plates, cut parallel to the plane of cleavage, transmitted the heat faster than any of the others. Where the flow of heat had become uniform, the water was raised 1° Fah. in thirty-two seconds. With marble, sandstone, granite, and serpentine, about thirty-nine seconds were required to raise it by the same amount. The greatest resistance to the passage of heat was offered by two specimens of shale, gray and black, from the coal measures in the neighborhood of Newcastle, which occupied forty-eight or fifty seconds in raising the water one degree, or half as long again as the time taken by the plate of slate.

PHOTOGRAPHS OF INVISIBLE SUBSTANCES.

Dr. J. H. Gladstone, F. R. S., called attention to some photographs of fluorescent substances. Fluorescent substances, such as bisulphate of quinine or uranium glass, have the power of altering the refrangibility of the violet or chemical rays of light; hence, although paper painted over with bisulphate of quinine will look nearly white, it will appear in a photograph as if it were nearly black. Dr. Gladstone exhibited some photographs of ornamental design traced on white paper with bisulphate of quinine; although the designs were nearly invisible to the eye, in the photographs they were boldly visible. A colorless solution of bisulphate of quinine was placed in one glass, and some ink in another glass; when both glasses were photographed, they came out equally black. Dr. Gladstone said that once, at the seaside, he painted a pattern with bisulphate of quinine upon paper, and took the paper to a photographer to be photographed; he objected, because there was nothing on the paper, but on trying the experiment he found out his error. It was stated that some kinds of varnish possess a similar power of affecting the refrangibility of light.

SHOOTING STARS.

It appears, from the report of the Luminous Meteor Committee of the British Association, that shooting stars and large fire balls have appeared during the past year in more than usual varieties. Large meteors have presented themselves in considerable numbers, and ordinary shooting stars in a more striking manner, as regards the explanation of their origin, than has often been the case in former years. Of all these kinds of shooting stars, both large meteors and meteoric showers, much accurate information has reached the committee. Two of the largest fire balls seen in Great Britain were aërolitic, or burst with the sound of a violent explosion on November 3 and February 3 last. Aërolitic meteors and aërolites have also been noticed in the scientific journals of other countries, which have given rise to experiments on the composition of aërolitic substances, both chemical and microscopical, the conclusions of which continue to extend the range of our speculations regarding the origin of these bodies. Thus the existence of carbon and hydrogen, in the atmosphere from which the largest iron meteorite yet found (a few years since upon the shores of Greenland) was expelled, confirms the discoveries of Grahame and Professor Mallet, in America, of the existence of the same gases in other meteoric irons. Dr. Wöhler has thus detected the oxides of carbon as gases in the vast meteoric iron of Oufak, found in Greenland and brought to Stockholm during the last few years by Professor Nordenskiöld; and the same gas was found by Professor Laurence Smith in the siderite which fell recently in the United States. A connection between comets and meteorites appears to be indicated by these discoveries, in the spectra of some of which gases containing carbon appear to have been certainly recognized by Dr. Huggins.

The past year was distinguished by the occurrence of a most remarkable star shower on the night of November 27

last, to the expected appearance of which astronomers were looking forward with especial attention, from the unexplained absence of the double comet of Biela (to which it belongs), from its accustomed returns in the last three of its periodical revolutions.

The cloudy state of the sky unfortunately deprived observers in the South of England from witnessing the sight; but in Scotland, and north of the Midland counties of England, many uninterrupted views of it were obtained. On the European continent and in the United States of America, as well as in the East Indies, at the Mauritius, and in Brazil, observers were equally fortunate in recording its appearance, and few great star showers have hitherto been more satisfactorily observed, or indeed more abundantly described. In an astronomical point of view, the agreement of the time and other circumstances of its appearance with the supposed path of the lost comet is so exact as to prove that the calculations made by astronomers of that comet's orbit cannot be affected by any errors of a large sensible amount, and a proof almost certain is thus obtained, that the disappearance of the comet is owing to no unexplained disturbances of its path; but that like some former comets of variable brightness, it has not improbably faded for a time out of view, and that at a future time a reasonable expectation may be entertained of re-discovering it pursuing its original path in repeated visits to the earth's neighborhood, and to the field of telescopic observation.

IMPROVED PROCESS FOR PURIFYING COAL GAS.

Mr. Vernon Harcourt said that the usual method of freeing coal gas from sulphuretted hydrogen was by passing it through lime. But oxide of iron was also employed in place of the lime, the advantage possessed by the oxide being that while the lime, after it had served its purpose, was useless and difficult to get rid of, the oxide of iron could be used repeatedly for the same purpose. The chemical changes involved were that, when the gas had passed through the oxide the latter was changed into sulphide of iron; when the sulphide was exposed to the air, the sulphur separated and the oxide was re-formed, thus enabling the oxide to be again used. This was called a continuous process, because the oxide could be continuously used. But the process was not quite continuous, for, after the oxide had been used some thirty times, it became so clogged with sulphur as to be useless. The new process was applicable wherever oxide of iron could be used in the purifying process. The difference from the old process was that the oxide during reformation was moistened with a solution of ferric sulphate (persulphate of iron), and a portion of the oxide was removed from time to time, and treated as follows: It was first extracted with water by the use of a well known arrangement. The soluble salts were sulphate of ammonia—formed in the purification by the reaction of ammonia upon ferric sulphate—and, in smaller quantities, sulpho-cyanide, hypo-sulphite, and probably sulphate of ammonia. This extract was mixed with a small excess of sulphuric acid; and yielded, when concentrated by evaporation, crystals of ammonium sulphate. The remainder of the substance was then boiled with dilute sulphuric acid, which dissolved the oxide and left a residue of sulphur. The actual process of extraction by acid consisted in treating the substance successively with (1) a solution of ferric sulphate containing some free sulphuric acid; (2) with a more dilute solution of ferric sulphate to which sulphuric acid had been added; (3 and 4) with more dilute solutions of ferric sulphate—all these liquids being the product of a former extraction—and (5) with water. The liquid resulting from the first of the treatments enumerated above was a strong solution of ferric sulphate, which was used as already mentioned, by being mixed with the charge of oxide before it was replaced in the purifier. The residue of the final washing consisted almost entirely of sulphur, and required only to be dried. It would be evident that all the oxide which had been freed from sulphate of ammonia and sulphur by this treatment passed into the condition of ferric sulphate, and in this condition it was replaced in the purifier. There it again became oxide by the action upon it of the ammonia in the gas, which it completely removed, fixing it as sulphate. This system had been brought into use as a manufacturing process, and had been found to be, as far as could be judged, a complete success.

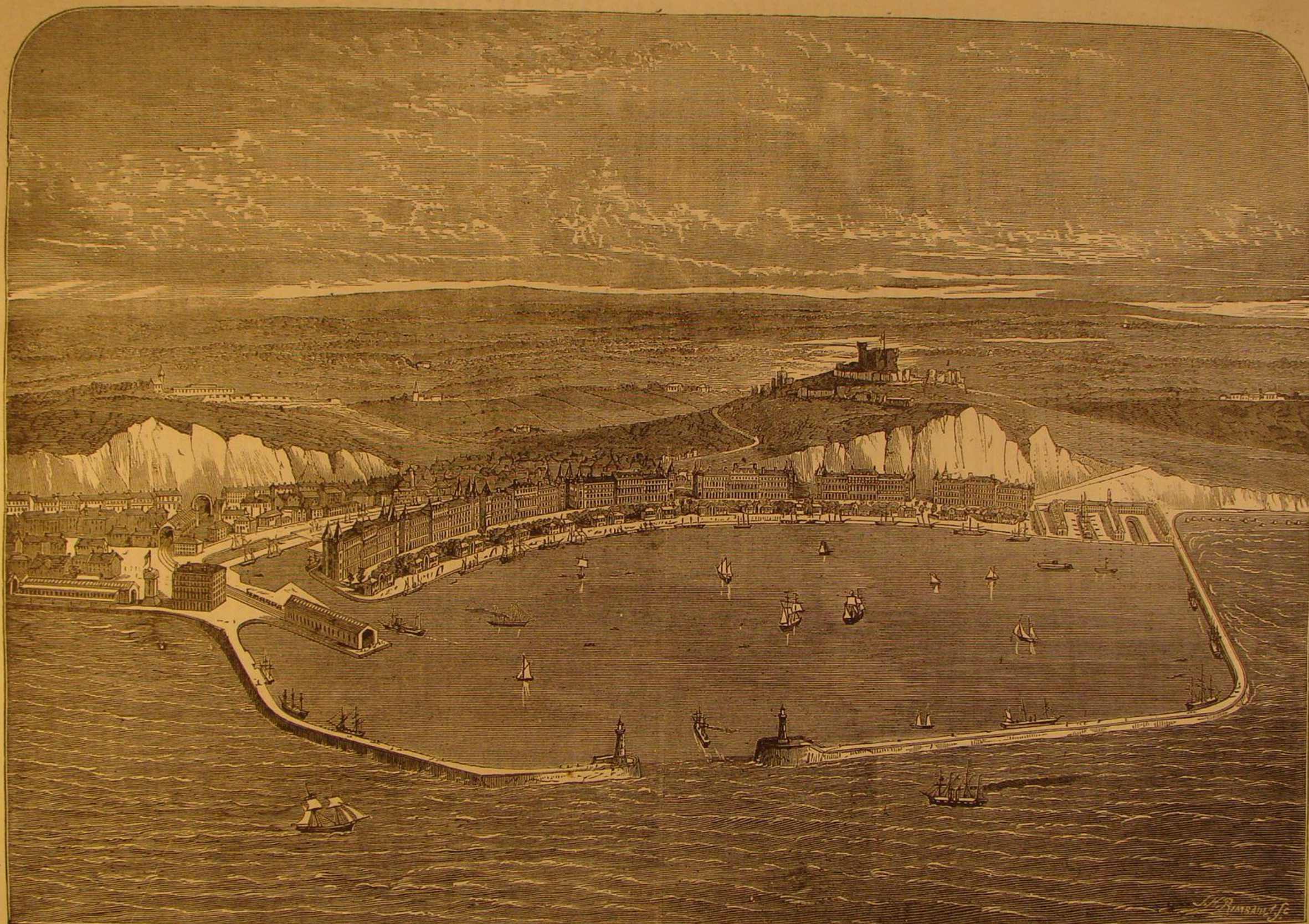
NEXT YEAR'S MEETING.

The next meeting of the British Association is to take place at Belfast, Ireland, on August 9, 1874. Professor Tyndall has been elected to preside.

A Gigantic Cotton Press.

We devote our initial page this week to the illustration and description of a new machine for the compressing of cotton, hay, or similar material. The apparatus is a gigantic affair, occupying two stories of a moderate sized building, and is a model of admirable workmanship. The parts, though weighing tons, move with the ease and regularity of a well balanced engine, and the tremendous pressure which they develop produce results which it is difficult to imagine could be otherwise so well and readily effected.

The application of the invention to the re-pressing of cotton bales, previous to their shipment abroad, will tend to increase materially our present facilities for exportation, as a vessel is thus enabled to carry fully three times more of the staple than heretofore. There are many advantages gained, notable immunity from danger of fire or injury by moisture, increased facility in handling, besides others which will be easily apprehended on perusal of the description of the device. Apart from its capabilities, the machine is intrinsically well worthy of the examination of engineers and mechanics.



THE TOWN AND HARBOR OF DOVER, ENGLAND, WITH THE PROPOSED NEW WORKS.

PROPOSED ADDITION TO THE HARBOR WORKS AT DOVER, ENGLAND.

The Admiralty Pier at Dover, well known for its immensely solid construction, has been found to be so convenient a landing and embarking place for continental traffic that another work, leaving the shore from the other end of the town and, with the work already constructed, inclosing a harbor of refuge of 350 acres extent at low water line, has been proposed by Colonel Sir Andrew Clark. We publish herewith a bird's eye view of the town, with the suggested improvement.

The trains of the two railroads, whose depots are seen on the left in the engraving, at present run on the top of the solid masonry of the pier, allowing passengers to pass immediately from the cars to the steamboats; but the new plan suggests the construction of an inside landing place, with covered platform for loading and unloading trains, also shown in the view (for which we are indebted to *Engineering*). This would improve the accommodations considerably, as the place of arrival and departure would be protected from the very strong tide of the Straits and from the sea, which runs at times at great height. But the more important proposition is the other arm of the work, quitting the eastern part of Dover and proceeding seawards in a south-westerly direction for a distance of 3,800 feet. It then turns westward and continues further for 2,200 feet, stopping at a point 600 feet from the end of the Admiralty Pier. This 600 feet width is the entrance to the harbor.

The pier already in progress has been twenty five years in hand, the work being executed in stone facing, the inner filling being of concrete. The new work is to be entirely of the latter material, and it is proposed to use convict labor in the construction. By modifying the design of the structure now being erected, which is another feature of Colonel Clarke's design, it is believed that the whole can be completed in five years.

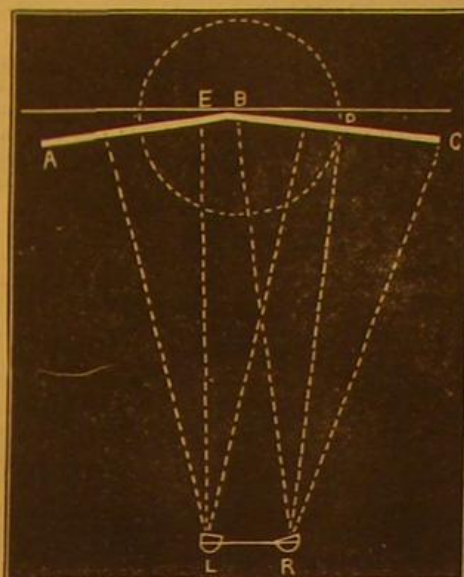
The value of a harbor of refuge at Dover will be understood when it is known that the South Foreland is but five miles east from the town. This promontory is frequently the scene of most tempestuous weather; and when the wind is northeasterly, whole fleets of vessels lay there unable to round it, suffering very considerable damage. The work would also add to the attractions of Dover as a marine resort, its beautiful surroundings and bracing air having long made it renowned in Europe. It has a very handsome facade of residences, and the commercial part of the town lies well protected by the South Downs, which almost surround it and through which the two railroads enter by long tunnels. Immediately to the left of our picture is the cliff whose appalling height is so well described in "King Lear," from which it obtained the name of "Shakespeare's Cliff." A prominent point in the view is Dover Castle, which was built by Julius Caesar after his landing in Great Britain, 1,930 years ago. Thirty-five acres of ground are covered by this work, which is still a redoubtable fortress, now armed with the best modern artillery. The heights on the west side of the town are surmounted by a very large fortification, with barracks, bombproof magazines, etc. But the harbor of refuge, open to all nations, will be a more beautiful and probably more useful example of the powers of modern science than either ancient or modern strongholds.

The Chemical Society of Berlin have decided to erect a statue of Liebig, either at Darmstadt, Giessen, or Munich. Subscription lists have been opened throughout Germany in order to secure the necessary funds.

New Stereoscope for Large Pictures.

In the accompanying diagram I have attempted to indicate the construction of an instrument, available for pictures of large size. The two halves of each stereogram are to be mounted on pieces of card-board, joined together by leather, cloth, or other flexible material, so that the whole may be shut up like a book, with the pictures face to face.

Let L and R indicate respectively the positions of the left and right eyes of the observer, and the lines, A B and B C, the boards or frames upon which the folio pictures rest. The perpendicular pencils of light from the center of each picture now reach the eye pieces in converging lines, which, by



transmission through the prisms, may be rendered parallel or divergent to suit the particular theory of binocular vision approved of by the constructor of the instrument. I may observe that parallelism is the idea which accords best with my own apprehension of the subject. After transmission through the prisms, the rays are finally passed through suitable magnifying lenses, whose centers, I apprehend, may be employed for the purposes of vision. The eye pieces themselves may be constructed of single pieces of glass ground to a spherical curve on one side (the outside), and to the refracting angle on the other.

To determine the angular inclination of the pictures to each other, find, first of all, the point, B, at which their juncture shall be placed. Then, with a radius equal to one half the width of the pictures to be shown, describe the circle seen in the figure. From each eye piece draw a line touching the outside of the circle, and from the center of the circle draw other lines through the points of juncture. The result is the angle for the pictures. In the right hand portion of the figure I have drawn lines showing the actual direction taken by the rays in passing from the picture to the prism, and in the left the virtual or seeming direction of those rays.

The advantages I claim for this form of lenticular stereoscope are:

1. That it admits the use of pictures of any size.
2. That those pictures are not mounted on separate sheets of card.

3. That they are, as heretofore, right handed, and therefore capable of production by any perfected process.—D. Winstanley, in *British Journal of Photography*.

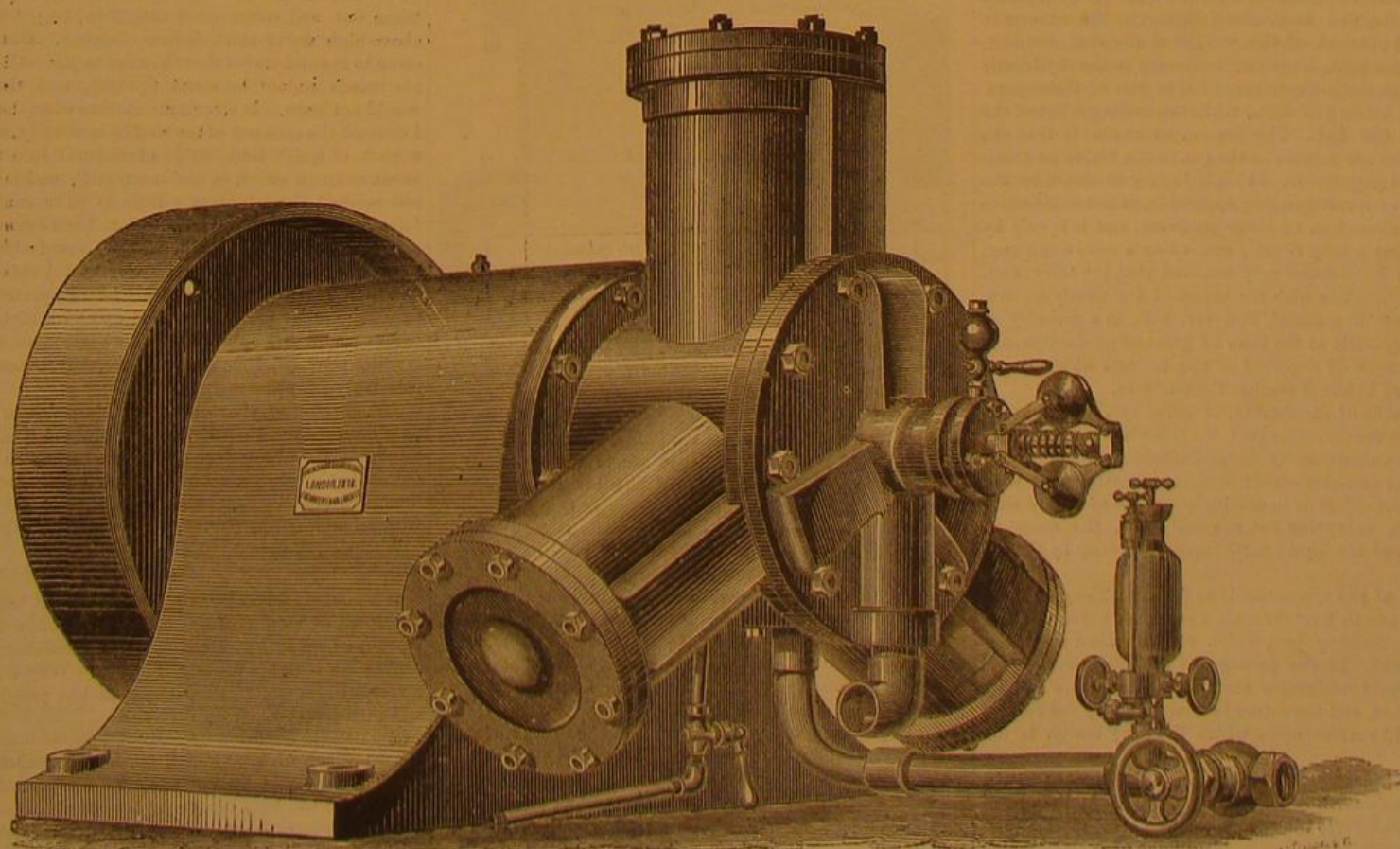
THE THREE CYLINDER ENGINE.

We published sometime ago a sectional view of an engine constructed with three cylinders, placed at angles of 120°, and three pistons operating one crank. We give herewith a view of the complete machine, from which it will be seen that the dead centers are overcome and the fly wheel is dispensed with; and a very high piston speed, to the attainment of which engine builders are now specially directing their attention, is at once made possible. Two thousand revolutions per minute, without jar or disturbance, are said to have been reached by this engine, which is the invention of Messrs. Brotherhood and Hardingham, London, England. The cylinders are arranged, says *Engineering*, to which we are indebted for our illustration, around a central chamber with which they communicate, the whole being cast in one piece. The crank pin, after passing through the connecting rod eyes, is prolonged, and fits into a hole in a rotary slide valve, which it thus actuates. The valve has a steam and exhaust port, which are alternately placed in communication with the passage belonging to each cylinder. In working this engine, steam is admitted to the central chamber, and exerts an equal pressure on the inner sides of the three pistons. Thus far the machine would be in equilibrium. But steam now passes through the slide valve to the outer side of one piston, thus throwing that piston into equilibrium but the three pistons collectively out of equilibrium. In other words, it renders the pressure on the inner sides of the other two pistons effective. A rotary motion of the crank and slide valve ensues, and the other pistons are alternately operated upon in a similar manner, the constant effective area for pressure being that of a piston and a half. If steam be not admitted during the whole of the inward stroke of a piston, it follows that the piston is not entirely thrown into equilibrium, and the crank has to assist it in the return stroke. The effect is of course equivalent to working steam expansively in an ordinary engine.

It will now be seen, and this is the most important feature of the engine, that a piston, when moving in one direction, pulls the crank, and when moving in the other, is pulled by the crank. Hence, the strain on the connecting rod is always a tensile one. No knock can therefore take place in the connecting rod eyes on the alteration in the direction of the piston's movement; so the fit may everywhere be quite loose, and, instead of constantly adjusting brasses, it is only necessary to renew a few bushes when excessive wear has taken place. Similarly the slide valve is free to slide on the crank pin, and adjust itself to its face as wear takes place; and the back of the crank disk always maintains a steam-tight joint in the same manner. The lubrication at first proved a source of difficulty, but it is now amply secured by the simple addition of an impermeator to the steam pipe, the oil being carried by the steam as a medium to all the working parts.

In the course of experiments it was found that few metals would stand heavy work in high pressure steam under such conditions. Ultimately hard phosphor-bronze bushes for the connecting rod eyes, working on a hardened steel crank pin, were adopted, and these are found to last a long time without any oil whatever, the steam affording of itself sufficient lubrication for these two metals.

An average speed of only 300 feet per minute for the pistons is said to give a very high indicated horse power in pro-



THE THREE CYLINDER ENGINE

portion to the size and cost; besides which, there are the advantages due to the saving in weight. It will be seen that great protection is afforded to the moving parts, and that cleanliness of working is insured. The economy arising from the friction being so much reduced is very considerable, while the ready applicability of the engine to a great variety of uses is one of its chief merits.

The Effect of the Panic on the Iron Works.

It appears that the late financial crisis is producing after results of a rather serious nature as affecting the iron manufacture in the neighborhood of this city. A *Tribune* reporter has lately visited officials of several prominent establishments, and, with the exception of the statements of representatives of the Quintard and Architectural works, the inference to be drawn from the opinions selected is that the prospect for the autumn and winter is far from encouraging.

The agent of the West Point Foundry says that, previous to the panic, there was every expectation of a brisk demand for machinery. Now, however, prices have fallen, and people are putting off enlarging or repairing their shops until more favorable times. The West Point works, which usually employ from 600 to 700 men, are working barely two thirds of that number, and it is probable that even further reductions will be made. Little hope is held out of a revival of business before spring. The President of the Atlantic Dock Iron Works confirms the latter statement, and adds that the workmen have but a gloomy outlook. Out of 250 men employed at the last mentioned establishment, 100 will be shortly discharged. To the panic, the entire difficulty is ascribed, notably through the stringency of money, the fact of a general retrenchment taking place, and buyers are holding back in apprehension. Few contracts are now being made because contractors hesitate to involve themselves in engagements in the present unsettled state of affairs, while manufacturers shrink from accepting orders, unless they are certain they can get ready money on their completion.

The J. L. Mott Iron Works will continue carrying on a large stock and running on full time with a strong force of hands, in expectation of better times in the spring. If matters become worse, the company will have to follow the general example and make reductions. About 400 men are employed.

The Astor Iron Works employs but 300 hands, instead of 700, and proposes to reduce the former number by half. Substantially the same views as already given, as regards an amendment of business in the spring, are held.

The Architectural Iron Works have work ahead for two or three months. Their customers are of the wealthiest class, and the government is also a patron; consequently collections are exceptionally ready with this company, but even in their case some difficulty has been found during the early part of the difficulty. No trouble is experienced in obtaining currency to pay off. The Quintard Works have not been interfered with seriously, on account of their business being mainly repairing. The proprietors consider that the complications will be merely transient and that money will be plentiful during the winter, while an unusually active trade will spring up during the spring. The full force at the establishment is 500 hands, and no material reductions will be made.

A New Mode of Condensing the Liquefiable Matters held in Suspension in Gases.

BY MM. E. PELOUZE AND P. AUDOUIN.

It is well known to all gas engineers that gas, as it passes from the retorts, carries along with it a quantity of liquefiable matters (tar and ammoniacal liquor) to the amount in general of 12 per cent of the weight of the coal distilled. Only 4 or 4½ per cent, however, condenses in the hydraulic main, although the temperature of that part of the apparatus is always below 212° Fah., while the boiling point of the tar is above 600° Fah. The reason, no doubt, is that the liquid particles are present in the gas in the vesicular form. The reduced temperature, which it is easy to obtain by the employment of a refrigerating apparatus, is not sufficient to cause the condensation of these particles; and it is only by carrying the gas a long circuit, and using a coke condenser, that they can be so completely removed that the tarry matters may not interfere with the action of the purifying materials. It may be asserted, however, that, in a majority of works and especially at the time of greatest production, the gas is not completely deprived of the matters which ought to be removed before it reaches the purifiers.

The new mode of condensing, invented by the authors, is founded upon the principle that the liquefaction of the globules, held in suspension by the gas, is brought about by the contact of the particles either with solid surfaces or with each other; the object is to obtain, by the aid of a very simple apparatus, occupying but a small space, the complete condensation of the liquid particles carried along by the gas or vapor.

The action of the apparatus is as follows: The gas to be purified is made to flow through a series of holes of small diameter, so forming jets, which strike against a surface placed opposite. In the passage of the gas through the holes, the liquid molecules are brought into close contact with each other, and the action is completed by the contact with the solid surface upon which the tarry matter is deposited.

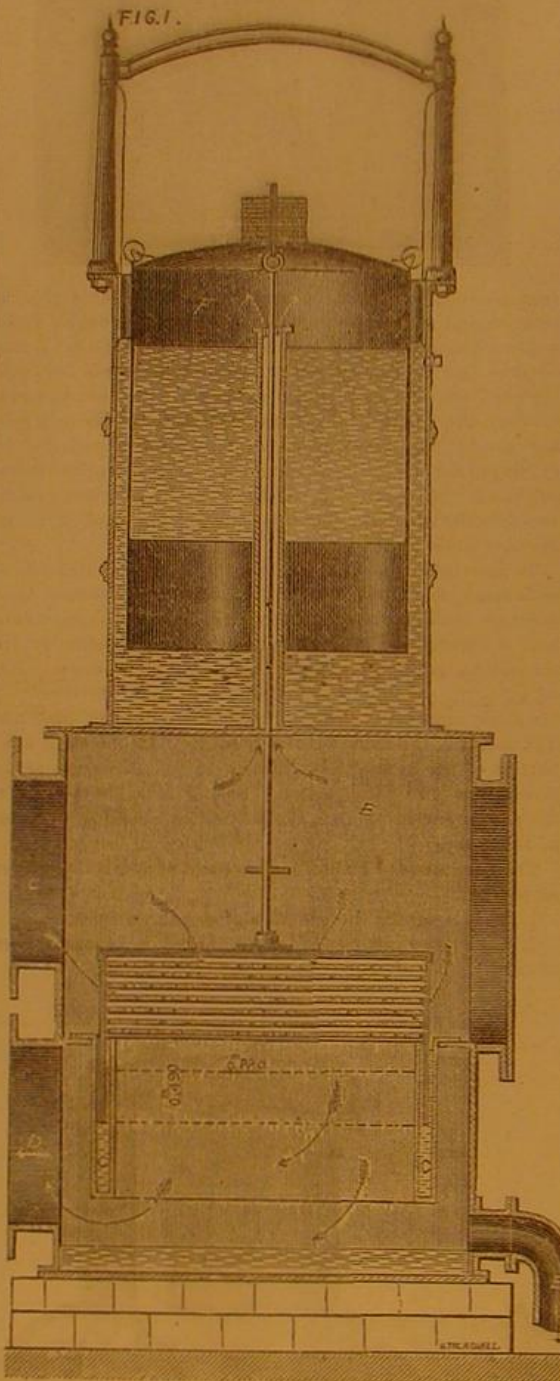
The intimate contact between the liquid globules and the gas which holds them in suspension, obtained by the use of this apparatus, effects the condensation of some matters (ammonia, sulphuretted hydrogen, bisulphide of carbon) which hitherto have only been removed by complicated methods,

sometimes injurious to the illuminating power of the gas (washing with liquor, etc.). It must be added that, by passing the gas, properly cooled, through the apparatus, any naphthalene is completely eliminated and retained along with the tarry matters.

A high pressure is not necessary to the use of the apparatus, eight tenths of an inch of water being sufficient in ordinary cases. It may be placed either before or after the exhauster; if before, a weak vacuum must be maintained.

The most striking result of the use of the apparatus is the almost complete removal of sulphuretted hydrogen from the gas, and it follows that a very important economy in purifying materials must be effected wherever it is employed. An apparatus (of which we append an engraving) has been in operation in one of the Paris works, at which the daily make exceeds 350,000 cubic feet, for several months with perfect success; and others are now to be installed in all the works of the Paris company. The gas, after passing through this apparatus, the capacity of which is less than a cubic yard, is found to be completely deprived of tarry matters; while the tar deposited is rich in oils, and the ammoniacal liquor collected is larger in quantity and more than twice the strength of the ordinary condensed liquor.

In conclusion, it is said that numerous photometric experiments have proved that the gas loses none of its illuminating power in passing through the apparatus.



A is the condensing apparatus, properly so called; B is the chamber in which the apparatus moves; C is the inlet for gas; D is the outlet for gas after passing the condensing apparatus; E is the outlet pipe for condensed products, terminated by a siphon; F is the regulator, by means of which the number of perforated plates in use is varied according to the quantity of gas to be purified; and G is the water space into which the apparatus dips.—*Journal of Gas Lighting.*

Statistics of Vassar College.

There are over 21 miles of gas pipe in the building, which, including the various stories, covers a floor space of over five acres. There are 410 young lady students, 50 professors, teachers, and assistants, and 100 servants and helpers, making between five and six hundred persons, all of whom board upon the premises. A special telegraph wire and a horse railway extend from the College to Poughkeepsie, N. Y., distant 2½ miles. The young ladies drink 150 quarts of milk every day, swallow 150 pounds of butter, and 40 pounds of sugar for pudding sauce for one dinner. The students are required to spend one hour daily in the open air for exercise; they have a lake, and boats for rowing in summer, and skating in winter. They have a riding school, bowling alley, gymnasium, etc.

Correspondence.

(Correspondence of the Scientific American.)
Middletown, N. Y.—Its Manufactures and Institutions.

To the Editor of the Scientific American:

If anybody wishes to find a really enterprising, thrifty and beautiful place, let him come up here to Middletown. It is 67 miles from New York on the Erie railway, in Orange county, the garden of New York State.

I suppose your readers know that the finding of so many fossil animal remains hereabouts, including bones of gigantic mastodons, is attributed to the ancient attractive fertility of the soil and its superior natural endowment with the phosphates of lime: a substance that contributes luxuriance of growth and vigor not only to grains and grasses, but to all living things that derive nourishment therefrom. Hence the inhabitants of Orange county are notable as an enterprising and long-lived people. The county chickens lay the finest eggs, the cows yield the richest milk, the cattle and sheep furnish superior meat, the oxen are large and brawny, the horses muscular and spirited.

Middletown is one of the homes of inventors. Here new inventions and manufactures flourish. I have been much interested during a tour of the shops. The Orange County Butter Pail Company are making here large numbers of the improved tub, patented not long ago by your house. In the various mechanical establishments, which include large foundries, rolling mills, hat works, horse shoe nail mills, file works, saw factories, etc., I find that the *SCIENTIFIC AMERICAN* is read and studied with satisfaction by the more intelligent operators.

Among the specially interesting places that I visited were the Madden rolling mills, and the saw factory of Wheeler & Co. Both of these concerns were built up and are guided by a man who, from what some might regard as a humble condition of life, has elevated himself to a high place in the regard of his fellow citizens. E. M. Madden was, only a few years ago, a poor factory boy, but now he is a distinguished man, has occupied many important public positions, is now State Senator, to which place he is soon to be re-elected. I see that some of your city papers speak disparagingly of him, doubtless from political bias. But they evidently know little of his real character. A natural orator, honest to a fault, incorruptible, progressive, the advocate of all useful enterprises and improvements, he is greatly esteemed by the people; and the masses have in him a faithful and able representative. The six noble public schools which exist here are examples of his personal efforts to promote the public good; while among the later works of which he is godfather is the new and splendid State Asylum for the Insane, at this place, now nearly finished. But I must defer a description of this model institution until my next; after which I may give you a few words upon the remarkable mineral deposits of this region, and perhaps say something of certain interesting geological curiosities found near Goshen, seven miles hence.

TRAVELLER.

Middletown, N. Y., Oct., 1873.

Carbonic Acid in Wells.

To the Editor of the Scientific American:

Last year I read your articles on carbonic acid gas in wells. I remember that I was once engaged in putting up a bathing house, to be supplied with water from a well. After getting, as I supposed, everything done, the pumps soon exhausted the water from the well, and there was no remedy but to take out the walling and dig it deeper. I had the wall taken out and commenced rewalling, to get the new wall above high water mark before stopping. One of the hands came to me and stated that the man in the well could not get his breath unless he stood upright, and that his candle would not burn. It struck me at once what the matter was. I ordered the man out of the well immediately, and put about a peck of quick lime (oxide of calcium) into the tub, with about as much water, stirred it up well, and lowered the tub and worked the winch a little so as to cause the gas to fall on the surface of the lime water. Then I drew it up, stirred up the lime and water again, so as to present a fresh surface of lime water, and lowered again. I did this three times, and then let down a candle, which burned perfectly well. My man then went back and walled up above high water mark before stopping for the night. I was astonished last year, in reading your articles on this subject, that no one struck upon this truly scientific remedy.

The burning of charcoal or anything else in wells would only increase the quantity of carbonic acid gas, unless such a current could be gotten up by the fire as to carry the gas out with the smoke, which I think hardly possible. The lime plan is easily done, absolutely certain, and in accordance with scientific principles.

F. A. HOKE.

Walhalla, S. C.

WE published last week a portrait of the late Joseph Gillett, Esq., of steel pen fame. A correspondent is reminded thereby of an amusing conundrum, circulated long ago in connection with his name, as follows: Why was Mr. Gillett a very wicked man? Because he makes people steel pens and then tells them they do write.

Two prizes, of \$350 and \$150, have been offered by the English Society of Arts, on the motion of Sir Joseph Whitworth, for the best essays on the establishment, in large industrial concerns, of savings' banks for workmen. Manuscripts are to be sent to the Secretary of the above association at London, before the 1st of December next.

LETTER FROM UNITED STATES COMMISSIONER
PROFESSOR R. H. THURSTON.

NUMBER 17.

LIVERPOOL, ENGLAND, September, 1873.

We have at last reached the end of our European tour of observation, and are ready to re-embark for America. The "doings and observations," of which we are directed to make reports to the President, have been fruitful of interest and of instruction, and we look forward to our arrival at home with almost unalloyed pleasure. We have enjoyed good health, have made many pleasant and some eminently distinguished acquaintances, have enjoyed most exceptional opportunities of acquiring information, have added largely to our stock of general knowledge, and have filled our notebooks with the technical and engineering statistics and memoranda which we came specially to seek.

Since leaving France, we have been even more fortunate in gathering professional information than during our continental journeyings. The fact is not at all surprising, however, for, as was remarked at Vienna, by far the greater part of all that is admirable as well as novel, in European practice, has its origin in British workshops. We have found time to make an excursion to some of the more interesting of the working districts of this country, and have also been fortunate enough to see some of the larger and best known workshops.

On the whole, there does not seem to have been an important advance in the standard practice in either of these important fields of labor since our last visit to Great Britain, three years ago. This is the case in the machine shops quite as much as elsewhere. Visiting the establishment of

SHARP, STEWART & CO.

a firm noted for the accuracy of their work, and particularly for the excellence of the tools of which a large proportion of their product consists, we found the verdict of the Vienna jury, which ranked them with our own best builders, fully sustained. Their shops have been erected in that patchwork manner which is often observed in Great Britain than in the United States, and are by no means as well built, or as well arranged as could be desired; and a large proportion of their tools would be considered antiquated, and would have been long ago replaced by more effective machines had they been the property of an American firm of first class tool builders.

The fact that the saving of the labor of a single man pays the interest on capital amounting to twelve or fifteen times his annual wages seems less generally recognized in Europe than on our side of the Atlantic, and the possibility of the principle finding application in the substitution of modern designs for older tools seems unsuspected. All tools here are made self-feeding, however, and considerable ingenuity is exhibited in devising new feed motions. We noticed here, as in some other shops, the adoption of the Whitworth tool holder for planing machines. This contrivance is a simple and effective one for rotating the tool and then taking a cut when the table runs backward as well as when moving forward. A round nosed tool is used, and a large saving of expense is effected by the efficiency of the device. A slotter was used for dressing up the cranks of a cranked axle. The axle was secured in a vertical position, and two cutting tools were employed, thus trimming both cranks simultaneously. Systematic endeavors to effect the greatest possible saving of labor, a direction in which our manufacturers excel all others, are more noticeable here than in any place visited in Europe. The rapidly increasing cost of labor in Great Britain is compelling rapid changes in this direction. A large amount of locomotive work is done here, and little more need be remarked than that the designs were in greater variety, and more in accordance with American ideas and practice, than is usual in this country. The work was unusually excellent. Steam riveting seems to be practiced wherever possible. In setting up seven eighths rivets, two blows were invariably given, and thus, although the machine was rather a light one, the work was thoroughly performed. The edges of all plates were planed, instead of being left, as is too generally the case with us, to be chipped by hand previously to caulking, a not infrequent cause of furrowing and of consequent explosion. Fireboxes were of copper, and the tube plates, at that end, which were an inch or more thick where the tubes entered them, were thinned down, below, to the same thickness with the other firebox sheets. Shells were made with butt joints and covering strips. Wheel tyres were of Vickers' steel, and were always flanged, whatever the position of the wheel. We were received most cordially by a member of the firm, and were introduced to a son of a director of the company, who kindly took us through the works. The young gentleman was serving an apprenticeship, and learning the business in the most thorough manner. We accepted this fact as an evidence of a better appreciation of the dignity of labor than has generally been observed in England, as well as of an understanding of the fact that scholastic attainments must be supplemented by a knowledge of shop practice, gained by actual contact, to secure ultimate success in any branch of mechanical engineering.

The most remarkable and in every way interesting locomotive building establishment in Great Britain, or in Europe, is that of the

LONDON AND NORTH WESTERN RAILWAY COMPANY,

at Crewe, and we spent a day there, seeing more that was novel and a greater display of ingenuity than we had ever seen outside the United States in a single manufactory. The superintendent at Crewe was, for a long time, Mr. Ramsbottom,

one of the ablest locomotive engineers living, and to him is due the credit of planning this great establishment, and for the majority of the many ingenious departures from and improvements upon standard practice, as seen elsewhere. Six thousand men are employed here, and a town of 22,000 inhabitants has been built up about the works.

One hundred and fifty locomotives are built per year, and nearly two thousand are kept in repair. Immense quantities of steel are made at these works, and converted into rails, tyres, boilers and running parts of locomotives. Even the bricks for the new building in course of erection are made by an excellent machine built at Rugby, and are baked on the grounds in the annular Hoffman kiln. The steel works contain four converters of ten tons capacity each. The large and well planned, finely lighted foundry, fitted with hydraulic cranes and steam travelers, is a model of its kind. The iron from a number of puddling furnaces, and the steel from the Bessemer works, are worked in a rolling mill in which the large plate rolls are driven by the now well known Ramsbottom reversing engine, or are forged in the smith shop, adjoining, by the curious but effective Ramsbottom steam hammer. In this machine, the work lies upon an anvil which simply supports it, while powerful steam pistons drive against it, simultaneously from both sides and horizontally, great masses of iron which run upon tracks supported at the proper height above the floor. The heating furnaces are Siemens' regenerative gas furnaces, the most economical known; yet even these are on so large a scale as to require two hundred tons of coal per day.

In the machine shops, we noticed that eccentrics were all bushed with white metal, and we were particularly interested in the style of connecting rod ends. They are all made solid, without strap, gib or key, and bushed with white metal. No provision is made for taking up wear. When worn and beginning to shake, the bushings are taken out and recast. This is only found necessary at long intervals. Dome tops are struck up, and the seats of all boiler mountings are of wrought iron. The boilers are usually four feet in diameter and three eighths of an inch thick. Steam is carried at 120 to 130 pounds. Engine frames are of 1½ inches plate, cut out, as in all European shops, straightened and then ground smooth by a grindstone revolving horizontally in a tank containing water. All wheels are of wrought iron. Piston rings are of the Ramsbottom style, small rings sprung into grooves in the piston, and seem to give full satisfaction. Our forward trucks are never used, their small wheels being looked upon with great distrust. English and continental builders prefer a single pair of larger wheels. The solid bar Stephenson link is used, a decided improvement upon the strap link universally used in the United States.

Both injectors and feed pumps are fitted to all engines. The express engines of this road are driven at higher speed and are claimed to make better time than those of any other road in the kingdom. They are remarkable for the great size of their, usually, single pair of drivers. Six and a half feet is the usual size, seven and a half is not uncommon, and eight feet diameter has been reached, in the one example of the engine "Cornwall," which is still kept at work. This engine shakes badly and has large bills for repairs. The favorite design is now, as with us, two pairs of coupled wheels for express engines, but with drivers six and a half feet diameter. Freight engines are given five feet six inches wheels.

This whole establishment, with its fine buildings, excellent plant, and peculiar designs of machinery, and its excellent work, should be carefully inspected by every American engineer visiting Great Britain.

In iron making, the growth in size of blast furnaces seems to have ceased; the temperature of blast has not been elevated; the same forms of hot blast stoves are still used; and the yield of metal per ton of fuel consumed still remains as three years ago, about ten per ton, for the best known results. In the

CLEVELAND DISTRICT

the most generally approved size of furnace seems to be about 75 to 78 feet high, and 26 to 27 feet diameter of bosh. The temperature of blast is about 1,000° or 1,100° Fah., with cast iron stoves, and two or three hundred degrees higher with brick ovens.

THE CUMBERLAND REGION

was the most interesting section visited, both on account of its own importance and the magnitude of its yield, and of its peculiar relations to our own iron manufactures.

This district is situated on the extreme northwestern corner of England, and, until within a few years, was only known as a beautiful country abounding in fine scenery and picturesque old ruins. An excellent red hematite, capable of yielding exceptionally fine iron, was known to exist, but its distance from the market and the comparatively high cost of fuel forbade the successful development of the iron manufacture in that country. The introduction of that most wonderful of all metallurgical processes, the Bessemer steel manufacture, and the discovery of more convenient and very extensive deposits, both of ore and of flux, has, during the last two decades, produced an astonishing change.

The ore of Cumberland is the only known British ore which answers well for the process of Bessemer, and it therefore happens that the opening of this section of country has been pushed with a rapidity which reminds one of the mushroom-like growth of some of our own western towns. It thus happens also that the future prosperity of Great Britain must, probably, depend largely upon the extent of this single deposit, for it seems very certain that the prosperity of any manufacturing people, like the British, must depend in an important degree upon, if it is not absolutely

determined by, the cheapness with which its demands for low steel can be supplied.

The principal town in Cumberland is

BARROW,

a city of twenty-five or thirty thousand people, occupying the site where, a quarter of a century ago, existed a small and unknown hamlet. Here, the wealthy owners of the soil and proprietors of all manorial rights, the Dukes of Devonshire and Buccleugh, have established what is probably the finest Bessemer steel works in Europe, in which, and in the neighboring mines, are employed from ten to twelve thousand people.

We found, at Barrow, sixteen blast furnaces, varying from fifty-six to sixty-one feet high and from sixteen to nineteen and a half feet in diameter, the larger of these sizes being considered to be about the maximum for economy here. The blast was heated in both iron and firebrick stoves, the temperature of blast being about 900°. A higher temperature had been tried with less satisfactory results. Nineteen blowing engines of a united power, as stated, of over two thousand horses forced this air into a conduit of immense size. The production of pig metal was given at 280,000 to 300,000 tons per year, from unmixed Cumberland ore. The metal, which we had an opportunity to examine, was a fine, rich, dark gray iron, precisely the material best adapted to the manufacture of Bessemer steel.

Eighteen converters are set in the steel works, and the production of steel amounts to 100,000 tons per year, principally rails and tyres. The roll trains and accessories were of the most approved modern design, and the heaviest train is driven by a Ramsbottom engine.

The plan of buildings and the general arrangement of plant are exceptionally excellent. The raw material enters the works at one point and passes through one process after another, continually approaching the opposite extremity, where it finally emerges in marketable shape. So fine an example of a well arranged and well built establishment is less often met with here than at home, where we have not a few engineers who know how such work should be done, and find a way of doing it.

The ore of Cumberland is smelted here without mixture. It is a rich ore, and is almost free from either of those poisonous constituents, sulphur and phosphorus.

The spiegeleisen is obtained from both Sweden and Germany, the former being now furnished of admirable quality. The coke is brought across the country from Durham, a distance of something more than a hundred miles, and the limestone is found, of good quality, nearer home. The material produced is, as might be expected, of most excellent quality, as was evidenced by the fine samples shown here as well as by the still more remarkable and beautiful specimens which we saw at Vienna. It finds a large demand in the United States.

We might wish that time would allow of an extended description of other establishments in which we have seen so much to admire or to criticize during our short stay on this wonderful island, but our letters have already, probably, occupied too much space in the crowded pages of the SCIENTIFIC AMERICAN.

In the great Cumberland iron-making district, we learned that, even there, the size of furnace and high temperature of blast had apparently reached its limit. In Lancashire and Staffordshire, we saw some of the worked out collieries which have drawn the attention of thinking Englishmen seriously and earnestly to the question of the future coal supply. The dozens of unused hoisting engines and water filled shafts to be seen between Birmingham and Stafford, and the startling figure—probably 150,000,000 tons—representing the present annual consumption, when considered together, may well startle British statesmen. To an American this may appear also most important as indicating the rapid approach of the time when our markets must be supplied solely from our own iron and coal producing districts. Fortunately, we are most amply supplied with this kind of mineral wealth, more valuable than the gold deposits of California or the silver of Colorado and Nevada. At

SHEFFIELD

we saw the great mills in which were rolled the fourteen and fifteen inch armor plates for the British navy, and enjoyed a pleasant meal with the proprietors of the establishment noted, the world over, for the manufacture of the strong, tough Firth steel, of which is made the inner tubes of all British ordnance. We found there also a large number of men employed in making files. We visited the district where the well known brands of

LOWMOOR AND BOWLING

iron are made, and learned to attribute their excellence, their hardness, pliability and uniformity of high quality to the care taken in manufacture rather than to any special peculiarity of ores or of processes. We particularly noticed that no squeezers were used, but that puddle balls were invariably hammered. We spent a day at

SOHO,

inspecting the works founded by James Watt, and seeking out the old tools, of which so many were designed by that great man.

Of all these and of many other interesting excursions we cannot write at length, but, undoubtedly, what is here left untold will be related, sooner or later, by abler correspondents of the SCIENTIFIC AMERICAN.

And now we leave many places unexamined that we had hoped to visit, and we embark, our pleasure in anticipating our early arrival at home being mingled with some regret that so much still remains unseen.

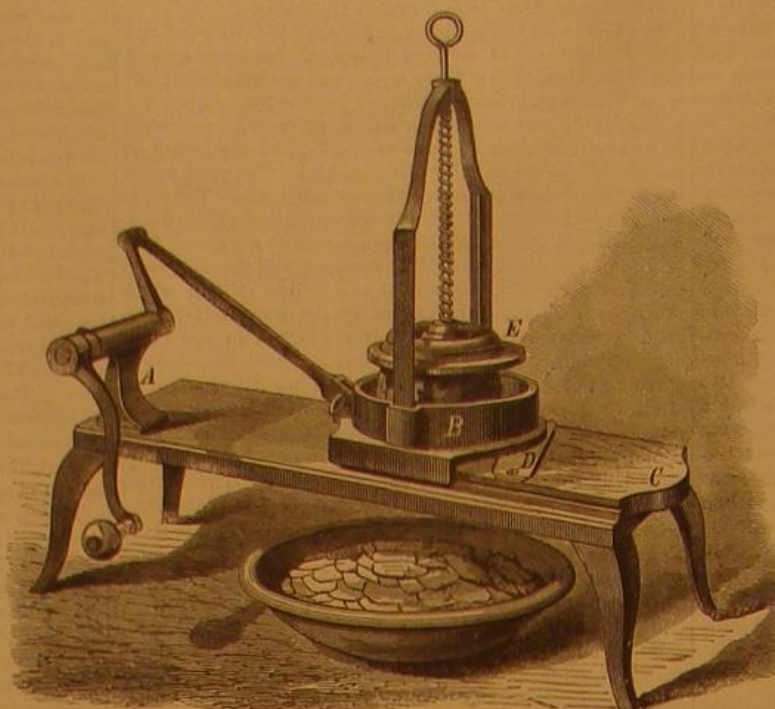
R. H. T.

FRUIT AND VEGETABLE SLICER.

Our engraving represents an ingenious little device for slicing potatoes, fruit, etc., preparatory to cooking. The mechanism is quite simple, and its work, judging from the performance of the machine sent us for examination, is expeditiously and nicely done. The hand crank shown actuates a shaft in the fixed standard, A. On the end of this shaft is an arm connecting, by means of the rod shown, with a bottomless metal receptacle, B. The latter has suitable flanges and projections, which, working in side grooves, confine its to and fro motion, caused by turning the crank, to the extent of the piece, C, which, it will be noticed, is elevated above the platform. The cutting apparatus is simply a two edged blade, D, in a slot in the bed piece, C. It is set at an angle, thus giving a drawing cut to the article brought against it.

Two bent standards are connected with the receptacle, C, and through their point of junction above passes a rod which is surrounded by a spiral spring, and carries at its lower end a follower, E. When the fruit is placed in the receptacle, B, this follower is pushed down upon it by the expansive force of the spring. The crank is then rotated, and the fruit and its holding apparatus caused to travel to and fro along the bed, C. The spring continually presses the fruit down, so that the blade, at each movement of the receptacle, B, across it, cuts off a thin slice, which falls through the slot into a dish below.

For further information regarding sale of rights, etc., address the inventor, Mr. F. C. Vibert, Hockanum, Conn.



VIBERT'S FRUIT AND VEGETABLE SLICER.

crack. The tang or shank is formed by a drop hammer and die, leaving the outer end, which is slightly hooked, and the edges to be the full width of the flat face of the bar. Cutting edges are thus formed which cut the width of the kerf and plane each of its sides. We are informed that the teeth thus made are durable and not liable to strain the saw plate, are intended never to be sharpened after insertion in place,

section of the inner faces of the jaws, F and G, is a circular hole in which fits the round portion of a movable jaw, H, which is so constructed as to be upset or riveted in a countersink at the outer sides of said hole, so that, while it cannot be disengaged or loosened, the jaw, H, may freely turn in the socket thus formed. I is a temper screw passing down through jaw, F, and bearing on jaw, H, so as to adjust the latter to different angles with relation to the face of the lower jaw. J is a saw tooth inserted in position, showing, by the dotted lines, that the jaw, H, may be adapted to suit its particular shape or that of any other ordinary form of tooth.

In operation, the jaw, H, is adjusted as represented and firmly held in position. Blows are then struck with a hammer at the other end of the body, hard enough to upset the tooth and give it the desired form and sharpness at its cutting edge. This the device is claimed to do in better manner than the work can be performed with a file, while one size of the invention is equally well adapted to every size and shape of saw tooth, from a 72 inch, through gang mill and muley saws, down to the finest toothed bench implement.

These improved tools are covered by various patents, the most recent of which are dated September 16, 1873. Further particulars may be obtained by addressing the inventor as above.

SAFETY RAILWAY SWITCHES.

We have lately examined, at the office of the Broadway Underground Railway, corner of Warren street and Broadway, this city, a large and splendid working model of Saxby & Farmer's railway lock switches, now so extensively used in England. The employment of this device is rendered obligatory upon all new railways in Great Britain, by act of Parliament, and it is voluntarily employed by most of the older companies. It is regarded in England as almost indispensable to the prevention of accidents.

This model, we understand, is a duplicate of the beautiful apparatus now on exhibition at the Vienna Exposition and which the London Times correspondent speaks of as follows:

"Saxby and Farmer exhibit a beautiful model of their apparatus for directing the traffic at great railway junctions or termini. It has already come very generally into use, yet it cannot be too widely advertised; for, as it renders accident humanly speaking impossible, a grave responsibility rests with those companies who delay to adopt it. Its principles are that the signals are worked in inseparable connection with the points and switches. It is impossible to signal that the line is clear unless it actually is so, while the act of manipulating one set of signals locks all the rest and keeps them at 'danger.' Thus the signal man cannot mislead the engine driver; the worst he can do is to do nothing at all; the very worst that can happen is an unnecessary suspension of traffic. It may give some idea of the importance of this invention if we mention that the men in the signal box at Cannon street have to work 67 levers, which play on the points and switches of that intricate network of lines as the keys of a piano act on the chords. Thirty-six trains go out or come in in the course of the hour, and on an average there is a movement of signals or points once in each 33 seconds. Another invaluable subsidiary invention is Messrs. Saxby and Farmer's patent switch lock and bolt. Often the signalman has to change the points at a distance of some hundreds of yards from his box. He may work his levers and signal 'all right' in innocent unconsciousness that anything is wrong; yet a stone may have interposed, the points may not have answered to his levers, and the train may be thrown off the rails. Messrs. Saxby and Farmer's bolt effectually prevents such accidents."

We are glad to know that this valuable improvement is to be employed upon the Broadway Underground Railway. Further information can be had of Mr. Joseph Dixon, agent for this country, as above, where the apparatus may be seen. It is well worth examination by railway people.

Travel between America and Europe.

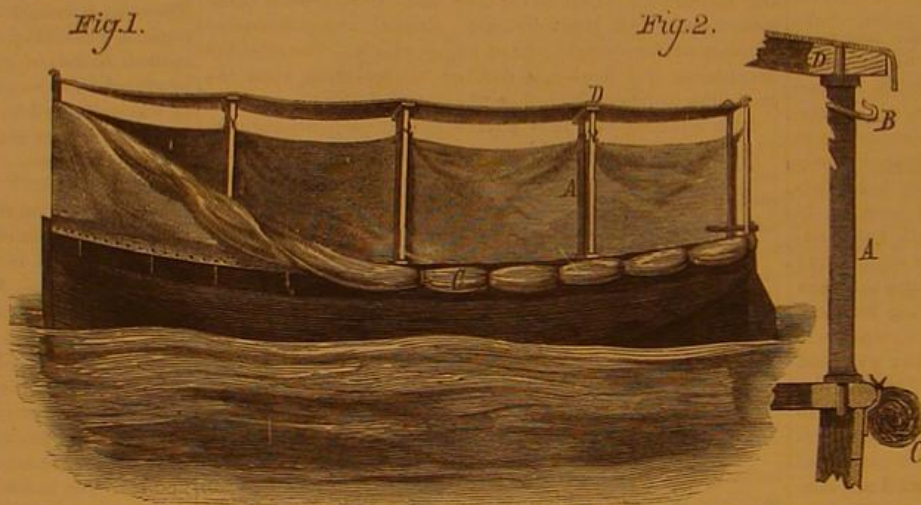
A new route between New York and London is proposed. It consists of railroad from the former city to Shippegan, on the Gulf of St. Lawrence, steamer to St. George's Harbor, Newfoundland, railroad to St. John's, steamer to Valencia, Ireland, railroad to St. George's channel, and steamer again to England. It is estimated that the voyage may be made in seven days and three hours.

TENT ATTACHMENT FOR LIFE BOATS.

The inventor of the device herewith illustrated presents a simple and detachable arrangement for use in connection with life boats, which consists in suitable tent-like coverings, serving as protection to the occupants from exposure to the weather or sea.

To any ordinary boat are applied stanchions, A, which are either hinged so as to fold down upon the rail or may be set in holes made for the purpose, and thus readily detached for storage, etc. These supports are placed at intervals along the gunwale, as represented. Near the top of each are a number of notches, Fig. 2, which serve to hold at various heights the movable hook, B. C, Fig. 2, is a roll of tarpaulin or canvas, which, when not in use, is stowed as shown, and fastened in compact form by proper stops. One edge is riveted to the outer portion of the boat, and the other strengthened by suitable lining and provided with eyes into which fasten the hooks, B, which serve to hold the cloth up, making it a kind of weatherboard. The pin-shaped ends of the stanchions, A, fit into holes of the lateral pieces, D, which are slightly arched and attached to the top cover or awning, also made of suitable waterproof material. The bow and stern ends of the latter are held and stretched tightly by hook-shaped ends of standards arranged for the purpose. The side covering, it is stated, will serve to keep out spray and water, and suitable openings provided with elastic bands may be arranged in order to allow the use of oars when necessary.

Patented September 23, 1873, in the United States and also in England, through the Scientific American Patent Agency. For further particulars address the inventor, Mr. John R. Adams, Truckee, Nevada county, Cal.



ADAMS' TENT ATTACHMENT FOR LIFE BOATS.

and are sold in the market by the hundred.

The second invention, represented in Fig. 2, is an adjustable jaw swage for spreading the teeth of saws. The body of the apparatus has two fixed and diverging jaws, F and G, the latter of which comes in contact with the under side of the saw tooth, and is made convex in form. Through the body, at the inter-

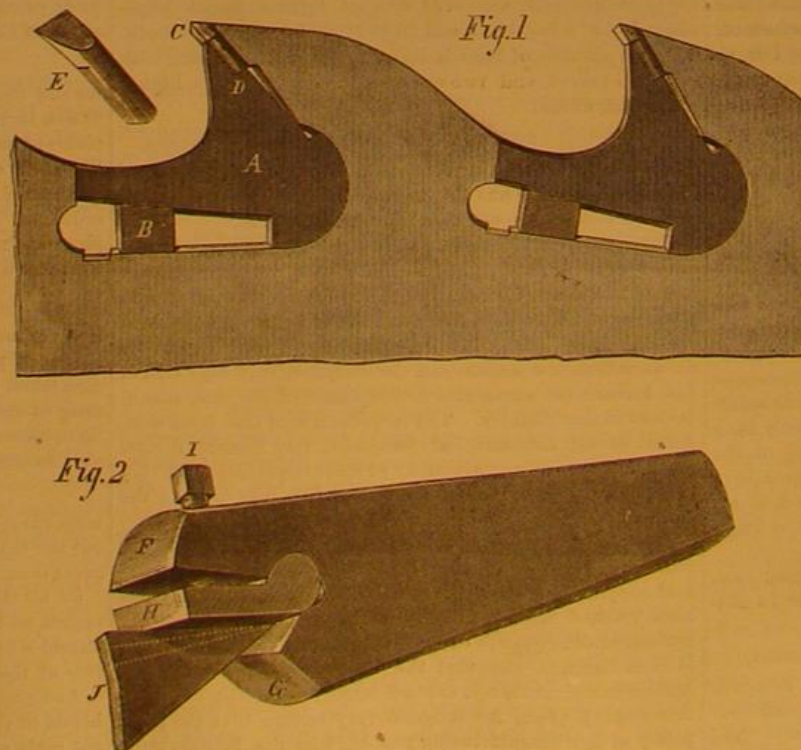
necessary suspension of traffic. It may give some idea of the importance of this invention if we mention that the men in the signal box at Cannon street have to work 67 levers, which play on the points and switches of that intricate network of lines as the keys of a piano act on the chords. Thirty-six trains go out or come in in the course of the hour, and on an average there is a movement of signals or points once in each 33 seconds. Another invaluable subsidiary invention is Messrs. Saxby and Farmer's patent switch lock and bolt. Often the signalman has to change the points at a distance of some hundreds of yards from his box. He may work his levers and signal 'all right' in innocent unconsciousness that anything is wrong; yet a stone may have interposed, the points may not have answered to his levers, and the train may be thrown off the rails. Messrs. Saxby and Farmer's bolt effectually prevents such accidents."

We are glad to know that this valuable improvement is to be employed upon the Broadway Underground Railway. Further information can be had of Mr. Joseph Dixon, agent for this country, as above, where the apparatus may be seen. It is well worth examination by railway people.

PLAHER-TOOTHED SAW AND ADJUSTABLE SWAGE.

Mr. James E. Emerson, of Emerson, Ford & Co., Beaver Falls, Pa., an inventor whose devices have frequently found place in our columns, has recently patented the two novel and, doubtless, useful inventions represented in the accompanying engravings. The first (Fig. 1) relates to movable teeth in saws, and its object is to obviate, in a great measure, the expense of such teeth by so constructing them and adapting them to a saw plate that they can be used until dull at their cutting edges, and then removed and a new set inserted in their places. Our illustration is a section of the saw plate, in which clamp pieces, A, and wedges, B, hold the teeth, C, firmly in position. The pieces, A, have shoulders at D, against which the inner ends of the shanks of the teeth firmly bear.

E is a finished tooth, shown separately. It is made from a bar of steel of suitable shape, from which blanks are cut of proper length to bear against the shoulder, D, and thus be prevented from being pushed inward during the operation. The circular side of the tooth fits into a correspondingly shaped groove in



EMERSON'S PLAHER-TOOTHED SAW AND ADJUSTABLE SWAGE.

IMPROVED FURNACE FOR BUILDINGS.

The improved heating furnace herewith illustrated serves not only as a means of warming the interiors of buildings, but also as an efficient ventilating apparatus. Its construction is such as to utilize the heat of the fire to the fullest extent, and also to distribute the same uniformly at every point to which the flues may be conducted.

Fig. 1 is a longitudinal and Fig. 2 a transverse section. A is the fire pot, the heated air and gases from which pass up and around the tubes, B, thence down and under a partition, C, and, finally, emerge at the chimney, D. By this means the cold air, which enters the tubes, B, in the direction of the arrows, from the chamber, E, is subjected twice to the hot current; and thus becoming warmed, is led away by such tubes, a prolongation of one of which is shown at F. As there are fourteen of these flues, it will be noted, that if desired, the entire number may be utilized, each as a separate conduit to a single register. Cold air also enters below and outside the fire pot, into spaces, G, Fig. 2, and thence travels to the rear, where it passes into a heating chamber, H, Fig. 2. This reservoir may, by a suitable partition, indicated by the dotted line shown at the rear of the fire pot in Fig. 1, be divided into two compartments, from each of which a separate flue may be led. I, in Fig. 2, shows a section of still another heating chamber, formed by the space between the shell surrounding the flues and the exterior casing. Air enters this from below by the conduits, J, becomes warmed, and exits by the flue, K; or, when desired, this chamber may also be divided by a longitudinal partition, represented in section in Fig. 2, when the hot air will then be led away by the two pipes, shown in dotted lines. It will be here observed that eighteen separate flues are thus provided, each totally independent of the other, and all supplying pure heated air without any admixture of disagreeable gases. The current drawn directly from the outer atmosphere never comes in contact with the fire; but on the contrary, is securely confined in tight flues or chambers, where it is heated and at once supplied to the desired localities. It will also be observed that a uniform quantity is thus, it is claimed, insured, as each flue or chamber forming a heater by itself, it becomes impossible for a strong current to escape in the lower part of the house while little or no

cularly well suited for hospitals and public buildings, where foul and deleterious gases are freely generated, and its effect is such as to keep the wards or halls perfectly supplied with pure air. Besides, the device aids in quickly heating rooms, as, its openings being placed low down, the cold air near the floor is drawn out, while the hot current from the heating register is continually pouring in.

The furnace, it is claimed, is well adapted to the heating of extension rooms; and by a nearly horizontal pipe, fifty feet long

from cracks. The mass is not hygroscopic, a property making it all the more suitable for pipes in the open air. The cost of the covering per foot of 8 inch pipe is 12 cents.

Concrete Foundations.

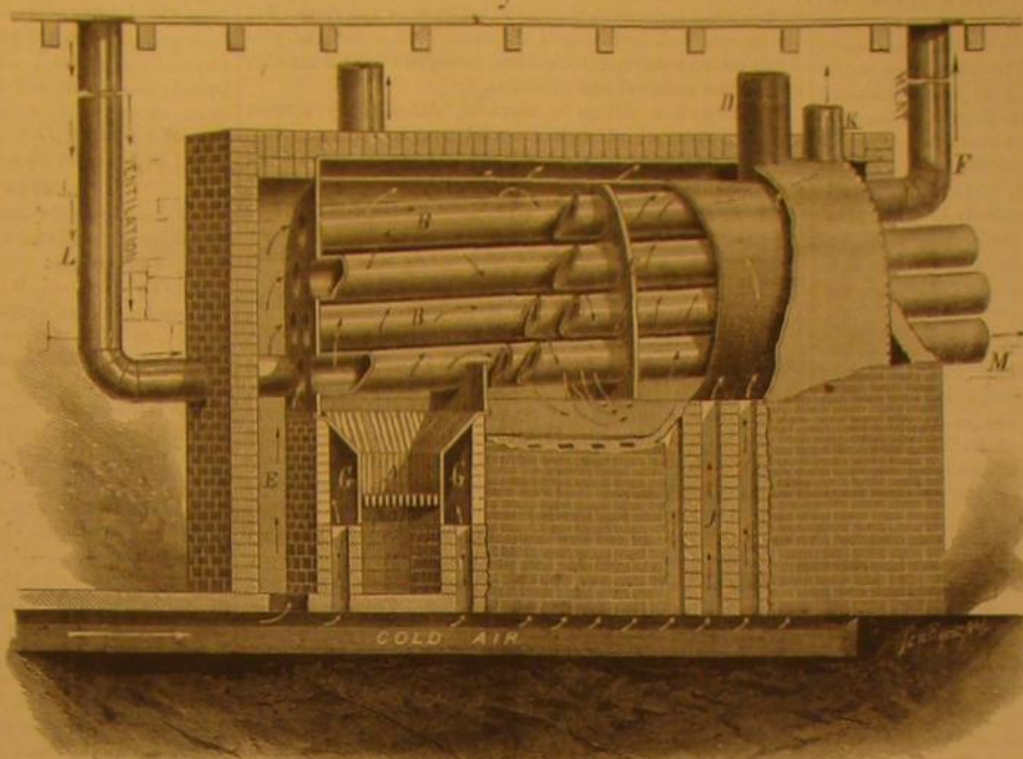
The Delaware and Hudson Canal Company are constructing an immense building on the corner of Church and Cortlandt streets, in this city, for their own use and as a coal exchange. The edifice is to be of brick and stone, nine stories high. Mr. R. M. Hunt is the architect. At the present time the foundations are being laid in concrete, under the superintendence of Mr. David Campbell. The mortar used is made of 1 barrel of Portland cement, 3 barrels sand, and 28½ gallons water. These ingredients are shoveled into an inclined tube, which works a worm blade that incorporates them together and delivers them in a thoroughly plastic mass. Ten cubic feet of this mortar, fifteen of broken stone, and twelve and a half of gravel, are then placed in a box of boiler iron, four feet square, which is hung on bearings attached to diagonally opposite corners and rotated by gearing from a stationary engine. Eight revolutions completes the mixing, when the concrete is removed and transported to the point where it is to be laid. Beds of the mass, six inches thick, are placed, each being rammed down by hand before another layer is applied. The lower bed will, in all, be two feet thick; and above this, to support the walls, the concrete will be packed in bevel form to a height, in all, of six feet seven inches. The piers are of stone, resting on a layer of concrete eleven feet square. The cost of the concrete, as compared with masonry, is estimated to be some thirty per cent cheaper.

LLOYD'S CAR COUPLING.

We present herewith an engraving of a car coupling which presents several points of novelty, while, at the same time it is of very simple design. It is intended to be automatic in action, and therefore to possess the various qualities which we have frequently alluded to in reference to inventions of this description, and which we need not here recapitulate.

A A are the drawbars, in mortises in the ends of each of which are jointed the coupling bars, B. A part of one drawbar is represented as broken away in order to show this connection, the object of which is to allow the bars, B, to be turned upward as much as is necessary, while it prevents them from falling much below a horizontal position. Upon the upper and lower sides of each of the bars, B, are formed shoulders, which are made V shaped and also dovetailed. This is more clearly shown at C C. The V shape prevents the shoulders from slipping apart when coupled, as represented, when the train swings around curves, and the dovetail stops the bars from jarring apart when the cars are run together or when in motion. The general form of the

Fig. 1



FURNACE FOR HEATING BUILDINGS.

and ten inches in diameter, with only ten inches rise, an adequate amount of warm air is easily delivered. Half of the flues may be led vertically and half in a horizontal direction. The heating surface aggregates four hundred square feet, all of which, as we have already pointed out, comes in direct contact with the hot gases. The construction of the apparatus generally is said to be strong and durable, the metal parts being of wrought iron. The flues are eight inches each in diameter. The grate is in two sections, and is very easily controlled, while the air supply, entering through a single pipe, may be regulated at pleasure. The furnace, we are informed, has been in use for the past year, giving in every respect satisfactory results. For further information relative to supplying the apparatus, its cost, etc., address Mr. W. N. Abbott, 40 Cortlandt street, New York city.

To Clear Photo Baths.

When photo printing baths become discolored, various agents are employed in order to decolorize them. Among the best of these is the substance known as China clay or kaolin, which consists almost entirely of silicate of alumina. At the present period, paper is adulterated to a large extent by the admixture of clay, and hence, when a silver bath has become discolored, owing to the presence of organic matter, an effectual remedy is always at hand; for, in the absence of kaolin, all that is necessary is to burn any good, heavy bodied paper and shake up the ashes with the silver. On filtration it will be found to have become pure and bright.

This little bit of useful knowledge may prove beneficial to those who live at a considerable distance from a photographic chemist. Of course we all know, says *The British Journal of Photography*, that there are many agents by which the bath may be decolorized, among which may be named animal charcoal, camphor, citric acid, chloride of sodium, and others. Kaolin, however, is more generally adopted than any other; and many of our readers will be pleased at being made acquainted with the foregoing very simple method of obtaining a supply with no greater amount of trouble than that of igniting a piece of any heavy bodied paper.

Covering for Steam Pipes.

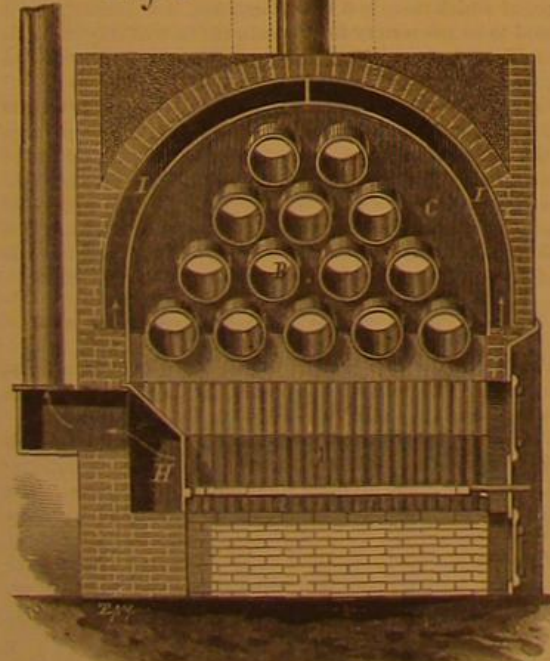
A new method of covering steam pipes is applied in the Saarbrücken district, Germany. A coat of thin loam wash is first given, to increase the adhesion of the mass. The composition consists of equal parts of loam or clay, free from sand and brick dust, with an addition of cow hair. This is well mixed up and put round the pipe in a hot state. For better securing this coating, pieces of board 10 inches long are laid along the whole length of the pipes and fastened by thin iron wire. After applying the loam wash again to the dried mass till all the cracks have disappeared, the pipes receive another coating of the mass, until they feel quite cool, which will be attained after the mass has been laid on to the thickness of from 5 to 6 inches. A coat of linseed oil and cement is finally given. This method answers at present all requirements, the covering being perfectly airtight and free

drawbars, adapting them to slide upon each other, is already shown in the engraving and needs no description. The chain leads up to the platform or top of the car, and serves to lift the bar which is uppermost, and thus effect the uncoupling. The holes shown in the ends of the bars are for connecting them by a pin with the ordinary link coupler. It is claimed that, by this means, cars of the same or of different heights may be connected or run together with facility.

Patented October 21, 1873, through the Scientific American America Patent Agency, by Mr. R. Lloyd, of Lake Shore Railroad Bridge, Cleveland, Ohio, who may be addressed for further information.

It is announced that Mr. Bennett, of the *Herald*, is now organizing a new Arctic expedition, to be sent in search of the North Pole.

Fig. 2



heat reaches the upper stories, a frequent trouble in furnaces the parts of which are mutually dependent.

All the tubes, B, need not, in some cases, be used for heating purposes, in which event two or three may be advantageously utilized for ventilating the entire building. It is proposed to place registers close to the floor in the lower stories and to lead therefrom flues, one of which is shown at L, Fig. 1, connecting with the heater tubes used. The other ends of the latter, M, may connect with a shaft which passes up through the edifice, emerging at the roof. The hot air in the tubes will generate an up current in this shaft which, receiving its supply of air from the register and flue, L, will thereby draw from the lower rooms all the foul and heavy gases. The upper apartments, it is stated, need only be connected directly with the shaft, as the same may be arranged to pass in proximity to all. This furnace seems to be parti-

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.—UP THE AMAZONS.

No. 4.

FROM THE NEGRO TO THE ANDES.

Manaos is an important point of departure for several lines of steamers. Steamers leave regularly for Pará and Tabatinga, and for the Madeira, Negro, Purús, and Juruá. The fare up the Madeira is \$40, and up the Purús, \$50. From Manaos to Tabatinga, on the frontier of the empire, is one thousand miles. The Icaméba, the first and only steamer, which has been running for nearly twenty years, leaves Manaos the 11th of each month; fare, \$50; time, one week.

The Solimões, as this middle portion of the Amazon is called, flows through a rank wilderness, broken at few points by the hand of man. There are, probably, not a hundred acres of cultivated land between the Rio Negro and the base of the Andes. The whole country is a vast plain of slight elevation, without hills or sandy campos, but with a soil of stiff clay covered with vegetable mold, and a lofty, luxuriant, humid forest. Palms are comparatively few, the most numerous being the short murumará, the slender assaf, the spindle trunk pashúba, the beautiful tucumá, and the urucú, the nuts of which are used in smoking rubber.

VALUABLE TIMBER.

But it is heavily timbered with useful woods, as cedar, copal, andiróba, guacupé, capiróna (called pao mulatto in Brazil, furnishing the fuel used by the steamers), sleupéra (an excellent boat timber), acari-cuára, acariúba, moira pirárga or red wood, moira coatiára or striped wood, itaúba, jatahi, sapupira, massarandúba or cow tree (one of the most valuable and durable woods on the river), paracu-úba (a very hard wood used for harpoons, etc.), cumará, palo de cruz, palo d'arco, and many kinds of loiro. And yet there is not a saw mill between Manaos and Iquitos, a distance of 1,300 miles!

We see three varieties of banks: low, alluvial deposits covered with arrow grass or wild cane; slightly higher land covered with broad leaved plants and dwarf palms, with a dense forest of lofty trees in the *terra incognita* beyond, the most common aspect; and cliffs of variegated clay from 25 to 50 feet high, generally cut squarely away by the current, presenting a massive colonnade of trees loaded with parasites and wound with creeping plants. The signs of animal life are not proportioned to this exuberance of vegetation. White egrets and tall gray herons stalking along the edge of the water; hummers whirring among the flowers; macaws and parrots flying across the river; capybaras on the banks, and rolling porpoises and ugly alligators in the water; these are the most conspicuous forms. But the most numerous and the most dreaded of all animals on the Solimões are the

INSECTS.

As we have already remarked, the strong trade winds keep the Lower Amazon clear of these pests; but soon after leaving Manaos, the traveller becomes intimately acquainted with five insects of torture: (1.) The carapaná, called mosquito in the United States and Europe, and sancúdo on the Marañon and in Spanish America generally. (2.) The píum or sand fly—the scourge of the Amazons, called mosquito in Peru—a minute, dark colored dipter with two triangular horny lancets which leave a small circular red spot on the skin. It works by day, relieving the carapaná at sunrise. (3.) The motúca (tábano in Peru) of the size and general shape of the house fly, of a bronze black color, with the tips of the wings transparent, and a formidable proboscis. (4.) The moquim (ysangui in Peru), a micro-copic scarlet acarus, resembling a minute crab under the glass. It swarms on weeds and bushes, and on the skin causes an intolerable itching. An hour's walk through the grassy streets of Teffé was sufficient to cover our entire body with myriads of moquims which it took a week to exterminate. (5.) Carapátos or ticks, which mount to the tips of blades of grass and attach themselves to the clothes of passers by. In sucking one's blood, they cause no pain, but serious sores result if the proboscis breaks off in the wound. Besides these are ants innumerable in species and individuals, and of all sizes from the mammoth tokandára, two inches long, to the small red ant of the houses. The sauba is the most mischievous, from its habit of marching in broad columns and stripping the most valuable cultivated trees of their foliage. Everywhere, from Pará to the mountains, complaints are heard of this terrible pest. In some places, agriculture is impossible. These half a dozen forms of insect life must for ever hinder the settlement of the Amazons. It is true, however, that they have their migrations: Fonte Boa, for example, the paradise of mosquitos in Bates' time, is now nearly free from them. There are two kinds of bees on the River, the black and yellow. Their cells are not hexagonal, but like those of the humble bee, and the honey is thin and sour when collected. Scorpions and tarantulas exist, but not in such numbers as to be dreaded.

THE GREAT WILDERNESS.

Man makes an insignificant figure in the vast solitude of Alto Amazonas. From Manaos to the entrance of the Huallaga, a distance of 1,700 miles, there are probably not over 10,000 inhabitants scattered along the banks of the river and its inlets. The largest Brazilian town west of Manaos is Teffé, the Omaha of South America in position; yet it contains scarcely 2,000 souls, although the best agricultural region on the Solimões. It exports annually 40,000 or 50,000 arrobas of rubber, and 4,000 or 5,000 arrobas of pirarucú fish. Here also are manufactured, by wild tribes in the interior, the celebrated grass hammock woven from the fiber of the tucum

palm. The population of the Upper Amazon has not increased with the introduction of steamers. The climate is healthy, although one lives in a constant vapor bath, and Nature is bountiful. Epidemics are unknown, and ague is confined to dark colored or sluggish tributaries.

Between Teffé, where Bates spent four years and a half and Agassiz six months, and Tabatinga, the frontier fortress of the Empire, is the most uncivilized part of the Amazon. Yet here enter five great rivers which are destined to be famous: Japurá, Ica, Juruá, Jutahí, and Javari. The only towns are Fonte Boa, Tonantins, and San Paulo, built on slippery clay bluffs, and exporting the produce of the forests and waters. Rice and cotton might be grown in vast quantities on the lowlands after the subsidence of the river. But the people, mainly the half civilized Tucúna Indians, prefer to collect rubber, catch turtles, swing in their hammocks, and live on pirarucú and plantains.

Tabatinga is a village of barracks, defended by sixteen guns and ornamented with graceful tucumá palms. This has been a military post since 1776. It stands on a high bluff of variegated clay which gives its name to the whole Amazonian clay formation. The depth of the river here is from eight to twelve fathoms, the difference between high and low water being thirty-six feet. The current, at flood time, is five miles an hour.

STEAM ON THE MARAÑON.

Here we exchanged the Brazilian Icaméba for the Peruvian Moróna. At present, the following steamers are afloat on Peruvian waters: Moróna, Pastássa, Tambo, Putumayo, Napo, Moiro, Alceste, and Ucayali, the last two belonging to private individuals. The Moróna is an iron vessel of 150 horse power, with a tonnage of 500, and consumes about 450 sticks per hour, which cost \$14 per thousand. The rate is eighteen miles down stream, and nine up. The running time from Tabatinga to Yurimaguas is ninety hours; distance about 800 miles. She leaves Tabatinga the 21st of each month, and Yurimaguas, the 9th. The first class fare is \$60, passengers providing their own bedding. There are no accommodations for ladies.

Travel on the Marañon exceeds that on the Solimões. Nevertheless, the towns are decaying, excepting Iquitos and Yurimaguas.

TURTLES AND FISHES.

Life within the Marañon presents greater variety, at least for commercial purposes, than in the Amazons below. This is the great turtle field; and turtle hunting is the chief business in the dry season. They are to be found on the main river and all the tributaries from the Madeira to the Huallaga; but Caballococha is considered the best region: 4,000 were caught on one playa in one year. They furnish the staple meat of eastern Peru, and the oil expressed from the eggs is an important article of export. The turtles of commerce are the tartaruga grande (charápa), measuring three feet by two, and the smaller, but more delicious, tracajá (charapita). The females only are taken, so that the males, which are inferior in size, must far outnumber them. The average price of the larger turtle is two dollars, and of the tracajá, fifty cents. Besides these are the mata-mata and aiaasá. The largest fish in the Amazons is the súngru (in Brazil called the tuberon), sometimes weighing three hundred pounds, and is edible; but the most important, as furnishing the codfish of the Amazons, is the pirarucú (called payshi on the Marañon). It abounds throughout the Great River, chiefly in lagunes and in clear water; with farina it constitutes the chief food of the Indians; but it is far inferior to the Newfoundland fish. The Amazons, however, yields many others which compare favorably with the trout and perch; among these are the tambaquí (the gamitana of the Marañon), piranha, corvina, tucunará, and acara-uassú. Rays (at least two species), some three feet broad; the manati or vara-marina, which is potted under the name of mishíri; three kinds of dolphins, the small, dark colored tucuxi, the white boto, and the flesh colored, which is the largest of all; and three species of alligator: abound, especially in the Marañon.

THE BIRMINGHAM OF THE AMAZONS.

Iquitos, the only village of size and enterprise on the Marañon is of recent origin, and now numbers 2,500 inhabitants, English, Americans, Peruvians, Indians, and nondescripts, the last forming a numerous class; for excepting a dozen lawful marriages, the rest are accidental unions. It was founded by the survivors of a massacre at Borgia. It stands on a bank of dark clay (containing a multitude of fossil shells and a stratum of lignite), sixty-five feet above the average river, and three hundred and fifty above the sea. The mean temperature is 80°, and the range but 10°. The climate is unusually healthy, the diseases, such as exist, chiefly *la tinta* (dark blotches on the skin), abscess, fever, and dysentery, being due to improper food and want of cleanliness. But Sodom would shine alongside of Iquitos in point of morality and temperance.

The government works are the making of this place. Twenty years ago it was a fishing village of 227 inhabitants; now it contains a machine shop for the repair of steamers, a steam sawmill, and a brick factory. The superintendent and most of the hands are from England.

PRICE OF LABOR.

Carpenters, masons, and machinists get from \$80 to \$100 a month; the first engineer on a steamer has \$145, and the second, \$116, with rations; day laborers have \$10 a month and rations. But the mischief is that this is promised, not paid; some of the foreign employees have not received a cent for sixteen months. By thus withholding payment, the government manages to hold on to imported skill. The

Marañon at present is a burden to Lima, for the works and the steamers do not pay; and Congress votes a monthly subsidy of \$20,000. But it is vital to Peru that she retain this Oriente. Iquitos even exceeds Manaos in

SCARCITY OF FOOD.

She exports nothing but money, and produces nothing eatable. She depends, strange to say, for almost every mouthful of food upon the east, instead of the west; upon Pará and New York rather than upon Moyobamba and Lima. And when the steamer fails to bring a supply, a famine is imminent. Iquitos receives its flour from Richmond and Baltimore; lard from Cincinnati; canned butter from England; potatoes from Portugal; coffee and sugar from Brazil; rice from Ceará and India; and all this, while almost any created fruit and grain would grow on the Upper Marañon or the slope of the Andes. Flour and potatoes sell at 20 cents a pound; butter one dollar a pound; fowls one dollar each; eggs, eighty cents a dozen; cachaça, one dollar a gallon; lime, \$12 a barrel; Newcastle coal, \$90 a ton; logs, \$4 a piece; and it costs \$5 a hundred feet for sawing.

SURVEY OF THE MARAÑON.

We were happy to meet at this place the Hydrographical Commission commanded by Admiral Tucker, which has been engaged for several years past in surveying the Marañon and its tributaries. It has just returned from an elaborate exploration of the Ucayali, ascending the Pichis to lat. 10° 22' 55", or 1,041 marine miles from Iquitos. We look forward to the publication of the report by the Peruvian government with the greatest interest. The determination of the latitude and longitude of prominent points by Captain Rochelle will straighten our geography of the Marañon region; while the meteorological and ethnological observations by Dr. Galt will make a valuable contribution to science. The Commission are about to map out the main trunk of the Marañon from the Javari to Borgia, and may then be called to explore Lake Titicaca.

Two little steamers, the Napo, of Iquitos, and the Ucayali, of Nanta, run up the Ucayali to Sarayacu and Cachaboya monthly, the voyage to Sarayacu from Iquitos taking eight days up and four down. The trade at present is light, consisting chiefly in the exchange of English goods and Huallaga salt for salt fish and turtles. But this tributary, contributing more water than the Marañon above it, and navigable for about one thousand miles or within a short distance (eid Tarma) from Lima, must ere long become a highway for commerce. A mule road is already projected to connect Sarayacu with the salt mines of Chasuta. Fine gypsum occurs above Sarayacu, and cinnamon around Cachaboya Lake. From the specimens collected by the Commission on the Pachita, exhibiting cyathophylloid corals, brachiopods, and ostraea, we infer that the formation in that region is Upper Silurian. Nothing in this collection indicates the presence of cretaceous beds intervening between the Silurian and the tertiary clays. The Ucayali, which is built of galvanized iron, has a tonnage of sixty, and draws when laden but three and a half feet, is about to make an exploring trip up the Rio Napo.

The largest village above Iquitos is Nanta, but the busiest is old San Regio—a little huddle of mud huts, but mighty in cachaça. Here they distill and export 2,500 garrafones (seven gallons each) a year of this white rum—the apparent life-blood of eastern Peru—and sell it at \$5 a garrafon. The cane, of which there is a vast plantation, is luxuriant, but it is said to be too watery for the manufacture of sugar. Sal-saparilla and payshi (salt fish) are also shipped from San Regio.

From this point to Borgia, the head of navigation on the main Marañon, where the river dashes through a deep gorge in the limestone mountains, is about 450 miles. But trade seldom calls a steamer beyond the mouth of the Huallaga. The Moróna turned up this tributary and left us on the clay bank of Yurimaguas, where we leave our readers while we make our foot tramp through the forest and the ascent of the Andes.

JAMES ORTON.

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 August, 1873:

The number of inspection visits made during the month were 1,087; boilers examined, 2,026; internal examinations, 563. The hydraulic pressure was applied in 180 cases. The defects in all discovered were 719, of which 176 were regarded as dangerous. These defects in detail were as follows:

Furnaces out of shape, 51—8 dangerous; fractures, 48—21 dangerous; burned plates, 35—19 dangerous; blistered plates, 123—27 dangerous; deposit of sediment, 105—15 dangerous; incrustation and scale, 97—7 dangerous; external corrosion, 77—22 dangerous; internal corrosion, 18—5 dangerous; internal grooving, 8—2 dangerous; water gages defective, 37—4 dangerous; blow-out defective, 27—6 dangerous; safety valve overloaded, 21—5 dangerous; pressure gages defective, 83—16 dangerous; boilers without gages, 100—3 dangerous; deficiency of water, 7—4 dangerous; braces and stays broken and loose, 47—25 dangerous; boilers condemned, 23. We feel compelled to call attention to the importance of often cleaning boilers out through hand holes. We have frequently recommended this precaution, and we speak of it again because steam users do not seem to attach the importance to it which they should. Scale is thrown off from the boiler, perhaps by some solvent, it accumulates on the bottom and, if not removed, becomes conglomerated with other impurities, covers the fire sheets, and the result is that they are sooner or later badly burned. We would advise all steam users to see that this work is not neglected.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations (which are approximate only) and for the observations collected in the following notes, I am indebted to students.

M. M.

Positions of Planets for November, 1873.

Mercury.

On the 1st, Mercury rises at 8h. 38m. A. M., and sets at 5h. 39m. On the 30th it rises at 7h. 2m. A. M., and sets at 4h. 38m.

Venus.

On the 1st Venus rises at 4h. 17m. A. M., and sets at 3h. 51m. P. M. On the 30th Venus rises at 5h. 27m. A. M., and sets at 3h. 26m. P. M.

Venus can best be seen at early morning at present, but a small telescope will show it in the daytime; it comes to meridian or south a little after 10 A. M. during the first half of the month, and before 10h. 30m. all through the month, its altitude in this latitude being about 45° on the first of the month, and 32° on the last of the month.

Mars.

Mars, which has been so favorably seen through the summer months, is at too low an altitude and sets too early in November to permit one to make good observations.

It rises on the 1st at 11h. 52m. A. M., and sets at 8h. 41m. P. M. On the 30th it rises at 49m. after noon, and sets at 8h. 39m.

Jupiter.

Jupiter is very unfavorably situated for observation at this time.

On the 1st of November it rises at 2h. 44m. in the morning, and sets a little after 3 in the afternoon. On the 30th it rises at 1h. 13m. in the morning, and sets at 1h. 24m. P. M. Its apparent diameter is increasing, and it reaches a greater altitude from day to day, when it comes to meridian. It is moving among the stars of *Leo*; is east of the star π *Leonis* on the 1st, and on nearly the same parallel of declination. On the 30th its diurnal course is very nearly in the celestial equator, its declination being only 1° 37' N.

Saturn.

Saturn, which during the summer months has been so beautiful, is becoming smaller, and is setting earlier.

It rises on the 1st of November at 0h. 32m. A. M., and sets at 9h. 50m. P. M. On the 30th it rises at 10h. 45m. A. M., and sets at 8h. 7m. P. M. It should be looked for early in the evening, in the southwest, among the stars of *Capricornus*. On the 30th it has nearly the same right ascension as the double star of *Capricornus* known as α^2 , which can be seen with the eye; and an imaginary line from this star, running below it some 9°, will reach Saturn.

Uranus.

On the 1st Uranus rises at near 11 P. M., and sets at 1h. 17m. A. M. On the 30th it rises at 9h. 3m. P. M., and sets at 11h. 23m. A. M. It is among the small stars of *Cancer*, and can be seen with a small telescope.

Neptune.

Neptune rises on November 1 at 4h. 25m. P. M., and sets at 5h. 27m. A. M. On the 30th Neptune rises at 2h. 29m. P. M. and sets at 3h. 33m. A. M. It cannot be seen without a good glass.

Spots on the Sun.

The record of sun spots by photography is from the 9th to the 13th inclusive, with the omission of Sunday, the 12th. On October 9th, one pair of small spots was near the western limb of the sun, another pair of larger, circular spots was between the eastern limb and the center, and an elongated spot was at a short distance from the eastern limb. On October 10th, besides a change of position, owing to the revolution of the sun on its axis, a fresh spot appeared, accompanying the elongated spot of the previous day. October 11th showed merely a change of position from the sun's revolution. On the 13th, the western pair had disappeared in consequence of the daily motion, the larger spot of the eastern pair had become circular, and, between it and the eastern limb, two small spots had appeared. Photographs of the 14th, 15th, 16th, and 17th show only daily change of position. On the 16th and 17th, the group nearest the western limb was surrounded by conspicuous faculae.

Amount of Rain.

The rains in October have been very heavy.

The rain which fell between the morning of October 6 and the afternoon of October 7 amounted to 2.3 inches.

The rain which fell between the evening of October 19 and the morning of October 21 amounted to 3 inches.

Death of Donati.

Professor Donati, the director of the Astronomical Observatory in Florence, died recently in Vienna, where he had just arrived to attend to duties connected with the exhibition. His name is connected with a comet discovered by him in June, 1868, which, during the following August, passed around the sun within the orbit of Venus, exhibiting a nucleus as bright as Arcturus, and a tail of great brilliancy and more than twenty degrees in length.

The Hayden Exploring Expedition—Remarkable Natural Curiosities.

The last Congress authorized the geological and topographical survey of Colorado Territory, under the direction of the Secretary of the Interior, by whom the active work was committed to the charge of Professor Hayden. James T. Gardner was the geographer of the expedition, and he gives a variety of interesting particulars concerning the location of the mountains. The district surveyed comprises

the grandest portion of the Rocky Mountains, where the highest peaks are found. The area surveyed was about 160 miles broad, and embraced Middle Park, South Park, and the Southern San Luis Park. The number of mountains surveyed and mapped is astonishing, large numbers of the peaks measuring from 13,000 to 14,500 feet in height. The triangulation extended over 30,000 square miles.

Professor Hayden reports some very interesting particulars in a letter to the *Evening Post*.

The 'explorers' experience on the Electric Mountains—a high and much exposed range separating San Luis Park from Wet Mountain valley—was most amusing. They could scarcely handle their instruments, sparks being elicited at every touch; their rifles, too, snapped under the electric influence, and were in continual danger of going off; while, when caught in a thunderstorm, their hair literally stood on end. The whole party experienced shocks more or less severe, but none were injured.

NATURAL SODA WATER SPRINGS.

These are at Colorado Springs, three days from Cañon City. The wide reputation of these springs is not undeserved, and the different ingredients with which the waters are charged, considering their close proximity, is quite remarkable. The waters of the main springs contain respectively iron, soda, and sulphur, together with other substances in minor quantities. The soda spring is particularly interesting, being heavily charged with carbonic acid gas, which bubbles up in a lively manner. Inverting your glass and plunging it quickly into the spring, you obtain a delicious draft far superior to any ordinary soda water. The water is led into bath houses, and is considered very efficacious in the relief of rheumatism. It is certainly most refreshing. The hotel accommodations are excellent and their situation very beautiful, built as they are in one of the main cañons leading up to the Rocky Mountains and entirely shut in by the foot hills. Pike's Peak rises grandly above all, forming the main feature in the scenery.

CURIOUS SAND HILLS.

One of the most wonderful sights of the exploration was encountered at the entrance of the pass. The wind sweeping down the valley is drawn towards the narrow gorge which furnishes the passage through the mountains, and has piled up a range of sand dunes seven hundred feet above the plain. They are several miles in extent, and, upon approach, glistening under the southern sun, resemble in their brilliancy mountains of pure snow; and the crossing was effected with even more difficulty than it would have been over a snowy range.

PLACES OF INTEREST.

The neighboring country contains many places of curious interest, such as "Monument Park" and the "Garden of the Gods." The former consists of a valley filled with pillars of hardened limestone, which have been left standing, the softer material having been eroded by the action of water and the atmosphere. As one looks upon these great monuments of Nature, he feels as if they might mark the resting place of the dread giants of the story books. The "Garden of the Gods" is of similar construction, only the remaining rocks are higher and more conical in shape, the material being a red sandstone; the pointed spires, upon approach, resemble a gothic cathedral.

PIKE'S PEAK.

A favorite expedition is the ascent of Pike's Peak, a feat that is now practicable even for ladies. A new trail has been constructed to the top, and a halfway house built to accommodate those who stay overnight, thus enabling them to reach the summit early in the day, when the atmosphere is clear and the view most extended. A signal station has been established on the summit by the War Department for the benefit of "Old Probabilities," forming an object of interest to those who reach the top.

RAILWAY RELIGION.—During the homeward journey of the western delegates to the recent Evangelical Alliance gathering in this city, a religious meeting was held on board of one of the trains, in a Pullman parlor car especially granted for the occasion. The returning delegates crowded the car, which was provided with an excellent organ, and had a splendid time of it; stringing out their prayers, hymns and exhortations for a distance of over sixty miles. Thus it is that science lends her aid to assist religionists. But it is ten to one that these divines will get up in their pulpits next Sunday and denounce scientific men as servants of the evil one, infidels and scoffers, because, having found out that the world was not formed in a week, they are bold enough to say so.

THERE is to be daily steamer service between New York and Liverpool, on the Cunard line. The company, we understand, are to withdraw their vessels from the West India trade and assign them to this duty. Eight new ships for this line are now in progress of construction at the yards of Messrs. J. & G. Thomson, on the Clyde.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From September 30 to October 9, 1873, inclusive.

CARBURETING AIR.—F. Cutting, Woburn, Mass.
CONNECTING ROPE.—N. Thompson (of Brooklyn, N. Y.), London, England.
CONNECTING ROPE.—N. Thompson (of Brooklyn, N. Y.), London, England.
FREE ARM.—Providence Tool Company, R. I.
GUNPOWDER.—L. DuPont et al., Newcastle, Del.
KNIVES AND FORKS.—H. Bramhall (of New Britain, Conn.), Sheffield, Eng.
LAMP BURNER.—T. Silver (of New York City), London, England.
LAMP.—H. Hitchcock et al., Watertown, N. Y.
LIFE PRESERVER MATTRESS.—H. B. Mountain, New York City.
POWER PRESS.—N. C. Stiles, Middletown, Conn.
PRESSURE GAGE.—G. A. Everett (of New York City), London, England.
PUNCH.—J. P. Richards, Whitinsville, Mass.
STEAM LUBRICATOR.—W. Hamilton, Pa.
TREATING CAST IRON, ETC.—W. M. Arnold, New York City.

Recent American and Foreign Patents.

Improved Mode of Connecting Pitmen with Shafts.

Rudolph Cleveland, Covington, Pa.—This invention consists in the mode of relatively constructing a bar and hand crank shaft, so that power other than that of the hand may be employed to operate. To the upper end of a vertical shaft is detachably attached bevel gearing communicating with a horizontal shaft. One end of the shaft projects, is flattened, and has a longitudinal slot formed in it. A crank is arranged so that the shaft may be operated by hand power when desired, or a bar, in one end of which is formed a slot to receive the flattened end of the shaft, when it is secured in place by a spring catch pin. The other end of the bar is slotted to receive the end of the shaft of the driving power, where it is secured in place by a bolt and nut.

Improved Lamp.

Louis Berns, Middletown, N. Y.—This invention consists in the combination, with a loose drip cup, of the sections of a lamp column connected by intermediate rods, wide enough apart to allow the insertion and removal of drip cup.

Improved Harvester Rake.

James Irvine, Parkersburg, Iowa.—This invention furnishes an improved elevating rake for attachment to reapers and mowers to convert them into harvesters. As the shaft rotated by the driving wheel revolves, the rake will sweep across the lower part of the platform parallel, or nearly so, with the cutter bar, so as to collect the cut grain, and gather it into a gavel against the side board attached to the inner edge of the said platform. As the shaft continues to revolve, the rake slides the gavel back along the side board, a spring allowing the rake to accommodate itself to the size of the gavel. As the gavel approaches the rear inner corner of the platform, it is pushed into a trough attached to said corner. As the rake passes the end of the trough a guide pin enters a sharp angle in a guide groove, which swings the rake around, so that it may move forward along the outer part of the platform into proper position to collect another gavel. A small spring gage placed in the guide groove just in front of the sharp angle in said groove, which spring is pushed back by a pin and serves the double purpose of guiding said pin fully into the said sharp angle, and preventing it from leaving said angle by the route by which it entered it. The gavel is removed from the trough by binders standing upon the platform, and are laid to be bound upon the tables at the front and rear ends of the said platform.

Apparatus for Arranging Type for Type Setting Machine.

D. Brainerd Ray, New York City.—This invention consists of a new and improved apparatus for arranging type in rows for a type setting machine, and is designed to facilitate type setting by machinery. The construction and operation are as follows: A series of hoppers or troughs is arranged, one for each letter and character used in printing, upon a frame, at a convenient angle. Into these hoppers the type are distributed by hand, just as they are now, into the boxes of a type case. The type slide down to the channels or tubes, some having their notches turned one way, and some the opposite way; but the bottom and sides of said hoppers are so shaped that the type are all turned up edgewise as they enter the channels, and these are shaped so that they must pass through them on the edge or narrow side.

Improved Pruning Hook.

A. P. Betterworth, Carlisle, Ill.—This invention relates to the class of pruning hooks in which a hook and sliding knife are so arranged that their cutting edges are made to approach each other by means of toggle or jointed levers, said effect being produced by a direct pulling or tractive force applied to the handle of the implement. The invention consists in the arrangement of double levers and a spiral spring in connection with a cutting hook and chisel adapted to slide on each other, said levers serving, by their extension, to operate the cutting devices, and the spring to retract and hold the same close together for renewing the operation.

Improved Steam Engine Governor.

Stephen P. Ruggles, Boston, Mass.—This invention consists of a pair of rotating registering disks side by side in the steam pipe, one of which is turned by clock work, or any power independent of the engine to be regulated, and the other is turned by the engine. The two are so connected that neither can advance or retrograde relatively to the other more than sufficient to close or open the register. The one turned by the clock geared to run as fast as the other should be driven by the engine, and they are so set relatively to each other that if an additional labor is imposed on the engine the retrograde motion of its disk will open the register and admit steam; or, if the labor is lessened the advance of the disk will close the register and shut off steam, and thus maintain the required uniform speed.

Improved Car Coupling.

Peter Kendrick, Trenton, N. J.—The object of this invention is improvement on the car coupling of Depeu and Hall, patented July 2, 1867, and Smith and Utton, patented September 12, 1871; and the invention consists in employing a headed bolt sliding in opposite slots of the drawhead and a link with a cross stud for strengthening it.

Improved Rice Cleaner.

David L. Geer, Lake City, Fla.—This invention consists, first, in the rotating shaft of the machine, with blades so arranged spirally, and turned in opposite directions, as to throw the grain upward and backward and forward; and, secondly, in providing the cylinder into which the grain is delivered with a bulge, which forms a cavity wherein the grain is forced by the spiral blades, thereby effecting the hulling.

Improved Travelling Thrashing Power.

Richard W. Faris, Murfreesborough, Tenn.—This invention is intended to furnish an improved power for driving a thrasher, so that each shock of wheat or other grain may be thrashed while passing to the next shock thus saving much of the labor required in harvesting grain. The invention consists in the combination of the gear wheels connecting with the rear wheels of the wagon and communicating with a transverse shaft. Upon the shaft is placed a gear wheel about eighteen inches in diameter, and which is provided with a clutch upon each side, so that the shaft may be kept in motion when the wagon is turning, or even when one wheel is standing still. The upper part of the wheel projects through an opening in the bottom of the wagon box, and connects by a gear wheel to a short shaft which is attached to a band wheel, about twelve inches in diameter, and which is connected with the pulley of the thrasher engine. By this arrangement the thrasher cylinder will make about seventy-two revolutions to each revolution of the wheels. A still greater speed may be obtained by varying the size of the wheels, or by employing more wheels.

Improved Coffee Pot.

Margaret J. Stubbings, Youngstown, Ohio.—This invention consists in a cylindrical steam cover, connected, by pipes, with a perforated drum, and a muslin bag attached to it. The steam generated in the bottom part of the pot forces the boiling water continually over the coffee in the bag till the full strength of the same is extracted.

Improved Oil Can.

Orr's H. Warren, Baldwinville, N. Y.—This invention consists mainly of a tubular rod, of suitable length, in which is an oil receiving chamber, and to which is secured a hollow handle, in which the air chamber is arranged. From the oil and air chambers the oil is forced out through the discharge pipe at the end of the rod by means of a pump arrangement operated by the thumb. Projecting lugs or ears, at the end of the discharge pipe, raise the covers of boxes or cups over bearings.

Improvement in Indexing Books.

John S. Hicks, Brooklyn, N. Y.—This invention relates to the indexing of books, and consists of a volume provided with index tags bound into the back with its leaves, and projecting beyond the side edges thereof.

Improved Springs for Vehicles.

George W. Lewis, Portsmouth, Va., assignor to himself and C. W. Walker of same place.—This invention consists in two lever springs, the long sections of the upper division being held by the backwardly curved ends of sections of the lower portion. The two divisions are separated by a considerable space by the metal or wood block confined between them in a yoke, which also tends to utilize the power of the springs. The ribs are raised in the upper surface of each leaf, at the center, by indenting the under surface, which ribs are seated with the indentations.

Improved Atomizer or Vaporizer.

John N. Gerard, New York City.—A hollow collapsible bulb is made in cylindrical form, and attached to the top of a hollow bottle stopper by stretching the mouth of the bulb over the top into a groove. A pipe, rising up from near the bottom of the bottle through the bottom of the stopper, extends by a bend through the side of the stopper, and terminates in a small nozzle. The nozzle for the air projects from the side of the stopper, surrounds the small nozzle, and terminates slightly beyond the latter, with a contraction arranged to cause the air jet to converge upon the liquid jet at a point a little in advance of the two nozzles, so as to vaporize the liquid in the most effectual manner. There is passage from the hollow stopper into the bottle below, to admit the air for forcing out the liquid.

Improved Bladder Attachment for Harvester.

Washington L. Sanford, Ashton, Ill.—A hollow cylinder is made long enough to receive the longest grain, and large enough for receiving sufficient loose grain for a gavel in one part, and having another part in which to compress it. It is attached by a suitable supporting frame to the side of a reaper in such manner that the endless elevator thereof will deliver the grain into the opening near the top, where there is a shaft provided with curved teeth, to adapt it to clear the grain from the elevator, and press it downward and compress it in the receiver. At the bottom of the cylinder a shaft with teeth retains the falling grain in the side where it falls until a quantity sufficient for a gavel is obtained. There are also fingers to guide the grain as it falls from the elevator to the side where it accumulates. Guard wheels working in the grooved ends guide the grain into a space under the curves of the elevators, for compressing it to be bound. While the gavel is accumulating, movable compressing arms are holding the one being bound, and after releasing it they are swung upward to the left, over to the right, downward on to the grain, and then up again to the left until arrested by the pressure of the grain brought up by them under the stationary arm. The extent of the compression of the gavel is regulated by springs and auxiliary compressing arms. Other arms cast the bound gavel down and out of the cylinder speedily, in order that the rake may the sooner revolve and save time for the binding. When the bundle is thus compressed the band is put round it and fastened by the attendant who stands on the platform. Suitable mechanism then throws the bundle clear of the machine.

Improved Ironing Table.

Walter B. Grosh and Simon H. Foreman, Reading, Pa.—The object of this invention is to furnish a table for ironing shirts, skirts, and other articles, and it consists in a folding table so constructed that the ironing board or leaf may be raised for putting on or taking off a shirt or skirt or other similar article, and the whole be made to fold together, so as to occupy but little space when not in use.

Picicle Compound for Sanitary and Decorative Articles.

Jesse Rust, Bond Street, Vauxhall, England.—This invention relates to the compositions for sanitary, pictorial, decorative, and building purposes. Glass of any kind is ground to powder and mixed with the same weight of sand or ground flints. This mixture is then placed in a suitable furnace and fused. When cold the same is reduced to powder, is afterward pressed into molds in a dry or in a dampened state by adding water or any glutinous liquid. Another compound used is of equal parts of fused and of powdered glass and sand, mixed with two or more parts of clay or sand, cohered with liquid, molded, and baked. The blocks or molded pieces, small or large, are placed in a potter's or such like kiln, and baked in the same way as pottery ware. When cold they are fit to use, and form a material which may be polished, painted, glazed, or decorated like other stoneware.

Improvement in the Preservation of Pulp Pigments, etc.

P. C. Tiemann, New York City.—This improvement relates to what are known in the trade as pulp, or slip, or paste colors or pigments, including whites, or that class of paint or coloring materials that is prepared for use by precipitation in water, or by fine grinding in water. The improvement in the preservation of the said pigments consists in treating the wooden vessel, in which the pigments are to be stored, with a material or filling that shall so close the pores of the vessel as to prevent any oozing away of the contents or loss of consistency in the pigments. This is accomplished by lining or covering the exterior of the vessel with a suitable insoluble paint or varnish, such as paraffin, shellac, wax, or ordinary oil paint or other insoluble material.

Improved Tool for Making Button Molds.

John T. Hawkins, Salisbury, Vt.—This invention consists of a chuck, with a conical cavity in the end, terminating in a cylindrical socket. There is a roughing tool in the conical cavity, and a finishing tool in the cylindrical socket, and also a center bit. All are so arranged that a square stick, being presented to the conical cavity and the roughing knife, will be turned down smooth and to the size of the required button mold, and then turned off upon the end by the finishing cutter to the required oval form for the top of the button mold. The stick, lastly, is presented to a saw and the mold cut off.

Improved Adjustable Tongue for Organ Reeds.

Maria Procopé, Stockholm, Sweden.—This invention consists in an improvement in tuning windreed instruments. A finger-shaped support is applied against the under side of the tongue to support the same near its root, and is attached to a slide which is held between guides that are fastened to under side of the board to which such tongue is secured. The slides are made with teeth at their sides, and a tuning key, having a pinion fastened to its lower end, is used for their adjustment. Whenever it is desired to tune the organ, it is only necessary to introduce the tuning key in one of as many openings as there are tongues in the board, and thereby to bring its pinion in gear with the plate to be moved, or with several plates successively. In this manner, therefore, the vibrations can be regulated by shifting the support and reducing or increasing the vibrating lengths of the several tongues. Instead of using an adjustable finger above or below the tongue to be tuned, the tongue itself may be made movable, and the length of its vibrating portion thereby increased or reduced.

Improved Fire Escape.

Peter W. Barnes, Albany, N. Y.—There is a box, one part of the top of which is stationary. To this is hinged a movable part, to the outer edge of which is hinged a plate which can be turned out of the window to rest upon the window sill. Another plate may be turned out to extend along the wall of building upon the outer side of the window blind. In the outer part of the latter plate is formed a hole where the ladder is dropped. This ladder is made of wire rope, and, when not in use, is kept in the box. Rattings are hinged to the plate so that they may be turned up into a vertical position as a guard to those using the escape, and turned down into a horizontal position when said plates are to be folded together. Arms provided with springs are arranged to rest against the inner side of the window casing to hold the device steady and prevent it from being drawn out of the window. These are locked, when extended, by stops, and, when closed, are held in position by catches, so that they may be released by opening the device.

Improved Machine for Driving Brush Handles.

John Ames, Jr., Lansingburgh, N. Y.—To the table is attached a frame in which a plate slides up and down in grooves. To the rear side of the plate is attached a rack which connects with a pinion on a shaft by which said plate is raised or lowered. A hand screw limits the downward movement of the plate and insures that the handles of the brushes are driven to exactly the same point. To the forward side of the plate is secured the follower, by which the handle is forced into the brush. Two blocks have half round notches to receive and hold the handle while being driven, and are so arranged in connection with arms as to be kept horizontal while moving toward and from each other. Said blocks, by suitable means, are kept exactly in line with each other as they move out and in, and may be moved back out the way to enable the brush to be conveniently removed from the machine. In operation, the point of the brush handle is passed down through the hole between the blocks, and is inserted in the center of the brush head, the lower end of the driver resting upon the upper end of the brush handle. A lever is then operated, forcing the brush handle down through the brush head until the forward end of a set screw strikes the top board of the frame. As the forward end of the brush handle passes down through the brush head, its point or forward end enters a socket in a guide which keeps

it centered. The brush handle is thus always supported at two points, and kept accurately centered. When the brush handle has been fully driven, the driver is raised from between the blocks, the blocks and arms are pushed back out of the way, and the brush is removed.

Improved Bee Hive.

Charles J. Sperry and Lyman Chandler, New London, Minn.—This is a double bee hive with two sets of honey frames. The roof is made in two parts hinged together at the center, and fits over the hive. The honey frames are suspended from cleats by means of projecting top pieces. The bottom of the hive consists of two inclines corresponding in form with the roof, the edges of which form the bee lighting boards. A slat partition extends from a cross piece to the center ridge of the floor, and a shutter closes the communication between the two parts of the hive. When the shutter is reversed, the bees can pass freely from one part to another. This is a great convenience in dividing swarms. Outside of honey frame of each part of the hive there is a compartment closed by means of the movable partition and a top slat. The partition is hinged so that, when the loose slat is removed, the top of the partition will drop over against the side, which allows the honey frames to be removed without difficulty. The bee entrances through the top bars of the honey frames are of peculiar construction, and are formed by cutting out the top part and inclining under sides of the bar, leaving the bottom part entire, the object being to avoid weakening the bar and to form passages for the bees, through which they may pass up or down on either side of the comb or comb frame.

Improved Combined Shutter Worker and Blind Operator.

Daniel M. Leonard, La Crosse, Wis.—The object of this invention is to provide mechanism for operating, adjusting, and locking the window shutters and blind slats from the inside of the window. A cog wheel is keyed on a sliding shaft to be brought into engagement, alternately, with a toothed disk attached to the shutter, and toothed segmental lever connected with the blind slats, whereby both the shutter and slats may be adjusted as desired.

Improved Potato Cutter and Planter.

Lemuel G. Mewborn, Kingston, N. C.—This invention relates to a potato cutter and dropper on wheels, and consists in combining mechanical instruments so that whole potatoes are fed to a hopper, cut up into an average size, and dropped at regular intervals in the drill or in hills. It seems to meet a want long experienced by farmers, who find hand-cutting and hand-cropping of potatoes a very tedious, a very laborious, and a very expensive undertaking.

Improved Locomotive Smoke Stack.

James Hughes, Scranton, Pa.—The object of this invention is to provide the smoke stack of locomotives with an improved cone by which the draft is increased and the rapid wearing out of parts of the stack by the exhaust steam prevented. This invention consists of flat plates and rings of varying sizes, which are placed above each other in such a manner that the steam cannot pass through without striking the plates and rings, varying thereby the direction of the steam and distributing it equally so that it will pass out from the stack without impinging on the sides of the same and bringing the bonnet into use over its whole surface. The draft is regulated by making the top plate and ring adjustable on the central standard.

Improved Trotting Gear.

Henry Schmalhausen, Bridgeport, Ill.—The object of this invention is to provide an elastic gear for horses, by which they can trot faster, raise their feet higher, and step higher, preventing them also from balking, kicking, backing, or rearing. It consists of an elastic strap, which plays easily through the hame ring, either end being fastened to a hind and fore foot.

Improved Ore Washer.

Ira T. Halstead, Fredonia, N. Y.—This invention furnishes a simple apparatus for collecting sulphurets, gold, silver, etc., from ores. The invention consists in the employment of one or more sieves, in connection with one or more sluices and pivoted boards, for separating the sulphurets and heavier particles of ore from the stream of water and pulverized ore passing through the apparatus.

Improved Neck Yoke Holder.

George B. Huntley, Hubbardston, Mich., assignor to himself and Carlos R. Hatt, of same place.—This invention consists in constructing the holder of a flexible sheet metal plate, which laps around the yoke and is secured to the perforated leather plate by rivets. Thus the plates lap around the yoke, and, being flexible and formed in one piece, they form a strong device for the purpose.

Improved Lubricator.

William A. Pratt, Baltimore, Md.—This invention consists in using on the inside of a reservoir a slide sleeve, to adjust the upper of the two valves of a locomotive lubricator toward or from its seat, to regulate the flow of oil into the feeding channel that leads to the parts to be lubricated.

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, Ericson, 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, Drawing, 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 needed 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 the invention to 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.

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.

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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, 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 \$30) 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.

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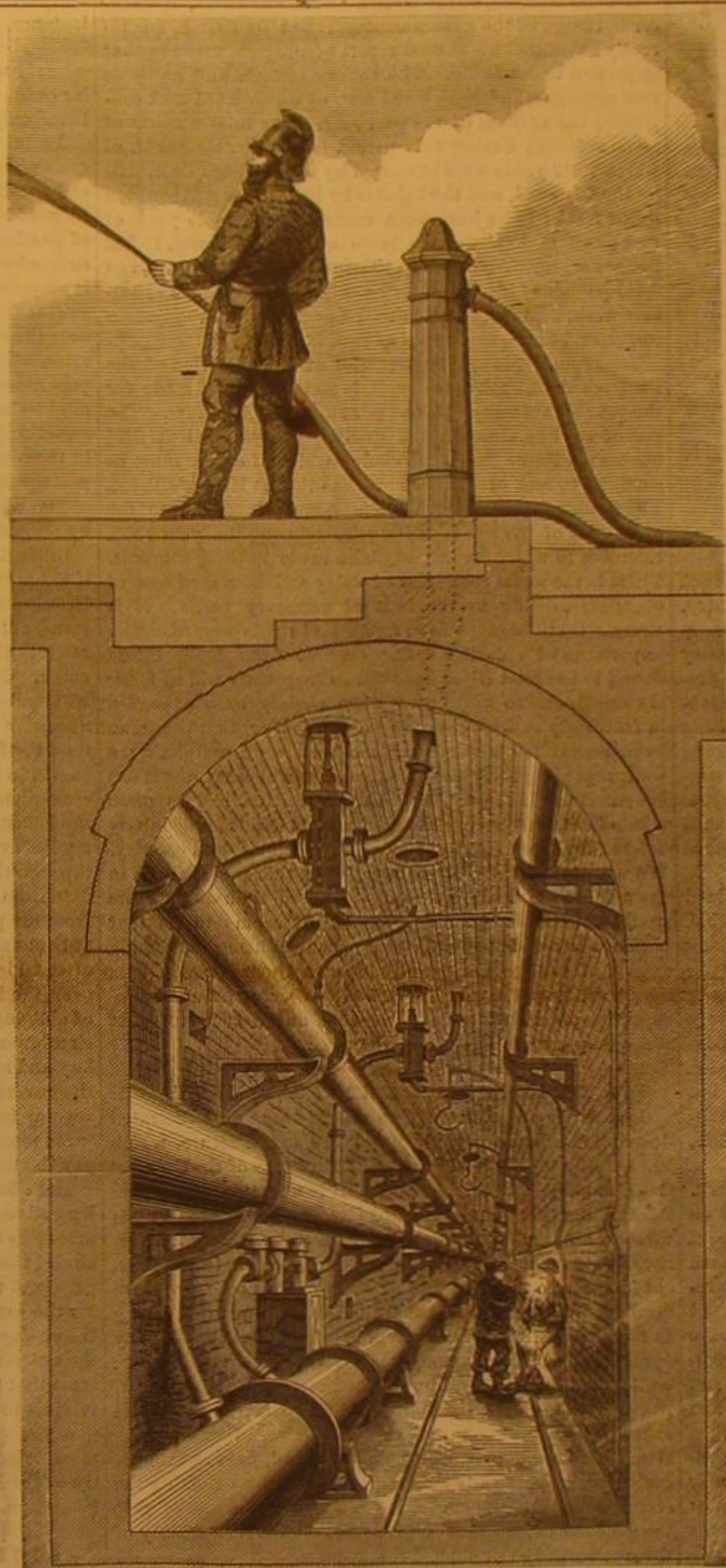
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IN ADVANCE)

HOLBORN VIADUCT SUBWAYS.

In the construction of the Holborn Valley viaduct, and the streets connected with it, the corporation of London determined to introduce subways for gas, water, and telegraph pipes, and thus to prevent the breaking up of the road surface, which is so often necessary with the ordinary system of placing them in the ground beneath the public way. As a means of conveying water, subways have, for some years, been used in Paris, and more recently in London. They were first introduced in London in the construction of Southwark street, from Blackfriars road to the Borough. The conveyance of gas, however, requires special arrangements for ventilation to prevent the risk of explosion, and the subways under the Holborn viaduct are believed to be the first constructed with a view to their safety when used for this purpose. The arrangements must here be explained. In the Holborn viaduct there is a subway, 7 feet wide and 11 feet 6 inches high, on each side of the road, running between the great arches which carry the roadway and the house vaults which support each footway. The subways are immediately above the sewers, and are well drained, floored with large slabs of York stone, and lined with light gault bricks. In each subway a 14 inch main pipe of the New River Company is carried by iron chains near to the wall nearest the frontage of the houses, and above it 10 inch gas mains, belonging to the City of London and Great Central Gas Companies, are supported on iron brackets projecting from the wall; on the opposite side of the subway a pipe, containing the telegraph wires, is carried in a similar way. All the pipes are so fixed that workmen can easily examine and repair the joints; and, in anticipation of the new buildings, junctions with the gas and water pipes have been made for each house; from these junctions the pipes will be conducted through holes formed in the sides of the subways and communicating with the house vaults. Branch pipes are laid on from the subways to the street watering posts, and to the fire hydrants in the streets, and gas is laid on to the street lamps. All the usual valves, meters, and other apparatus are accessible within the subway itself. Rails are laid along the floor of each subway, on which runs a traveling crane, to facilitate the removal and fixing of the gas and water mains. The subways are ventilated by means of small circular gratings fixed in the footways along the center of each subway, and by flues which run up the party walls of the houses and terminate above the roofs. Every street lamp, and every post along the edge of the footways, communicates also with the subways, and is so perforated as to act as an efficient ventilator. Wherever practicable, the doors of entrance are also constructed of open iron work. Hitherto the ventilation has been perfectly efficient, and no danger is apprehended from the use of naked lights or from the gas jets by which the subways are lighted at times of inspection. One portion of the viaduct subways, between



HOLBORN VALLEY VIADUCT.—SECTION OF SUBWAY ON EACH SIDE.

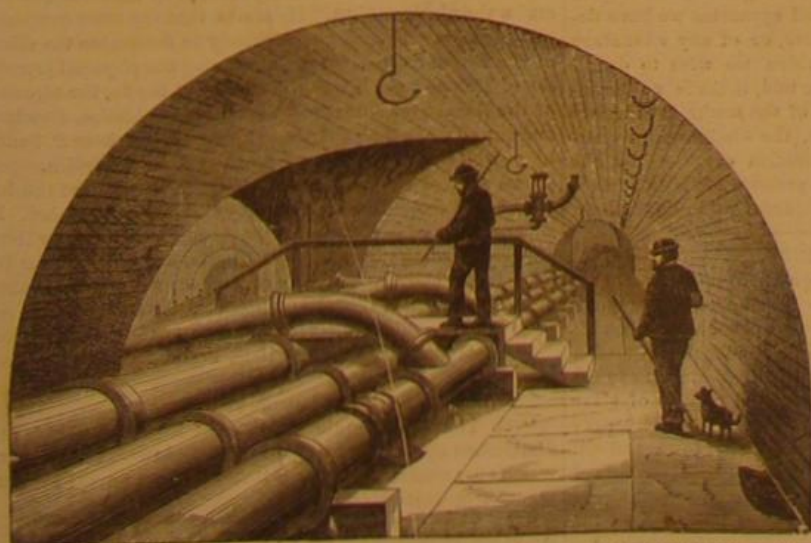
Farringdon road and Shoe lane, has been lighted by means of Hyatt's patent vault light, an American invention introduced into England by Mr. Haywood, the engineer of the Commissioners of Sewers, who designed the Holborn viaduct. It consists of a large frame of cast iron glazed with thick bosses of glass, let into the footways, at intervals, over the crown of the arch of each subway, forming a very efficient means of lighting. In Charterhouse street, Snow hill, and in the other subsidiary streets, there is but one subway, of a lower form, 12 feet wide and 7 feet 6 inches high, running under the center of the roadway. In these, the pipes are laid on dwarf walls along each side of the central pathway. In all other respects, the arrangements are as nearly similar to those already detailed as the circumstances would allow.

Jasmine Pipe Stems.

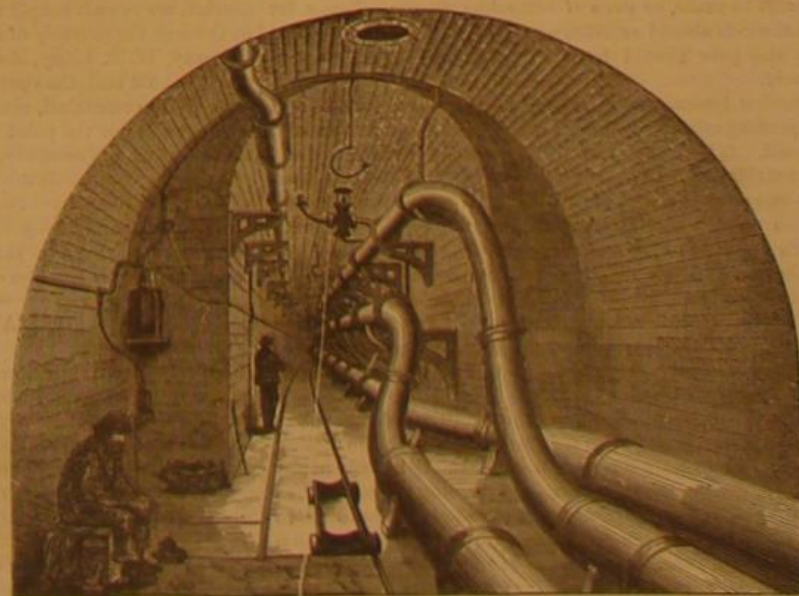
In a recent number of the *Revue Horticole*, M. Barillet describes the cultivation of the common jasmine (*jasminum officinale*), near Constantinople, for the purpose of tchibouk (pipe) making. The object sought is a long straight stem, free from leaves and side branches. For this purpose the plants are grown quickly in a rich soil, and drawn up by being grown in a sheltered situation, to which the sun has little access at the sides, but only at the top. Pinching is resorted to, and during the second year's growth one end of a thread is attached to the top of the jasmine stem. This thread passes over a pulley attached to the post to which the jasmine is trained, and from it is suspended a weight, the effect of which is to keep the stem always in a vertical direction. When the jasmine stem is about two centimeters (say $\frac{1}{2}$ inch) in diameter, a cloth is wrapped around it to prevent access of dust and of the sun's rays. Twice or thrice in the year the stem is washed with citron water (*eau de citron*), which is said to give the clear (*claire*) color so much esteemed. When the stem has acquired a length of some 15 feet it is cut down and perforated by the workmen, and fitted with a *terra cotta* bowl and an amber mouth piece. The length of the tchibouk stems varies from one to five meters (3 feet to 16 feet about); in the latter case as much as \$100 is demanded for their purchase.

Annealing.

The change produced by annealing is not well understood. Most of the malleable metals assume two distinct forms: one crystalline, which is the result of slow cooling, and the other fibrous, which is brought about by hammering or rolling. If hammered or rolled beyond a certain point, the metals become so hard that they cannot be bent without breaking. If annealed beyond a certain point, the metals become crystalline. The particles of the metal change their arrangement without altering the external form. Hence it is necessary to preserve wire, such as is used in the manufacture of pins, in a dry air, or under the surface of water.



SECTION OF LONDON SUBWAY—NORTH SIDE, JUNCTION OF CHARTERHOUSE STREET.



SECTION OF LONDON SUBWAY—SOUTH SIDE AT WEST END OF VIADUCT.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

A. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year	\$3 00
One copy, six months	1 50
One copy, three months	1 00
One copy, one month	25 00
CLUB RATES (Ten copies, one year, each \$2 00, and over ten copies, same rate, each)	2 50

VOL. XXIX, No. 20. [NEW SERIES.] Twenty-eighth Year.

NEW YORK, SATURDAY, NOVEMBER 15, 1873.

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THE PANIC AND THE LABORING CLASSES.

The daily journals of the past week have exhibited such crowded columns of reports from all parts of the country, indicating the temporarily depressed condition of the manufacturing and industrial interests, that it is hardly necessary here to particularize individual cases as evidence of the prevailing despondent feeling. By far the majority of establishments are retrenching: some by reduction of working force, others by cutting down hours, and more by removing a percentage from the salaries of employees. While the outlook is far from cheerful, there is a belief that the worst is over. The railroads and many of the iron foundries still take a gloomy view of affairs, and we notice that reductions of expense are yet being largely made.

With all the facts in view, however, we still are inclined to adhere to our belief in the passing nature of the trouble. We find much to applaud in the course adopted by many establishments, which, trusting to the early revival of better times, are working straight on, with no greater alteration in their business routine than such as they are imperatively driven to make. So far as the producers of the necessities of existence are concerned, we think little apprehension need be felt as to their rising superior to the disaster; but with reference to those who gain their living from the manufacture or sale of articles pertaining to the luxuries of life, there is a probability of less favorable results.

To the workmen, however, the prospect is indeed dark. No pay on Saturday night means, to hundreds, no dinner on Sunday—no rent for the coming week—no fuel to keep off the bitter cold of winter. In ordinary times, these men might seek other employment, or turn to some labor, the return for which would keep body and soul together; but now, when thirty thousand operatives in this city alone have been thrust from employment, the chances of gaining comfortable support for a family are far from promising. Let employers put themselves in the places of their hands, and imagine their own feelings in so dire a strait, and then think of the hardships which, perhaps through a mere sentiment of over-caution, they entail, not only upon their immediate workmen, but upon their families and the host of other people dependent upon their small custom for a means of existence. It is for this reason, above all others, that we advocate the keeping open of every industrial establishment while its bare expenses can be met, no matter if not a cent of profit be made, or even if some loss accrue. Better far that the rich should sacrifice a portion of their wealth than that the poor should be left destitute or driven to pauperism.

Another lesson, and a fruitful one, is to be gleaned from the pending crisis, which the workmen would do well to take to heart. It is the utter futility and hollowness of strikes, and notably that of a year ago, when regarded in connection with the present aspect of affairs. It is strange that hardly twelve months should elapse before the very condition to which a number of wrongheaded men strove to reduce the employers, through coercion and an unjust exercise of power over the ignorant, should be brought home to their own doors. The defeat of the great movement of 1872 was complete enough, but it has been reserved for the panic of 1873 to give it double effect and to render its teachings indelibly impressed.

As to the means of alleviating the condition of those who, it now appears, are to be so sadly reduced during the coming winter, some organized plan will undoubtedly become necessary. A contemporary suggests the division of large cities into districts, and the appointment of suitable committees to visit the houses in each, in order to solicit contributions to a general fund. Our opinion is that now is the time for the trades' unions to assert themselves, and to prove that they are unworthy of the odium under which they now labor. Several of these organizations, during the great strike,

boasted freely of their reserve capital and of the assistance to be gained from kindred societies in Europe. Now let the International and the British associations, which send such earnest emissaries here, come forward and render that aid which they have so freely promised. If the trade associations will join forces, and labor, not merely in the interest of their own members but of all working men, they will do more towards elevating the condition of the laboring classes than they could accomplish by any number of successful strikes.

THE PROGRESS OF THE HELL GATE EXCAVATIONS.

General Newton, of the United States engineers, the officer in charge of the government works at Hell Gate, has recently submitted his annual report of progress made in that important undertaking. The various tunnels and galleries now aggregate in length 5,884 feet, of which 2,731 feet constitutes the advance of the past year. The total amount of stone removed during this period is 9,554 cubic yards, of which 7,619 yards were extracted by the Burleigh drill, 185 by the Diamond, and the balance by hand work. About ten linear feet of holes have been made in each cubic yard of rock; and to explode this large number of blasts, 11,808 pounds of nitro-glycerin, 1,218 pounds of giant powder, and 3,445 pounds of black powder have been employed. In hammer work, 9 03 feet of hole and 0 9 pounds of nitro glycerin correspond to one cubic yard of rock blasted.

The report speaks very favorably of the operation of the Burleigh drill, each machine, it is stated, having made for the year an average of 25 feet per shift of eight hours. The loss of steel by abrasion and drilling is estimated at 0.54 ounces per linear foot, a calculation which of course must be confined to rock of similar nature to that at Hallett's Point. The balance of the report refers more particularly to the operations of the steam drilling scow during the year 1872, reference to which has already been made in these columns. There is the usual complaint of delay and increased cost of operations, owing to the lack of necessary funds. It is strange that Congress is so apathetic in this regard. The importance of securing a free channel from Long Island Sound to the East River has been so frequently and so forcibly urged, and so much money has already been expended in fruitlessly endeavoring to secure the same, that there can be no reason for withholding the means of completing a work regarding the ultimate success of which no doubt can be entertained. Delay, as General Newton has so often pointed out, only increases expenses, and besides indefinitely defers the advantages to be gained by both city and country. We were told during last winter that at that period a sum in the neighborhood of five or six hundred thousand dollars would be sufficient for all purposes. It seems to us that both our city and state authorities should, during the coming session of Congress, especially interest themselves in this matter, and, by the exercise of their powerful influence, ensure the appropriation of the balance now needed to effect the speedy completion of operations.

A RECENT IMPROVEMENT IN GAS MAKING.

On another page of this issue will be found an illustrated description of an improved plan of gas manufacture, which has recently been put in practice at the works of the Citizens' Gas Company in Brooklyn, N. Y. It is a matter of general information that the forcing of jets of superheated steam through anthracite coal, over heated metal, or through a furnace fire, is not a new idea, nor is it our intention in the present instance so to infer. Some sixty patents or more have been granted for "water gas" and kindred processes, dating as far back as 1823. The system in general has found many opponents, notably, among others, the late Dr. Torrey; while Professor Wurtz, in published reports on the subject, has pointed out that it is impossible to convert the steam entirely into hydrogen and carbonic oxide. Some of the steam, he considers, is not decomposed, and, passing into the coal retorts, operates injuriously, probably by oxidizing the olefiant gas. In conclusion, the same author remarks that the greatest of practical objections is "the uncertainty of the quality of the product."

Without entering further into the details of the subject or inviting discussion of the vexed question in the present connection, we submit simply a statement of facts as laid before us through the courtesy of the President of the above named company, W. P. Libby, Esq. Whether gas experts may or may not hold that the operation and apparatus we have described are economical, remunerative, or of any advantage whatever, is not the point upon which we wish to dwell. The books of the company, we are told, indicate no inconsiderable saving, while the aspect of the works, the absence of the usual complement of hands, the diminished requirement of coal, and finally the satisfaction expressed by the officials employing this threefold process, add still further testimony in corroboration of its apparent value and utility.

POSTAL SCIENCE.

It seems to us that the postal regulations now in force are singularly inconvenient, not to say unjust, as regards publishers, who, in the ordinary course of their business, find it necessary to transmit large quantities of printed matter through the mails. We have already called attention to the fact that we are now preparing a special edition of sixty thousand copies of the SCIENTIFIC AMERICAN, numbers of which will be mailed to persons in every city, town and village in the United States. As the recipients of these papers will in all cases be non-subscribers, the postage thereon must be paid in stamps previous to mailing; so that, at the rate of two cents per copy, the aggregate expenditure for this item alone will reach the sum of twelve hundred dollars.

Now sixty thousand papers would supply 1,154 subscribers with one copy each per week for one year. But each person, paying at his own post office, would be charged only five cents per quarter postage, or twenty cents for the entire period. Consequently, the 1,154 people would together aggregate the sum of about \$231, or a very little over one sixth of the amount which we pay in advance in order to send all the numbers at once. If, as it is urged, the low rate of postage to subscribers has for its only end the facilitating of the dissemination of news and useful knowledge, then why is it not equally fair to further the same object by giving those who produce the means of imparting such information similar advantages? Why should we, in the present instance, be required to hand out one dollar and four cents for sending fifty-two copies of our special edition at once, when if we forward the same number of issues of our regular publication, weekly for a year, our subscriber would be taxed only twenty cents?

Again, is it not possible to simplify the mode of sending such masses of matter, to the interest of both government and publishers? We are now obliged to purchase sixty thousand stamps—three hundred sheets—and go to the labor of pasting them on the wrappers, after which each stamp of course has to be cancelled in its passage through the mails. It seems that it would be a much easier proceeding for the Post Office to detail one employee to weigh the entire issue, note the result, and thence calculate the charge at regular rates. This sum determined, we could pay it at once, the papers would be despatched, and the proof of prepayment might simply be a hand print of "New York—paid," or something of similar kind, applied by the same people and in the same manner as they would obliterate the ordinary postage stamp. The government would thus gain the cost of manufacturing the sixty thousand two-cent stamps, while we should be spared the trouble of affixing them.

In England, the sender is not obliged to stamp his matter if the postage thereon equals or exceeds one pound sterling. If, for example, he has two hundred and forty letters to forward, at the rate of a penny each, the office weighs them and receives the cash, stamping them paid in the manner above noted. Or, in other cases, if it be so desired, the post office will emboss stamps upon wrappers or envelopes of any size, upon any variety of white paper, without any charge other than the face value of the imprint. These plans might well be put in practice here, and it seems might prove of no small convenience. For the English newspapers even a better arrangement is in existence. Formerly there was a revenue tax on every journal, which covered its transmission, free through the mail, for any number of times up to a certain date from that of its publication. London papers were sent from the publishing offices to those of the Internal Revenue, at Somerset House, where the proper stamps were affixed; after which no further payments were required. Now, however, the income goes directly to the post office; but instead of obliging journals, like the London Times, for instance, the circulation of which outside of the capital is very large, to buy and attach innumerable penny stamps, an electotype of the government imprint is locked up and struck off in the regular forms of the paper. An official is stationed in the press room to count the sheets printed, and the proprietors pay the tax called for by his report.

The efforts toward postal reform, which have been for so long advocated by both press and people, were well inaugurated by our last Congress in the abolition of the franking abuse, the establishment of charges upon exchange newspapers, and the authorization of the postal cards. It remains for the coming legislature to continue the work by reducing the postage on all letters, sent within the United States, to the uniform rate of one cent; while, at the same time, we trust that the discrepancies which we have pointed out in relation to newspaper charges may be fairly adjusted. The question of increasing the facilities for transmission, by means similar to those referred to above, is within the authority of the Post Office Department, and merits its careful consideration.

ON THE MOLECULAR CHANGES PRODUCED BY VARIATIONS OF TEMPERATURE.

Professor R. H. Thurston, of the Stevens Institute, has prepared a very interesting paper on this subject, in which is presented, in brief form, a history of the various practical experiments and the conclusions reached by different observers on the above subject. He states that the most complete investigation ever made, particularly to determine the effect of changes of temperature in modifying the physical properties of iron and steel, was that of Knut Styffe, the director of the Royal Technological Institute at Stockholm, Sweden, and supplemented by the experiments of Christer P. Sandberg, who translated the report of Styffe into English.

The work of the first named engineer was done at the instance of a committee appointed by the King of Sweden. It was commenced by Professor Angstrom, continued by Herr R. Thalen, of the University of Upsala, and by Engineer K. Cronstrand, and it was finally concluded, with the assistance of Cronstrand and Lindell, by Styffe, who wrote out the results of the whole investigation and made the report public.

These labors were begun in 1863, and extended over several years.

The conclusions of Styffe were:

"(1). That the absolute strength of iron and steel is not diminished by cold, but that, even at the lowest temperature which ever occurs in Sweden, it is at least as great as at ordinary temperature (about 60° Fah.)."

"(2). That, at temperatures between 212° and 392° Fah., the absolute strength of steel is nearly the same as at ordinary temperature; but in soft iron, is always greater."

"(3). That neither in steel nor in iron is the extensibility less in severe cold than at ordinary temperature, but that, from 266° to 320° Fah., it is generally diminished, not to any great extent in steel, but considerably in iron."

"(4). That the limit of elasticity, in both steel and iron, lies higher in severe cold; but that at about 284° Fah., it is lower, at least in iron, than at ordinary temperatures."

"(5). That the modulus of elasticity in both steel and iron is increased on reduction of temperature, and diminished on elevation of temperature; but that these variations never exceed 0.05 per cent for a change of temperature of 1.8° Fah. and, therefore, that such variations, at least for ordinary purposes, are of no special importance."

The experimenter gives it as his opinion that the cause of the frequent breakage of rails in cold weather, and of articles made of iron and steel, is unequal expansion and contraction and the rigidity of supports, where, as is the case with rails, frost may very greatly affect them.

Sandberg's conclusions, from 20 experiments, are thus given:

"(1). That, for such iron as is usually employed for rails in the three principal rail-making countries (Wales, France, and Belgium), the breaking strain, as tested by sudden blows or shocks, is considerably influenced by cold; such iron exhibiting, at 10° Fah., only from one third to one fourth of the strength which it possesses at 84° Fah."

"(2). That the ductility and flexibility of such iron is also much affected by cold; rails broken at 10° Fah., showing, on an average, a permanent deflection of less than one inch, while the other halves of the same rails, broken at 84° Fah., showed a set of more than four inches before fracture."

"(3). That, at summer heat, the strength of the Abardare rails was 20 per cent greater than that of the Creusot rails; but that, in winter, the latter were 20 per cent stronger than the former."

Sandberg suggests that this considerable decrease of toughness at low temperatures may be due to the "cold-shortness" produced by the presence of phosphorus. Our knowledge on this point must remain imperfect until similar experiments have been made with iron free from phosphorus.

The practical result of the whole investigation is that iron and copper, and probably other metals, do not lose their power of sustaining "dead" loads at low temperatures, but that they do lose, to a very serious extent, their power of sustaining shocks or resisting sharp blows; and that the factor of safety in structures need not be increased in the former case, where exposure to severe cold is apprehended; but that machinery, rails, and other constructions which are to resist shocks, should have large factors of safety and should be most carefully protected, if possible, from extremes of temperature.

MEDICAL SCIENCE IN COURT.

Nearly two years ago James Fisk, a managing director of the Erie railway and a prominent man in various steamboat and other enterprises, well known, doubtless, by fame to many of our readers, was shot by the hand of an assassin. The scene of the tragedy was at the Grand Central Hotel, on Broadway, in this city. Fisk had just entered the premises, and was in the act of ascending the stairway of the ladies' entrance, when he was shot by a person standing on the landing above. The ball entered his abdomen just above the navel and passed obliquely downward through the intestines, lodging in the muscles of the thigh. Another ball made flesh wounds in the arm. The assassin was Edward S. Stokes, who was almost immediately arrested and lodged in jail, while the wounded man at once received medical attendance in the hotel, where, after lingering until the following day, he died.

Stokes has had three trials. On the first, the jury failed to agree. On the second, he was found guilty and sentenced to death. But the Court of Appeals, in consequence of certain informalities in the proceedings, ordered a new trial. This third trial has just been finished, resulting in the finding of the prisoner guilty of manslaughter in the third degree. The highest punishment of the law, four years in the State prison, was immediately pronounced, and thus has terminated one of the most remarkable cases in criminal jurisprudence.

To the superficial observer, the result of the trial seems strange enough. Here was a man ruthlessly shot down in broad daylight, and the shooting clearly brought home to the accused; yet he escapes with a comparatively slight punishment. It is even stated, on good authority, that nine of the jurors were in favor of an absolute acquittal, and consented, with great reluctance, to the verdict given. The questions naturally arise: What basis had these jurors for such a verdict, and why, if Stokes shot Fisk, was he not found guilty of murder?

The defenses were: 1. That Fisk had threatened to shoot Stokes, that on this meeting he drew his pistol, when Stokes discharged his revolver in self defence. 2. That the previous threats of Fisk had affected the mind of Stokes, and that at the moment of the shooting he was insane. 3. That Stokes did not shoot with intent to kill. 4. That the death of Fisk did not result from the shooting, but from poisoning by malpractice of the doctors after the shooting. It is to the evidence pertaining to this last theory of the defence that we wish to direct attention, for it involves the testimony of some of our most distinguished physicians, acting in the capacity of scientific experts.

From this evidence, it appears that Fisk was attended by seven doctors and surgeons, all prominent men in this community, namely, Drs. Carnochan, Tripler, Steele, White, Sayre, Fisher and Wood. In the multitude of counsel, there is generally supposed to be wisdom; but it seems to have

proved otherwise in this case. Dr. Tripler began operations by deeply probing the distressing wound, an injudicious proceeding, according to some of the medical experts. Subsequently Dr. Fisher, Dr. Wood and Dr. White each used the probe. Several glasses of brandy and water were administered, also chloroform and morphine. The latter was administered by the mouth, and by subcutaneous injection, six times within four hours.

Dr. Wood testified that he told Drs. Fisher and Tripler, who were the choice of Mr. Fisk as attendants, that they had two lives on their hands, Fisk's and Stokes', and must administer the opium with their fingers on the pulse and watch carefully the condition of Fisk's pupil and of his intelligence. He ascribed Fisk's death to shock, but admitted that the latter symptoms, such as stertorous breathing, were symptoms of opium poisoning. He had heard of many cases of recovery from serious wounds in the intestines; he had seen, in cases of hernia, a portion of the intestines slough away and the patient recover; he did not, in the light of authenticated cases, consider Fisk's wound necessarily fatal.

Dr. John M. Carnochan, the distinguished surgeon, reached Fisk's bedside some seven or eight hours after the shooting. He did not think, when he saw Mr. Fisk, that he exhibited the symptoms of shock; he had reacted; he thought the giving of two and a half grains of morphia—thirty drops—hypodermically was a most dangerous way of using opium; it was, he believed, at least the cause of his premature death, that is, that it hastened his death. He thought Fisk could not intelligently have made his will, if he was laboring under shock. He related cases, that he had known, of penetration of the bowels which had not proved fatal. On cross examination, Dr. Carnochan said that he found Fisk, when he reached him, in an unnaturally somnolent condition; the wound did not kill him, the morphia did; there was a possibility that the wound had something to do with it, but he had none of the usual symptoms immediately following injury from a gunshot wound; there was nothing to indicate that he was suffering in any manner from the wound; it was a very dangerous wound, but not necessarily a fatal one. Q. You would expect him to get well? A. Of course I would.

Dr. Gurdon Buck testified that the wound was alone sufficient to account for death, and that the use of opium he regarded as a proper treatment; but some of the symptoms agreed with those of opium poisoning.

Dr. A. B. Crosby testified that he would consider such a wound fatal.

Dr. Thompson, professor at the university, explained that death from shock arose from enfeeblement of the heart, while death from narcotism arose from coma or from the head. Probing, in abdominal wounds, while the shock lasted, he thought should rarely be resorted to. Chloroform was contra-indicated by shock. It should not be used while shock lasted. He thought he had seen death result from the administering of twenty drops of chloroform. He described at length the symptoms of opium poisoning, which ends in coma, and declared that, in death by shock, though there might be insensibility, that was different from coma. Snoring was utterly inconsistent with shock. Deep breathing was the clear mark of recovery from shock. He declared that the symptoms described indicated that Mr. Fisk had recovered from shock. He thought the length of time excluded entirely the idea of death from peritonitis, and the only conclusion was that he died from an overdose of morphia.

Dr. Macready was examined as an expert on the effect of the wound, and the effect of the morphia administered. He was inclined to think, from their describing the doses by drops, that one half more had been given than was supposed, as ten drops would be fifteen minims. The administering of morphia hypodermically nearly doubled its power. He was strongly of opinion, from the description of the case, that Fisk did not die from shock or peritonitis. There was not enough peritonitis to produce death, and the development of the symptoms were not those of shock. The symptoms were those of inflammation of the brain or uræmic or narcotic poisoning. There being no disease of the brain or kidneys, he ascribed the death to an excess of narcotics.

Dr. Marsh, deputy coroner, testified that he made the post mortem examination. In his opinion the death of Fisk was due to shock and peritonitis. But the latter was not sufficient of itself to have caused death. As to narcotism, he did not make any examination. Subcutaneously administered, one twenty-third part of a grain of morphia had been fatal. Taken in the stomach, two grains had been fatal. As to wounds in the abdomen, in the Crimean war ten per cent of those wounded had recovered; in the recent rebellion war, twenty-five per cent had recovered.

Judge Davis, in submitting the case to the jury, made an elaborate and excellent charge. He solemnly warned them against allowing themselves to be influenced by any feelings of prejudice either for or against the prisoner. They must be wholly governed by the evidence before them. In reference to that branch of the defence here under consideration, the Judge was very clear and explicit. "If morphia, improperly administered, either as to the manner or as to the quantity, caused the death of James Fisk, Jr., on the 7th of January, 1872, not as an accelerating cause, but an independent cause, being in itself the sole agent producing death at that time, then the prisoner is not chargeable with the death, because another and an independent agent produced that result, in which his act—the wound he caused—did not occur."

"I charge you, as the law on this subject, that if you come to the conclusion that the medicines administered were the sole cause of death, and at the same time that the prisoner intended to kill, that he fired the fatal shot with intent to kill, and inflicted a wound with that design, then it is your

duty to convict him of an attempt to commit murder in the first degree." In view of this charge, and the medical evidence, it would seem as if the jury had reason for giving the verdict they did, independent of the other points of the defence, which were well sustained.

THE GOVERNMENT BOILER TESTS.

We have already announced the appropriation by the Government of \$100,000 to be expended in an extensive and exhaustive series of boiler trials at Sandy Hook and at Pittsburgh. Although it was intended to conduct these tests during the past months of September and October, it has been found that the extent of the necessary preparation has caused an unavoidable delay, existing up to the present time. Now, however, it seems that the experiments will be begun at once, and some 20 workmen are engaged at Sandy Hook setting up the ten boilers to be employed. The latter are of the best material and construction, and will be placed in the position in which they are usually located upon steamers. The bomb proof shelter is to be built at a distance of 260 feet from the boilers. Suitable pyrometers, thermometers, and other necessary instruments will be supplied, and self-regulating gages are to be buried in the earth near the boilers.

The Government Commission consists of the following gentlemen: Supervising Inspector Addison Low and C. W. Copeland, of New York, J. H. Robinson, of Boston, Supervising Inspector John Menshaw, of Baltimore, J. V. Holmes, of Ohio, Benjamin Crawford and Supervising Inspector John S. Devinney, of Pittsburgh. The experiments will be mainly to determine the truth or fallacy of the various theories as to the causes and conditions of boiler explosions, which theories are briefly:

First: Explosions caused by the gradual increase of steam pressure.

Second: Those caused by low water and overheating of the plates of the boiler.

Third: Those caused by deposit of sediment, or incrustation on the inner surface exposed to the fire.

Fourth: Those caused by the generation of explosive gases within the boiler.

Fifth: Those caused by electrical action.

Sixth: Those caused by the percussive action of the water in case of rupture of boiler in the steam chamber—Clark & Colburn theory.

Seventh: Those caused by the water being deprived of its air.

Eighth: Those caused by the spheroidal condition of the water.

Ninth: Those caused by the repulsion of the water from the fire surface or plates.

The Sandy Hook trials will extend over several days, and the results will be duly noted on these columns. The Pittsburgh tests will begin on November 12; and on their completion the Commission will return to Sandy Hook, with a view of experimenting upon various safety valves.

SCIENTIFIC AND PRACTICAL INFORMATION.

SPIRITUALISM NOT PATENTABLE.

Spiritualism fails to meet with official recognition in the Patent Office of the United States. "Psychic stand" was the name of the device on which a Massachusetts inventor wanted a patent, because, as he stated, it would spell out words and sentences known as spiritual communications "through an alphabet not only invisible to the operator, but the very location of which he cannot know." "Moreover," he added, "the mode of its operation precludes all possibility of trick or imposture." The obtuse examiner, however, not only refused to perceive the peculiar merits of this useful invention, but gave, as an opinion, that spiritual manifestations are "largely mixed with ignorance, deception, and fraud." The Office, it is stated, offered to issue letters patent on the contrivance as a game table, thereby adding insult to injury on the exasperated inventor, who, shaking the dust of the capital from his feet, departed in a state of indignation bordering on absolute ferocity. The alleged offer of the Patent Office to issue the patent for a game table seems to us quite improbable.

THAT EASTERLY CURRENT.

An attempt was recently made at San Francisco to find the easterly current, and by its aid to rescue New York by balloon in a few hours' time. The machine took a fine start, having on board three passengers, who, instead of finding the breeze they wanted, struck a westerly current and came down in the Pacific ocean, happily near the shore. The balloonists were received by boats and had a narrow escape.

Donaldson made another ascension a few days ago from Newark, N. J. He found the easterly current, which took him over the cities of New York and Brooklyn, landing him near Roslyn, L. I. In attempting to reach the earth, the car was swept violently against a stone wall, and the aeronaut was considerably bruised.

PETROLEUM IN BURMAH.

According to the report of Captain Storey, agent for the British Government, there are at present about 150 wells worked at Yegnanyoung, which yield 63,500 barrels of oil a year. At Pagan there are about 50 wells. The oil from these wells is obtained in a more liquid state, and more resembles naphtha. It is of a brackish nature, and is better suited for lighting purposes than the Yegnanyoung oil.

THE back page of the special edition of this paper, to be published about November 15, has been all taken by advertisements; a few more advertisements will be received for the inside pages and Business and Personal column. For terms, see inside. Order immediately.

AMERICAN LIGHTHOUSES.

Last year the Lighthouse Board of the United States had under charge 179 sea and lake coast lights, 394 river and harbor lights, 22 lightships, and 33 fog signals operated by steam or hot air engines, besides large numbers of unlighted beacons and buoys. Naturally the great diversity of the conditions under which the American lighthouses have to be erected, and the fact that the great extent of coast has necessitated the division of the work of superintendence into thirteen districts, each with its own engineer, have led to considerable variety of design, and we illustrate herewith two of the lighthouses lately erected by the Board, the first engraving showing the Race Rock lighthouse, and the second engraving that at Thimble Shoal, at Hampton Roads, Va.

The Race Rock lighthouse, at the eastern entrance to Long Island Sound, is one belonging to the third district, of which Colonel I. C. Woodruff is engineer. The general design of the structure is shown by the engraving, and we need merely add here that the foundation consists of about ten thousand tons of riprap stones, weighing from three to five tons each. The foundation was completed in November, 1871.

The Thimble Shoal lighthouse is in the fifth district, of which the engineer is Major Peter C. Hains. This light has been erected to take the place of the Willoughby Spit light ship, and it is situated on the shoalest point at the entrance to Hampton Roads. A start was made with this lighthouse in May, 1872, and on the 10th of June of that year the platform, which the screwing of the piles into the shoal was carried on, was completed. The shoal proved to be very hard, consisting of fine compact sand, but by the 1st of August, 1872, the last pile was planted. The light is of the fourth order, and the general design of the structure is very neat.

We may add, says *Engineering*, to which journal we are indebted for the illustrations, that the chairman of the Engineering Committee of the United States Lighthouse Board is General Barnard, and the engineer secretary, Major George H. Elliot.

The Cocuyo.

M. de Dos Hermanos has recently succeeded, after considerable trouble, in transporting from Cuba to France some fifteen hundred living cocuyos. These insects he has submitted to the French Academy of Sciences, for dissection and general examination.

The cocuyo appears in Cuba generally toward the end of April, after the first rains, and abounds in wooded places and cane fields. It emerges at twilight, but its nocturnal promenade lasts barely over two or three hours. In hollows of trees, under masses of shrubs, among the young portions of cane plantations, it finds favorite places of concealment, feeding upon tender leaves, the soft substances found in old trunks of trees, and analogous materials. It appears that dampness is a condition essential to the insect's existence.

At about the end of July, the cocuyo disappears; but insects may be kept imprisoned in baskets or cages, if carefully guarded and nourished, until September or October. The cocuyo should not be confounded with the aquacero, a

name given to an insect exactly resembling the former but hardly one third its size. The aquacero remains out and shows its phosphorescent light during the entire night. The brightest radiance of the cocuyo is found in the ventral region; and it appears at its greatest splendor when the insect flies or is dipped in water. Although completely inoffensive to man, the cocuyo is of quarrelsome disposition, since it attacks its fellows in a terrible manner, especially when a

portion. Whenever one of these dorsal or ventral organs is uncovered, its moist and brilliant surface darkens in color, and slow irregular movements, due to the contraction of the striated muscular bunches which are inserted in the lower face, supervene. Sections of the different organs show that they are lenticular in form, about one third as thick as broad, and are contained in a deep adipose envelope. The latter is entirely formed of very large cellules, containing

numerous fatty globules, as in the adipose tissues of insects; and it has very many healthy vessels in comparison to the rest of its structure. The tissue proper (semi-transparent and damp, forming the central portion) is the most voluminous. It is composed of cellules which do not differ sensibly from those which constitute the luminous organs of the *lampyris*. These cellules are closely contiguous to each other; and between their adjacent faces, are found only wind pipes and nerve tubes, with the exception of which the mass of the tissue thus constituted may be subdivided into lobes and lobules.

Brown and Linnaeus have already pointed out that the luminous production of the *pyrophorus* is governed by its will. The light appears

number are confined together. The claws form its offensive arm, with which it often penetrates the neck of its adversary so completely as to separate the thorax from the body. It frequently loses its weapons by the operation. M. de Dos Hermanos mentions instances where the insect has nevertheless continued to exist for some months afterward. The mutilation of the members doubtless hastens death, the approach of which can be foretold by the darkening of the eyes which, when the cocuyo is in a state of health, are of a yellowish

first at the center of the organ and then extends over its whole surface, becoming more brilliant and greenish as its area enlarges. It is well known that, during repose and outside of all nervous influence, the electrogeneous apparatus of fishes passes to a state of electric tension more and more pronounced, from which the fishes free themselves suddenly when they so desire or when under the experimental influence of such and such physico-chemical action. Now in the present case, consider the investigators, the probabilities

are that the phosphorescent tissue produces little by little a substance which accumulates slowly in the producing cells themselves independently of all nervous influence, by operations of the same order as those of various secretions, and that the only act by which the discharge takes place is voluntary. The principle which renders luminous during several minutes the substance of broken cellules acts like noctilucline, a nitrous coagulable phosphorescent principle obtained by Phipson from the luminous mucus of certain scolopendras, fishes, etc. It is a natural principle of little stability, of which the chemical and molecular segregations take place as soon as it becomes free, and which manifests itself by a production of light alone, without heat and in a manner similar to that caused by

the accidental decomposition, putrid or not, of different kinds of tissue, mucus, sugars, etc.

The abundance of urates in the substance of the cellules where the disengagement of light takes place, it is believed, indicates that uric acid is one of the crystallizable components resulting from the photogenic decomposition of the above mentioned coagulable substance, since it is gradually eliminated, like the crystalline principles of similar assimilations.

In St. Andrew's church, Dublin, an excessive reverberation of sound has been checked by stretching wires across the building.



LIGHTHOUSE AT RACE ROCK—EASTERN ENTRANCE TO LONG ISLAND SOUND.



LIGHTHOUSE AT THE THIMBLE SHOAL, HAMPTON ROADS, VA.

A NEW IMPROVEMENT IN GAS MANUFACTURE.

There are few subjects of public importance which are just at present engaging a greater share of the attention of scientific men than the economical production of illuminating gas. The English technical journals—owing in no small measure to the recent coal famine, coupled with the knowledge of the fact that, of the hundred millions of tons yearly drawn from the mines of the kingdom, fourteen per cent of the aggregate amount is used for lighting purposes, and hence rendered unavailable for industrial or domestic employment—have, of late, been filled with references to the manufacture of gas from petroleum products, resinous substances, and from coal by improved and less expensive systems.

In our own columns we have already presented our views, as well as those of many valued correspondents, regarding the advantages to be derived from the general adoption, in this country, of processes for the utilization of other materials than coal for the purpose noted. Several valuable systems have been patented; and notably some for the use of petroleum and other hydrocarbon oils are in actual employment. Of the relative merits of the different plans, or as to the estimation in which they are held by those using them, it is not our intention here to speak. Suffice it that, considering any or all in comparison with the employment of coal solely, the question of cost of transportation of the latter forms an important argument in their favor; and hence, so far as we can learn, gas companies and engineers generally manifest no lack of willingness to entertain or experiment upon suggestions or inventions having for their first object the reduction of this very material item of expenditure.

As an instance in proof of this latter assertion, the Citizens' Gas Light Company, of Brooklyn, N. Y., have recently

hydrocarbon vapors which otherwise would be lost; third and last, naphtha gas, or any of the petroleum products, which may be made of almost any richness that it is possible to burn, is led into this mixture, in sufficient proportion to produce the requisite degree of illuminating power. In other words, coal gives coke for fuel to run the works, and common gas; hydrogen takes up the carbon vapors, and

er holes in their upper surfaces, communicating with other apertures which, when several tiles are laid side by side, form two longitudinal passages through them. Thus arranged, three retorts are placed in each bench, in the usual manner, and, when in use, are filled with anthracite coal. Once in a day, the coal is raked back, and about a bushel of anthracite is thrown in; and once in each week the retorts are refilled.

From an ordinary cylindrical boiler, steam is led to a superheater, and thence to the vertical pipe, marked A in our large engraving (Fig. 4). Following its course for the retort on the right, the steam escapes from tube, A, into two pipes which lead to the dryers, the ends of which are represented at B. Near the junction of the pipes with tube, A, are placed suitable valves to regulate the supply. The dryers, B, are made double; that is, the steam enters an inside metal tube, by which it is carried back five feet into the bench, and then passes to and through an inclosing metal tube, back to its starting point. This is intended to prevent any wet steam from reaching the clay superheaters or retorts in the bench; and, finally, the steam passes out by two upwardly leading pipes, which terminate each just above a retort, at C. At the latter point, each pipe connects with a short tube which joins it with clay superheaters placed just above the retorts, so that the steam, entering at C, travels to the rear of the superheater, which is five feet in length, and then returns, highly heated, in an opening parallel to the front, making its exit by the tubes, D. In the latter it is conducted down under the lower portion of the retort into the longitudinal passages formed through the tiles. Hence, it escapes up through the perforations and through the incandescent

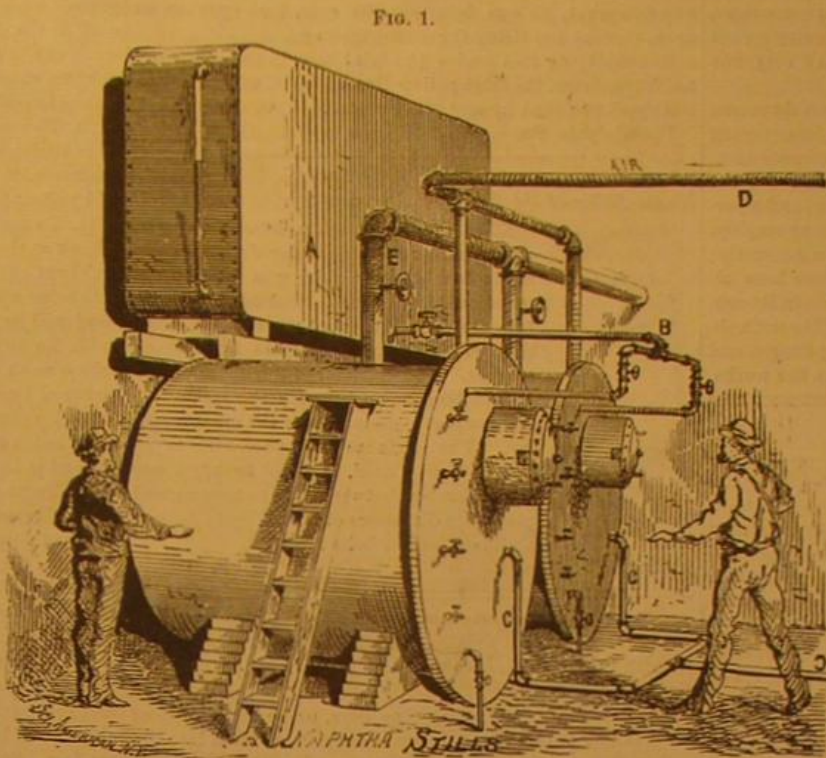


FIG. 1.

adds heat to the flame; thus creating more perfect combustion; and naphtha increases the lighting power to any desired standard.

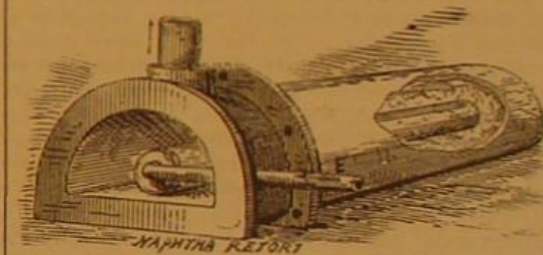
Using coal alone, we are told that 9,026 feet of gas per ton was about the yield with the full complement of benches. Now, 13,000 feet of coal gas and hydrogen mixed is produced, or an average of about 6 feet per pound of coal, which may be increased by increasing the hydrogen.

As the hydrogen and naphtha processes are quite distinct, we shall refer to each in detail, separately. In our large engraving (Fig. 4) the artist has shown the exterior of the hydrogen bench, and in the smaller engraving (Fig. 2) is represented one of the retorts here used. The latter, though of the general shape and of the same material as the ordinary gas clay retort, differs from it in that it has a diaphragm extending horizontally across the center, forming a double retort, and is, besides, covered at the bottom with tiles, one of which is represented separately. The diaphragm is perforated with medium sized openings. The tiles have small

coal, and is decomposed, forming hydrogen and carbonic oxide gas.

The gas thus generated by this American process passes into the hydraulic main, and thence is conducted to mingle

FIG. 3.



with the gas generated by the bituminous coal retorts. The product of the two hydrogen benches is in the neighborhood

of 100,000 feet per day, and its estimated cost is, at outside figures, 20 cents per 1,000 feet.

The naphtha employed is deposited in a suitable reservoir at some distance from the works, whence it is pumped as desired into a tank, marked A in Fig. 1. This receptacle receives its supply in order to deliver it by the pipes, B, into the two huge cylindrical stills. Within the latter is a worm pipe which is filled with steam from the boiler by the pipes, C. By means of a fan blower in the engine room, a current of air is driven into the stills by the pipes, D, which mingles with the vapor of the naphtha given off through its heating by the interior steam coil. The gas then passes from the stills by tubes, E, into the works, where it enters peculiarly arranged retorts, one of which is shown in Fig. 3. It will be noticed that the vapor is conducted

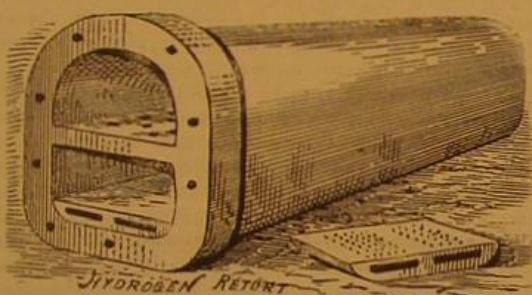


FIG. 2.

introduced, in their works, apparatus for the manufacture of hydrogen, by the decomposition of steam under the

Gwynne-Harris or American hydrocarbon process, and also for the preparation of naphtha gas, both of which products are mingled with that obtained in the ordinary way from coal. As a result, we are told that, as against 28 benches or 140 retorts in use in October, 1872, at present but 14 benches are employed, two of which generate hydrogen, two naphtha gas, and the rest coal gas, supplying the full amount required, and yet working only from 14 to 15 hours per day. The process, briefly stated, is threefold: first, coal which produces the ordinary quantity of gas, but of inferior quality, is carbonized in separate retorts; second, hydrogen, generated in the manner about to be described, is mingled with the coal gas, giving it high incandescent power, and, besides, taking up

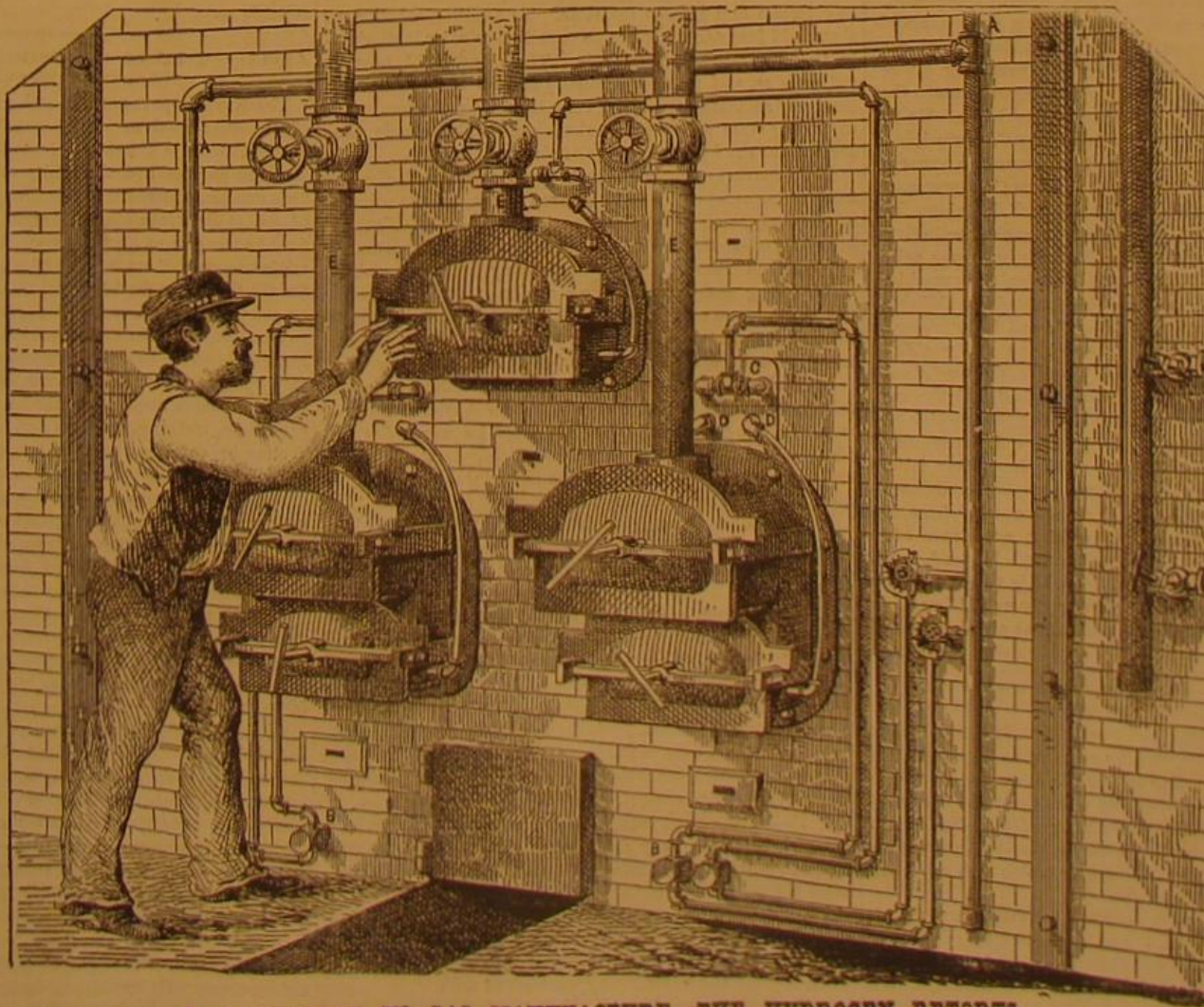


FIG. 4.

IMPROVEMENT IN GAS MANUFACTURE—THE HYDROGEN RETORTS

to the back of the receptacle by a pipe, whence it escapes. After heating, the gas is conducted to a condenser, where it passes through a series of pipes surrounded by cold water, and from which it is drawn by an exhauster and carried to the station meter, whence it goes to the main to mix with the coal and hydrogen gases. About 300 feet of gas per minute are thus made, a gallon of naphtha giving some 135 feet. This is of a uniform quality of 22 candle power.

The mixture of the three gases, as supplied to consumers, averages about 18 candles; and by carefully observing proper proportions in combining them, we learn that a very fine silver white light is obtained.

The process is unquestionably one of considerable economy to the gas company, as is evident from the large saving in the number of hands employed, due to the decreased number of benches used. Moreover, the raw material for the hydrogen, or anthracite gas, costs almost nothing, and a portion of the anthracite coal used is available for re-employment as fuel under the steam boiler. Naphtha is not costly; no canal coal is required, and the gas coal, as we have already observed, is of the type only serviceable in its production of the usual quantity of inferior gas. The main object of the bituminous coal benches, where hydrogen and naphtha are used, is to make coke for fuel to run the works.

Correspondence.

The Perpetual Motion Seeker.

To the Editor of the Scientific American:

Perhaps no enthusiasts are more contemptuously regarded by society in general than those who waste their energies in searching for a perpetual motion. Even persons who have little or no knowledge of the principles of mechanics never fail, upon a mere mention of the subject, to testify unmeasured disapprobation of the fruitless scheme, and, as a term of reproach to any whose visions appear to be Utopian, speak of their efforts as "savoring too much of perpetual motion." Orthodoxy regards the victim of this hallucination as an object of horror, his pursuit showing that he believes he can create; men of science avoid him altogether, or, at best, regret the ignorance that prevents him from appreciating the fact that motion is an equivalent term for expenditure; and the whole world expands into a broad smile when the victim of this very prevalent mental disorder reveals the weakness that possesses him. It is lamentable and extraordinary that at this day, when no end of opportunity is afforded to even the poorest person to thoroughly educate himself in all branches of knowledge, no less than one hundred thousand individuals in the United States alone are wasting time and substance in this seductive and barren pursuit. So infatuated do they become by long application that defeat but stimulates desire, until, disappointed, impoverished, disheartened and despised, the poor victim often seeks the suicide's grave.

An opportunity was afforded me some months since to interview a veritable perpetual motionist, who was said to have expended fourteen thousand dollars in constructing models, and who now believed himself upon the verge of reaping the reward of his exertions. A ride upon a street railway car to the end of the route, and a walk across open lots brought us to his cottage, whither he had retired from the crowded city, as he explained, that he "might uninterruptedly pursue his invention to a successful conclusion." We were permitted to enter the workroom containing his last model. It consisted of the usual combination of gear wheels, balance weights, springs and compensating levers; it was of very large dimensions, and so elegantly made that we at once recognized him as a superior mechanic. He experienced much satisfaction in explaining the principle of its operation; he talked learnedly of "the surplus power retained by relative levers of unequal fulcrum;" he was querulous on the subject of a criticism which his views had evoked from some previous visitor; he spoke feelingly of the "untimely death of Thomas Babbage, who was called away on the very eve of completing his calculating machine, thereby giving a victory to those who doubted his ability to accomplish the object of his ambition"; and he expressed a hope that he himself might live to rebuke a cold world, by giving it what it scorned to believe possible, a powerful self-motor. His wife, a pale anxious woman, had left the sewing machine at which she had been at work (and which was doubtless the chief support of the family) and, accompanied by her little son, listened to the conversation. Our failure to acquiesce in her husband's views gave her a moment's apparent concern; but the cloud passed quickly from her mind, and she manifested the touching confidence of a woman's loving nature. George Howard is dead. His model was purchased by a speculator who is now applying a secret actuating attachment, preparatory to exhibiting it, in our large cities during the coming winter, as a real perpetual motion.

FORBES.

The Lamp and the Spectroscope.

To the Editor of the Scientific American:

For the benefit of those who have met with difficulties in examining a spectrum, caused by extraneous light emitted by the Bunsen flame used to render the substance under examination incandescent (especially when the flame is colored by the salts of strontia, lithia, etc.), and also the light emitted by the flame used for illuminating the scale, permit me to describe a simple piece of apparatus which very effectually shuts off the extraneous light.

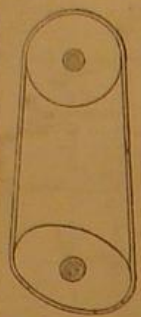
While recently engaged in examining the spectra of the alkalis and alkaline earths, I was exceedingly annoyed by difficulties from the above named sources; and I cut a circular piece of cardboard about nine inches in diameter, with a hole in the center large enough to slip on the extremity of

the collimator tube, carrying the slit and the prism of comparison. This entirely conceals the light of the Bunsen flame. If you cut a second piece, of a similar size and shape, and slip this on the eye piece of the telescope, or on the tube carrying the scale, by inclining it at a proper angle (which may readily be determined by the experimenter) a point will be reached which shades the eye from the second light. One of the chief merits of the plan is that, instead of keeping one eye shut, as was formerly the case, both eyes can be open, thereby not tiring the disengaged eye.

By employing this device the faint lines in the spectrum, as, for instance, the faint yellow line of lithia, are more distinctly shown than by any other means. C. A. DAVIS, Philadelphia, Pa.

Elliptic Pulleys.

To the Editor of the Scientific American:



Elliptic pulleys, such as here shown and now used at this place for driving automatic machines requiring a differential movement, are found efficient substitutes for elliptic gearing; and where applicable, they will be found preferable for obvious reasons. The diameter of the upper pulley should be a mean between the transverse and conjugate diameters of the elliptic pulley. The distance between centers of shafts, as now used, is about twenty times the difference between the transverse and conjugate diameters of the elliptic pulley. Ordinary leather belts are used.

New Britain, Conn.

F. H. R.

Simple Experiments for Young Chemists.

1. An easy way to prepare an invisible gas, that will burn with an intense heat, is to put some nails or strips of sheet zinc in an old bottle with a good, tight cork. The cork has a hole bored in it, and a clay pipe stem, or better, a piece of glass tubing with a fine opening at one end, is fitted into the cork. The zinc is covered with water and a little sulphuric or other acid added. The effervescence is violent; and if the cork is put in, the gas will escape through the tube. After waiting several minutes, wrap the bottle in a cloth and apply a match to the end of the tube, when the gas will take fire and burn with a colorless flame. If any air still remains in the bottle, an explosion will take place. Hold a cold white saucer in the flame, and it will soon be moistened but not blackened. This gas is called hydrogen, because, when it burns, it forms water.

2. To imitate the delightful odor of rotten eggs, it is only necessary to place some pieces of the sulphuret of iron in an old bottle and pour on water and oil of vitriol. The sulphuret of iron is made when iron filings and sulphur are heated together. If the bottle in which this vilely smelling gas is prepared has fitted to it a tight cork and a glass tube bent so as to conduct the gas under the water in a second bottle, much of it will be dissolved and can be bottled up and preserved for several days. This gas is called sulphydric acid, and must always be prepared out of doors.

3. To produce light, flaky clouds in a clear liquid, dissolve a piece of alum in water and to the clear solution add ammonia (spirits hartshorn) and stir or shake it. The clouds will be colorless and almost invisible. To another solution of alum, add just enough carmine or indigo to color it distinctly, then pour in some ammonia. The clouds will now be red, or blue, and as they gradually sink to the bottom will leave the solution colorless. This illustrates the method of preparing what are known as "lakes." The clouds thus formed are the hydrated oxide of alumina.

4. To convert a colorless liquid to an orange red, dissolve some tartar emetic in water and drop in some of the solution of the vilely smelling sulphydric acid. (See No. 2.) Next put some tartar emetic into a bottle with zinc and sulphuric acid, as described above (No. 1) for making hydrogen. After waiting long enough for all the air to be expelled, ignite the gas and place a cold saucer in the flame, when it will be blackened; and the spot thus formed, which is metallic antimony, will not dissolve in a solution of bleaching powder.

5. Analogous experiments could be performed with acid solutions of arsenic, but, owing to its poisonous nature, we would advise our young friends to avoid its use. The sulphydric acid would form a yellow precipitate instead of a red one, and the black stain on the saucer would be readily dissolved by chloride of lime, or bleaching powder.

6. To produce a strong smell by mixing two dry powders, each without smell, take pulverized sal ammoniac and stir in a little dry whitewash lime. A pungent ammoniacal odor is evolved.

7. In one tumbler or wine glass of water, place a single drop of oil of vitriol, in a second place some carbonate of ammonia, in a third some hydro-fluo-silicic acid and alcohol, in a fourth some bichromate of potash. Drop into each of these glasses some barium chloride. In three of them a white precipitate is formed, in the fourth a yellow one. Dip a clean platinum wire in the barium chloride; then hold it in a colorless gas or alcohol flame, and a green color is produced. The green fires in theaters are made with this substance.

8. To convert a fair complexion into one of African hue, persuade some fair lady to improve her complexion with bismuth pearl powder (many do it voluntarily); then let her enjoy the perfume of the sulphydric acid, and she will gradually blacken. A curious instance of the action of water on an acid solution is noticed by dissolving subnitrate of bismuth in muriatic acid, and then pouring it into a glass of water, when it gives the latter the appearance of milk.

9. To prepare a gas heavier than air, place some pieces of

chalk or marble in a deep jar, or in a bottle like that used for hydrogen, and pour some muriatic acid on them. Effervescence takes place, and a taper lowered into the jar is extinguished; or if the gas, which is called carbonic acid, be collected in another vessel, it may be poured from one vessel to another like water. The substance formed when marble is dissolved in muriatic acid is called calcium chloride, and may be used for some interesting experiments: Fill three glasses with water, and to the first add a little sulphuric acid, to the second some carbonate of ammonia, to the third some oxalic acid and ammonia. On pouring the solution of calcium chloride into these glasses it will in every case form, unless too dilute, a milky liquid.

10. To produce an intensely blue liquid, make a solution of blue vitriol, so dilute as to have but a faint color, then add ammonia, and it becomes intensely blue. To another portion, add yellow prussiate of potash and it turns a reddish brown.

11. To make blue glass, bend a piece of platinum wire to a hook at the end and heat red, then touch it on a bit of borax and heat until the latter melts to a little bead. Now dip it into some nitrate of cobalt and heat, when a fine blue glass bead will be formed.

12. To form a yellow precipitate, in a yellow solution, take a weak solution of bichromate of potassium and add sugar of lead; the effect is very pretty.

13. To produce a beautiful purple, take a dilute solution of chloride of gold and add a little chloride of tin; the color formed is known as purple of Cassius.

14. To pour red, blue, and black ink from one bottle, fill three glasses with water, and into one put a little sulphocyanide of potassium, in another some yellow prussiate of potash, in a third a solution of gallic acid, or nut galls. Dissolve a small nail in muriatic acid and dilute the solution. On putting a drop of this chloride of iron into each of the glasses, the three colors will be produced.

15. Yellow and white can be formed similarly by pouring acetate of lead into glasses containing bichromate of potash, and sulphuric or hydrochloric acid, respectively. The white chloride of lead dissolves in boiling water and crystallizes on cooling. Sulphydic acid blackens lead.

16. Red, yellow and black are produced as follows: put some potassium iodide in one glass, bichromate of potash in a second, and sulphydric acid in a third. Pour corrosive sublimate slowly into each, and the three colors will appear. Into a clean glass put a little corrosive sublimate and acid potassium iodide, carefully; the color becomes intensely red, but on adding more it disappears entirely, and can be restored by the addition of more of the sublimate.

17. One other way to make a milk-like liquid is to pour phosphate of soda into a solution of magnesium sulphate.

18. When a piece of silver is dissolved in nitric acid and some muriatic acid added, all the silver is precipitated, and the precipitate may be dissolved in ammonia, or a piece of zinc may be placed in it and acidified, when the silver will all be restored to the metallic state as a fine black powder.

We hope the above experiments will prove an amusement for many of our young readers; and when they become experts in exhibiting these "tricks of magic," as we might have called them, they will have also gained some knowledge of the methods employed by analytical chemists in testing for the common metals. Even practical men, who need sometimes to handle chemicals, will find that the above are reliable tests.

Another Trial of the Gatling Gun—One Hundred Thousand Rounds Fired.

The Navy Department, in order to determine the quality of the solid head metallic cartridges made by the United States Cartridge Company, Lowell, Mass., and to test the working powers and durability of the Gatling gun of $\frac{5}{8}$ inch caliber, ordered that one hundred thousand cartridges of $\frac{5}{8}$ inch caliber (containing United States service charge) be fired in the gun at Fort Madison, near Annapolis, Md. The trials commenced on October 23, and lasted parts of two days. On the first day (the 23d) over 30,000 rounds were fired; and on the 24th, 64,000 cartridges were fired, without stopping to clean the barrels; and after this unprecedented test, the gun (without the barrels being cleaned) was fired for accuracy at a target 12 x 12 feet, placed 300 yards from the gun; and out of 30 shots fired, 29 of the balls hit the central part of the target, striking point on and giving good penetration. It may be safely said that this number of discharges was never before made from any arm in the world.

Singular as it may appear, the fouling of the barrels did not increase after 4,000 or 5,000 rounds had been fired. The trials were made under the supervision of Lieutenant Commander J. D. Marvin, United States Navy, commandant of Fort Madison. Many distinguished navy and army officers were present at the trials. During a part of the trials, the gun was fired at the rate of over 400 shots per minute. A drum which supplied the cartridges to the gun, and which contained 400 cartridges, was frequently exhausted in from 50 to 55 seconds.

Of the cartridges used, none of the heads burst, none of the shells failed to extract, and there was only one misfire in about five thousand cartridges discharged. The cartridges are headed by a new process, which prevents injury to the fiber of the metal from compression.

AT THE recent meeting of the British Association, one of the ruled speculum plates of Professor Rutherford, of this city, 2,300 lines to the inch, was exhibited by Mr. Norman Lockyer, who stated that in the spectroscope it gave the same amount of dispersion as a train of twenty or thirty glass prisms. By its aid, movements of the sun's atmosphere as slow as five miles per second could be measured.

AMERICAN ACADEMY OF SCIENCES.

This select body met at Columbia College, New York city on October 28, when Professor Joseph Henry read an interesting paper upon sound, with especial reference to its employment for

FOG SIGNALS.

The principal part of the paper related to abnormal phenomena of sound, of which a number of instances were given. In many instances the sound from a fog signal is heard at a great distance, while it is inaudible at a much smaller distance. This was attributed to the effect of the wind on the sound. As a general rule the sound is heard at a less distance in opposition to the wind, but in one case the sound is always heard at a distance of nine miles against the wind during a northeast snow storm. This anomalous case is accounted for by an upper stratum of wind in an opposite direction to the one at the surface. Another principle which is applicable to the explanation of several of the abnormal phenomena of sound is that it diverges much more rapidly than light, so that a beam of sound produced by a powerful instrument swells out into a cone of sound, and it is on this account that reflectors have not been found to be of much use in enforcing the sound of fog signals.

Our sea coast is the largest in the world, extending over more than 10,000 miles, and a considerable portion of this distance is beset with dense fogs. On the northwestern portion of the Atlantic coast, whenever the wind blows from a southerly direction, it wafts the warm, moist air from over the Gulf Stream to the cold current coming from the arctic region, and passing along our coast between the Gulf Stream and the land; and thus, in the intermingling of the warm and cold air, the vapor of the former is condensed into fog. On the western coast, when the wind blows directly from the Pacific across the colder current from the north a fog is similarly produced. Fog signals, therefore, are almost as important as lighthouses. Accordingly the Lighthouse Board has devoted much attention to this subject; and however our lights may compare with those of other nations, our fog signals are superior to any elsewhere adopted. They consist principally of three instruments, all founded on the principle of resounding cavities, in which the air itself is the sounding body as well as the conductor of sound. The instruments are: (1). The fog trumpet, furnished with a reed and blown by air condensed by an Ericsson calorific engine. (2). The siren trumpet, blown by steam from a high pressure tubular boiler. (3). The ordinary locomotive whistle of large size, blown also by a high pressure engine. These instruments can be heard in perfectly still air at a distance of from fifteen to twenty-five miles.

ON THE CONSTITUTION OF THE SUN'S SURFACE.—BY PROFESSOR C. A. YOUNG.

Professor Young, in a brief extemporaneous address, placed before the Academy his latest views on that subject. Every one is aware, he thought, of the fact that, in the present state of science, it is impossible to regard the sun as anything but a gaseous body: the law of density, it seemed to him, could not be reconciled with the solid constitution of that body; and it is difficult to see how it could be liquid, as the liquids of which we know it must be composed are largely metallic liquids. It is safe to say we know that it is mainly gaseous. Another thing might be said. The luminous surface from its appearance has something of the nature of cloud. We find rapid changes in the appearance and constitution of the surface. It is impossible to consider it anything but flocculi floating in gas. But when we come to examine the overlying chromosphere with the telescope, we find evidence of violent outbursts from beneath, of extreme intensity. At first sight, it was thought that it might be only an apparent motion, or the same kind of motion that we see when a flame jumps up from a coal fire, and simply is communicated among particles already in position. But that would not account for the disturbance of the spectrum lines. It is not uncommon to find displacements of the spectrum lines indicating motion (in a line that joins the mass with the observer) of one hundred, and sometimes two or three hundred, miles per second. There is every reason to suppose that these masses, which we see—masses thrown vertically from the sun,—have really velocities of a corresponding magnitude. The question that pressed upon his mind was to reconcile that with the cloudy character of the photosphere. If anywhere, the explanation, he thought, was to be found in the condensation that goes on the photosphere. If the heat of sun is anything very great (it would melt about 40 feet of ice a minute over the whole surface), the amount that is turned from vapor into liquid, that is, the amount of condensation over the surface of the sun, is something very enormous. On the surface of the earth a shower that gives us two inches in an hour is something tremendous. The rain descends in buckets. But the rate is exceedingly small compared with the rate of condensation on the surface of the sun.

Now these droplets so produced would at first descend in fillets, with an accelerated velocity, and therefore growing slenderer as they fall. But soon they would come down to a place where the atmosphere and gases are denser. The materials they would encounter in the first 300 or 400, and still more in the first 3,000 or 4,000, miles would become denser, and the motion would be retarded. They would thicken in it. Besides whatever weight of liquid drops down from the clouds in a minute, that amount of gas must travel upward in order to maintain an equilibrium. That would cause the currents passing upward to be extreme in their rapidity, and the retarding effect would be still greater. It is probable that a good deal of the descending liquid would be evaporated at that point. But it seemed to him likely that the

fillets would thicken and begin to coalesce, in which case they would form sheets. In that case we might get a surface something like a sheet of water at Niagara. The mass of the whole sheet would be vertical, and descend until a portion of the sun would be reached where the rapidity of the evaporation would equal the rapidity of the descent. Then it would be something like a series of descending ponds without any bottom to them. If their velocity were retarded entirely, their whole weight would be supported by the underlying atmosphere. The pressure would be something enormous. The gases would be forced up through them, the whole being in the condition of a liquid breaking up, the gas probably taking portions of the liquid and throwing them up. This theory is compatible with that of the gaseous constitution of the sun. But we do not know what to do with the sun spots on this theory any better than on any other theory. Possibly they may be partly solid matter, as has been asserted. In that case, you might get a mass floating on the top of a more liquid portion. One element, which we are much at a loss about at present, is to determine what amount of the sun's mass is to be referred to condensation, and what to dissociation.

Among other papers presented and discussed was one upon

RECENT FISH COMMISSION EXPLORATIONS.

by Professor A. S. Packard Jr., in which some results of the late cruise of the United States Coast Survey steamer Bache, in the shape of rare marine animals, were described. Near Portsmouth the dredge brought up a sea cucumber, *molpoda borealis*, new to the American coast, and tubes of a worm which occurs at the greatest depths off Norway. The latter came from the coldest abyss found during the expedition. The same author also read a paper on the "spiracles of insects," in which the conclusion he has arrived at is that, no known hymenopterous larvæ—that is, the bees and wasps—have more than two pairs of spiracles on the thorax. Certainly at least, on evolution principles, it is considered, we are perhaps warranted, from the indications in existing caterpillars, in concluding that the ancestral type of lepidopterous larvæ was provided with two pairs of thoracic spiracles.

Professor Hilgard, on the subject of

MEASUREMENT OF VOLUME.

said that the kilogramme which was originally determined to be the weight of a cubic decimeter (61 027 cubic inches) of water, was not an accurate standard, and that there was an uncertainty of 10⁻⁴ milligrammes in its theoretic value. It is proposed to use a cylinder having a height of a quarter meter and a circumference of one meter. The weight of water displaced by it will be nearly 20 kilogrammes, which can be weighed to 10 milligrammes—equivalent to half a milligramme in a kilogramme or to a fraction of one two-millionth. The circumference is to be measured by developing it upon a railway and comparing with a meter. The two rails are a little further apart than half the length of the cylinder.

A communication was also received from Rear Admiral Sands, stating that the preparation of instruments, etc., for the observation of the approaching transit of Venus was in satisfactory progress, and that everything will be in readiness at an early day.

Cyrus Wakefield.

Probably few men have ever contributed more largely to the material prosperity of those around them than Mr. Cyrus Wakefield, the announcement of whose sudden death we notice in recent New England journals. As is well known, he was an extensive dealer in rattan furniture, with headquarters in New York and Boston, and a large manufactory in Wakefield, Mass., a town named after him and to which he presented a fine public hall. He was preeminently a self-made man, clear headed, active and tireless in business, and apparently capable of performing labors far in advance of the capabilities of ordinary individuals. Always charitable toward others, his relations with the large number of his employees was constantly friendly and cordial, while, throughout his life, his efforts in the cause of education were untiring. About two years ago he gave \$100,000 to Harvard College, to erect the building which now bears his name. He was also one of the projectors of the Boston Globe, and a large operator in real estate in the last mentioned city.

Mr. Wakefield was born in Roxbury, N. H., in 1811, and was consequently sixty-two years of age at the time of his decease. He was also an inventor, and had taken a number of patents of no mean value in relation to his own business.

Inter-Planetary Communication.

Mr. Charles Cros, in a communication to the French Academy of Sciences, thinks that the approaching transit of Venus will afford an excellent opportunity for establishing communication with the inhabitants of that planet—if any exist. He says: "It is possible that among the dwellers on the surface of Venus there may be some who are astronomers, to whom it may occur that the passage of their world across the sun's disk will attract our curiosity. Hence it is reasonable to suppose that these savants will perfect means to transmit signals to us precisely at the instant when they determine that multitudes of earthly telescopes are turned in their direction."

A writer in *La Nature*, commenting on this novel idea, suggests that it would be better to reverse relative positions, and for Venus substitute Mars. That is to say, when to the Martian inhabitants our globe appears to be crossing the sun's face, we should do something to attract their notice. As Mars is an older planet than the earth, it is supposed that its inhabitants are wiser than we, and hence better able to

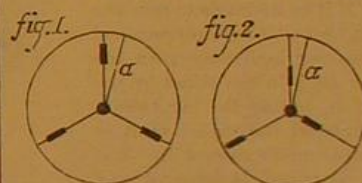
comprehend our signals than those existing on more youthful Venus.

It would be more satisfying to the inquisitive mind if M. Charles Cros or the correspondent of our contemporary would kindly ventilate their plans somewhat more in detail. We have heard somewhere of a scheme for signaling to the moon by means of long black platforms, arranged on wheels and placed on the extended snowfields of Siberia; and, if we remember rightly, it was proposed to roll these about to make the letters of the Morse telegraphic alphabet. How the assumed lunar inhabitants were to interpret the symbols was not explained. Somebody has also suggested huge mirrors arranged to send flashes of light to our satellite.

These ideas are all very nonsensical, but rather pale in absurdity before that of M. Cros. The moon, to be sure, is only about 240,000 miles away, and our big telescopes carry us to within a hundred miles of its surface; if that million dollar instrument is ever made, probably we shall be able to see with reasonable distinctness whether clusters of habitations exist thereon. But Venus and Mars are respectively thirty and forty-nine millions of miles distant from our planet, and it is only by careful observation that the movements of vast glaciers on Mars are estimated, or spaces near the poles, of forty thousand square miles extent, detected; and even the phenomena noted are merely supposed to be due to the causes ascribed.

Engine Turning with the American Chuck.

Looking at the American chuck, we see that the three teeth are worked to and from the center by a spiral coil, and that, when in correct working order, these teeth are drawn in regularly by winding up the screw, so that at any one time they are all exactly the same distance from the center. Now, by unwinding the screw, these teeth can be removed from the body of the chuck. I removed the teeth, and, putting two of them back into their proper places, I gave the screw one or two complete turns round; then I replaced the third tooth, and the position of the teeth was as shown in Fig. 2. Fig. 1 being the usual position.



The wood is first turned on the true center (Fig. 1), each end being turned down so that the block assumes the form of a right cylinder. The chuck is now altered as shown, and the wood put in and made fast. It is evident that, when the lathe is put in motion, the wood will revolve on a new center; and, by moving the wood round regularly in the chuck, a series of circles can be described as with the eccentric chuck.

In order to keep these circles at a regular distance from each other, I filed a line, *a*, on the face of the chuck, and drew lines across the base of my wood, passing through the center, as shown in Fig. 3. Putting each of these marks—A, B, C, D, E, etc.—in turn against the line, *a*, a regular distance was maintained; and by alternating the tooth which I took out, I was enabled to describe a variety of patterns.—*W. E. P., in the English Mechanic.*

The Water Supply of Paris.

Two new artesian wells have been in course of construction for some years in Paris, one at the Butte-des-Cailles, the other on the Place Hébert. The former has been sunk to a depth of 1,725 feet, and it is expected that water will be obtained at 1,890; its cost will be about \$125,000. The other well, like that completed after so many years' labor at Passy, presents great difficulties; and although the work is pushed on with activity, the progress is not more than 16 feet per month; and it is believed that 18 months' time will be required to finish the work. The boring tools now in use are worked by means of a steam engine of 40 horse power; a load of excavated soil takes from seven to eight hours to raise it to the surface. The object of this well is not so much the increase of the water supply of the city as the establishment of public baths and wash houses at a cheap rate, as the water, as it issues from the well, will be of about the temperature of 95° Fah.

PROFESSOR HITCHCOCK, of Amherst College, recently explored Miles' Cave, in Salisbury, Mass., with a guide. Hundreds of feet below the surface their torches were suddenly extinguished, and as there was no means of relighting them they remained below for hours. The professor faintly on emerging.

At the late fair of the St. Louis Agricultural and Mechanical Association, there was a large display of flour samples. The flour was arranged in open barrels without brand or mark by which it could be identified as the product of any particular mill. Thus prepared, a committee, consisting of practical millers, subjected the samples to the severest tests, and made their award. The Anchor Mills, of St. Louis, received the highest award.

SPEAKING of the scheme to warm the Erie canal, the Boston Post thinks the invention might be applied to agriculture. "There is no reason," it says, "why the farmers should lose six months in the year just to whim the season." Why not go farther and melt the barriers to the open polar sea?

IMPROVED FROST LOG DOG.

The engraving shown herewith is a side view of Brown's frost dog, a new and useful device for holding frozen, knotty, or crooked logs while the same are being sawn. The object is to clutch the log instantaneously and hold it firmly while sawing the first half, or until the log is cut through and through. It is the invention of a practical mechanic and sawyer, who, finding it impossible to hold frozen logs as firmly as desired, with any available means, went to work and, with his jack knife, whittled out the patterns for his device. It has now been in use in circular saw mills in nearly all sections of the country for over three years.

The apparatus is bolted down from three to six feet from the head end of the set beam, where the sawyer has it under his immediate control, and the log is rolled on the set works in the ordinary way and left or held in the position desired. By means of the handle, A, on the back side, the whole dog is drawn toward the log until it comes to a bearing, working in long slides, B, bolted to the set beam. As the operator lets go this handle, it drops down, and is held firmly wherever left by the half circle gear, C. The bottom dog, D, is next drawn up by the handle, E, at the lift until it touches the log and is held up by the little crank, F, which works in a movable nut. By pressing together, with the thumb and forefinger, the two catches, G, the other dog is instantly placed in position on the top of the log. These catches work in the notched slide, to which they are attached, and to which is secured another movable nut, so that it is impossible for the dog to slip up or down while the catches are in action. The sawyer now turns the top crank, H, on the shaft of which there is a right and left hand thread; thus imbedding both dogs in the log and holding the same immovable until it is entirely sawn, leaving only a thin slab in the clutch of the dogs. If it be desirable to turn the log when partly sawn, the crank is simply revolved back a half turn, loosening both dogs; then the knee is thrown clear back in the slides by the handle at the back of it, letting the log have a bearing against the knee at the right, as it is turned over with the sawn side against it. The operation, as before described, is repeated, and the dogs will hold up the last board firm and solid. It is claimed that the device is so arranged that it is simply impossible to run the saw on the ends of the dogs, as the latter are always half an inch inside and clear of the blade.

It is stated that the apparatus can be readily attached by the sawyer to any set works in the country having a beam run lengthwise, and it is now in use in at least one hundred and fifty of the principal mills in New England. The operation of dogging a log, as described, is very rapid, and we learn that the whole time it takes for the sawyer to fasten securely a knotty, frozen, hemlock log does not exceed a few seconds.

Patented August 23, 1870, by John S. Brown, of Windham, N. H. For further information address the sole manufacturers, S. C. Forreath & Co., Manchester, N. H.

COMBINATION CORN SHELLER, BOOTJACK, ETC.

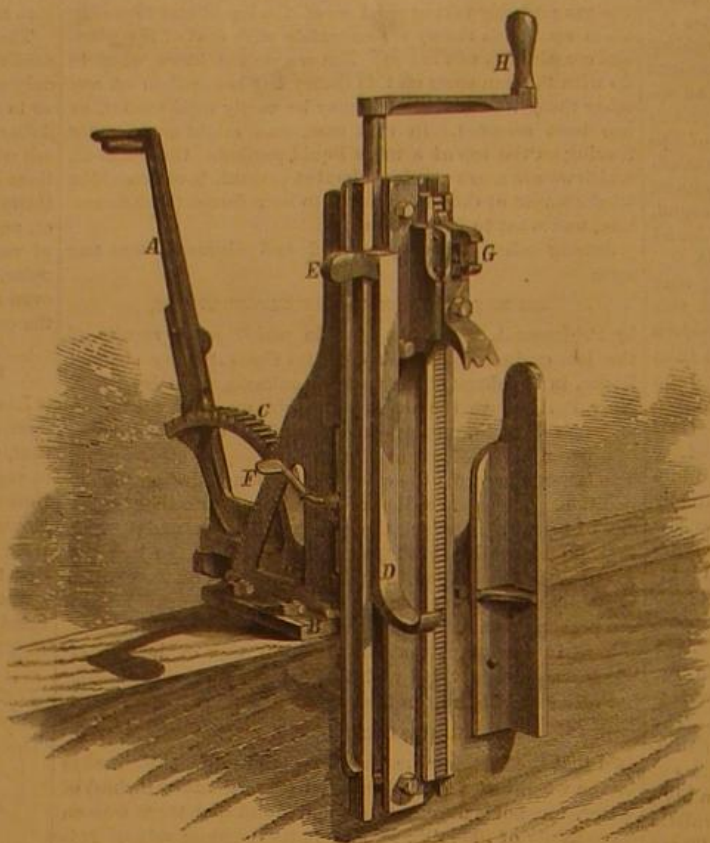
A hand corn sheller, a bootjack, a hammer, a hook claw, a tack drawer, a pot lifter, and a wrench, are all combined



in the single instrument represented in our engraving, the construction of which amounts to simply three pieces of metal fastened together by a single rivet. Mr. Anthony Lake, of Lancaster, Pa., is the inventor, and he clearly deserves credit for no small amount of mechanical ingenuity.

The portion, A, is provided with a hammer at one end, a fulcrum or rest near the middle, and a curved stem, having teeth on one side. The part, B, is S shaped, and its upper

curve is provided with teeth facing those on portion, A. Its lower extremity, C, is formed for drawing out tacks or lifting off stove lids. The third section, D, is terminated with a hook which adapts it to various purposes. The position of the pivot is clearly indicated. Fig. 1 shows how the implement is used for shelling corn, the ear being introduced vertically between the toothed portions and the hammer edge placed upon the table. The shelling is accomplished by a downward motion and a quick turn of the wrist. When laid upon the floor, as in Fig. 2, on the hammer end being



BROWN'S FROST LOG DOG.

pressed down by the foot of the operator, the leg or fulcrum raises the handles, which, together, form an excellent boot-jack.

Not content with all the applications of his device, as above noted, the inventor also suggests that a recess might be arranged in some portion so as to adapt it to cracking nuts.

Patents on combined implements of this kind and simple household contrivances of easy manufacture, without involving large capital, are the class of inventions most in demand, and meet with ready sale.

Hydraulic Mining in California.

Five years ago, fifty inches of water was considered an unusually large quantity for a company to purchase, says the *Calaveras Chronicle*. It was conducted to the claim through a small canvas hose, with necessarily little pressure, and precipitated against the bank from an inch nozzle. The stream had no more effect upon the gravel than would have been produced by the discharge of a six inch syringe. Miners were forced to "coyote" under the bank and "cave it down" to get gravel to wash—a slow, laborious and expensive method of procedure. The sluices attached to these primitive "hydraulics" were never more than twelve inches wide or high, and yet the capacity was ample for the requirements of mining as then conducted. That whole system of operations has been revolutionized. At present three hundred inches of water is the minimum employed in any claim that aspires to the dignity of a hydraulic. Iron has taken the place of canvas for hose, and the greater the pressure to be obtained the better. Patent nozzles direct the streams that cut down the bank like grass before the scythe, and the mingled gravel and water find passage from the mine through a three foot flume. Really, more dirt is put through the sluices of a modern hydraulic in a week that was formerly washed during an entire season. And yet the cost of running one of the mammoth hydraulics of today is but a trifle, if any, more than the expense of conducting one of the piddling concerns that disgraced the name ten years ago. Water works cheaper than hands, and the employment of that element, to the almost entire exclusion of manual labor, is the principal reason why it costs no more to wash a ton of gravel now than it formerly did to move a single pound.

Hydraulic mining in this country, notwithstanding the progress made during the past two years, is yet in its infancy. A beginning has scarcely been made. Two thirds of the abandoned ground, from one end of the country to the other, will pay for re-working, and new mines are constantly being discovered and opened. As an illustration we will cite one instance: Near Murphys in this county, a gravel mine, one hundred and sixty acres in extent, has

lately been located and patented. Beyond a little superficial prospecting no work has been done upon it, and yet a tenth interest in the ground was sold for \$10,000, the other day. Some curious individual has made an estimate of the probable yield of the entire mine, basing his calculations upon the "prospects" obtained. The result of his figuring is that the whole one hundred and sixty acres will yield an average of ninety cents per square yard.

New Mode of Liquefying Gases.

By the application of cold and pressure in suitably contrived machines, all of the gases with the exception of six, nitrogen, hydrogen, oxygen, marsh gas, carbonic oxide and nitric oxide: have been reduced to a liquid condition. This liquefaction was first performed by Faraday and served to prove the fact that gases and vapors are not distinct in their nature. It may be remembered that the simple apparatus used during these initial experiments consisted of a bent glass tube, having a long and a short leg at right angles. Into the open end of the longer portion was placed a substance from which gas could be obtained by heat, after which the tube was hermetically sealed. The shorter limb was then plunged into a freezing mixture, and heat applied to the larger portion, generating large quantities of gas, upon which, being confined in a small compass, the pressure gradually increased, finally condensing the same into liquid form in the smaller receptacle. The facts thus recalled will indicate the importance of a recent experiment made by M. Melsens, a celebrated chemist of Brussels, who, it is stated, has lately succeeded in obtaining wood charcoal in an absolutely pure state. So great is the absorbent power of this substance that it will concentrate in its pores a quantity of gas equal to its own weight. This has been used by Melsens in an apparatus similar to that of Faraday above described; and through its agency, he has succeeded in liquefying gases with great readiness. The charcoal, it seems, is placed in the long leg and allowed to absorb as much gas as possible. The tube is then sealed and enclosed in a tin pipe heated to 212° by a current of steam. The gas in the charcoal is thus disengaged and caused to compress itself into the short limb, passing almost immediately into a liquid state. It is stated that from one to one and a half cubic inches of liquefied gas can be quickly obtained.

Taxes on Knowledge.

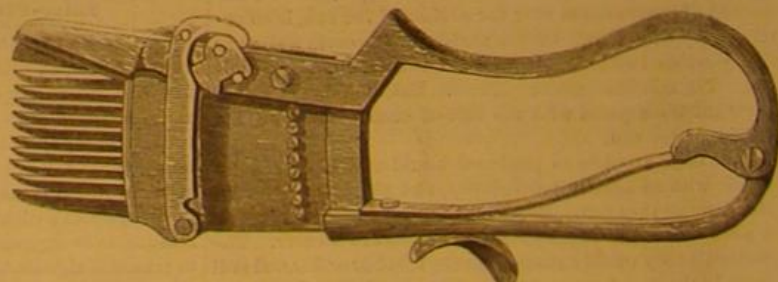
O. M. says: Please ask our next Congress to remove all taxes on means of education, such as the import duty of 40 per cent on philosophical apparatus. "I know of several parties who propose to import telescopes and other scientific implements for their own use; but on ascertaining the fact of that enormous duty, they at once gave it up. I cannot see that it would lessen the profits of those in this country who sell such instruments if the duty were removed, as the goods are mostly imported; nor would it materially interfere with such men as Alvan Clark, Ritchie, Zeutmayer, Spencer, and others, whose business depends mostly on their well known skill and integrity. Please lend your influence to assist those whose purses are scant, yet who are trying to educate themselves and others."

Fast Trains in England.

There has been a dispute as to which is the fastest train in England. Precedence has been claimed for the 10 A. M. express from King's Cross. It also asserted that the Great Western express between Paddington and Exeter is faster. Between Paddington and Swindon the distance is 77½ miles, and both the up and down trains travel it in 87 minutes, including the starting and stopping, or at the rate of 53.62 miles per hour. At full pace, the speed is as nearly as possible a mile a minute. The Great Western railway is built on a 7 feet gage, but many parts of the line have a third rail, allowing narrow (4 feet 8½ inches) gage trains to run on it also.

LIGHTNING SHEEP SHEARS.

This ingenious apparatus, according to the *Ironmonger* will shear six sheep in the time that it now takes to denude one of his fleece. Anybody can operate it and do better



work than the most skillful shearer with the old fashioned shears, and without danger of cutting the flesh. The handle of the knife is arranged with a spring, and the blade, by pressing the former, is caused to travel across the sharp teeth, which are first imbedded in the wool. The movement resembles that of the ordinary scissors blade. When the knife returns, it raises itself clear of the wool, allowing the same to escape uninjured by scraping.

THE GREAT BRIDGE AT ST. LOUIS.

In former numbers of the SCIENTIFIC AMERICAN, we have given various interesting details pertaining to the remarkable work involved in building the granite piers of this great example of engineering. We have also given various illustrations thereof, and of the superstructure. We now present an engraving which will intelligibly illustrate the inge-

in July, 1874. The following interesting particulars are derived from a letter in the New York Times:

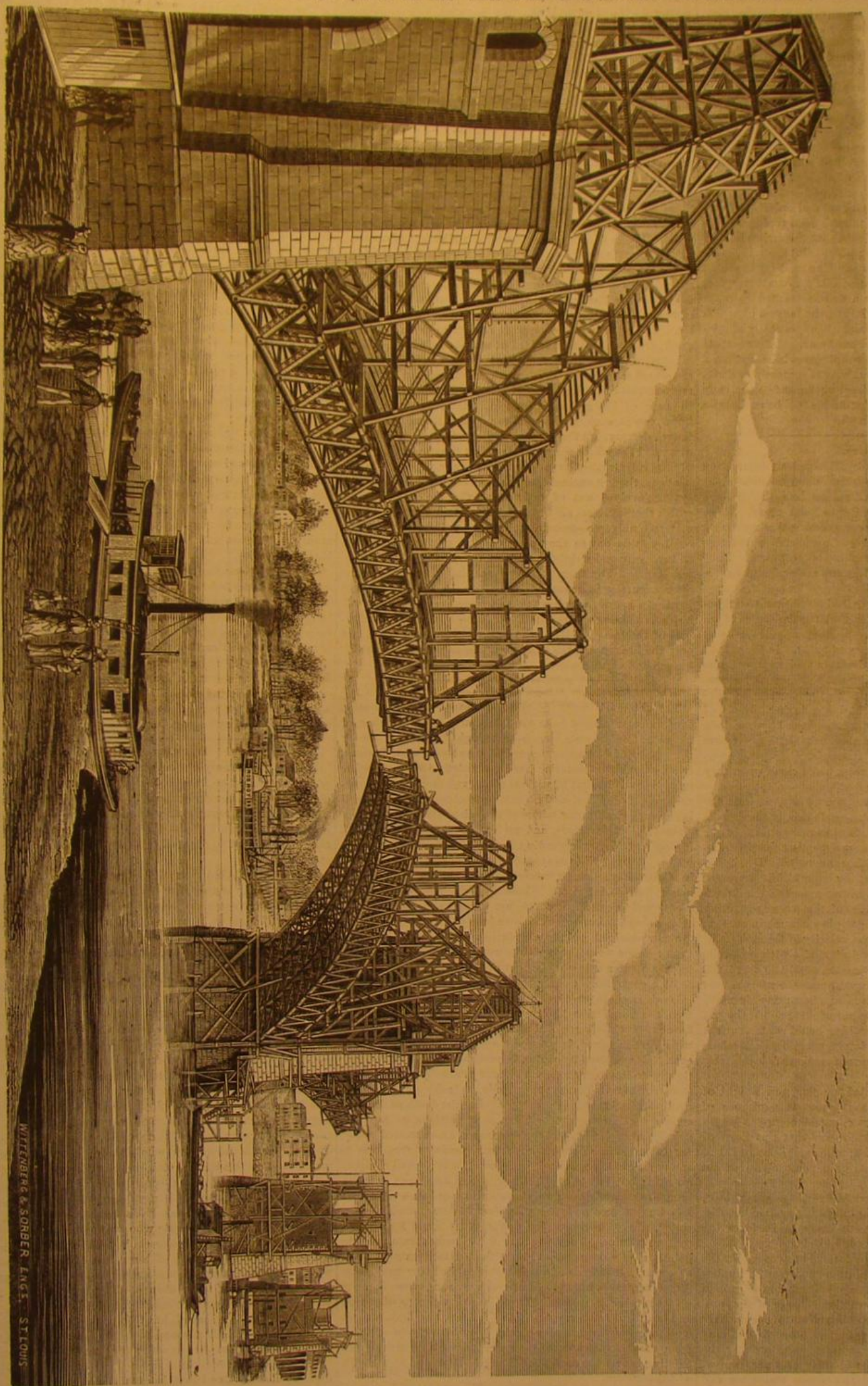
The river is spanned by three arches springing from east and west abutment towers to piers in the river. From the abutments to the piers, east and west, the arches have a span of 502 feet; the central arch from pier to pier has a span of 520 feet. These arches are of cast steel. The

top and bottom row form what is technically called a chord, and these are united together by main braces in the form of the letter A. The two chords are united laterally by huge tie rods. That is the whole principle of the matter.

The *modus operandi* is as follows: The tubes are brought in barges underneath the place where the men are working, and are elevated by a small stationary engine. The ends of

the tubes are so nicely grooved that they fit in very tightly, even without the couplings. They are grooved also on the outside, to correspond with the grooves and fillets of the couplings. When the latter have been applied, an enormous pin, with a diameter of five inches and a weight of 100 pounds, is screwed through the couplings, going, of course, also through the united ends of the two tubes. The bridge being double, there are eight rows of tubes, making, for the side arches 340 to the span, and 342 for the central one. The men are working now on the eastern half of the bridge, the other being in such a forward state that it has to be neglected until the rest of the work balances it. In this gigantic work the utmost thought of little things is imperatively needed. The moment that one tube is in place, the tube that balances it on the other side of the pier must be put into position. The strain upon the iron cables that support the tubes until they form a perfect arch is regulated to a pound weight by means of hydraulic rams. When the temperature rises the cables stretch, and the whole fabric of uncompleted arching sinks a little. It has to be raised up, and the rams do this by taking a little gentle pull upon the cables, or, as the mariners would say, "hauling taut." This is effected by pumping a little glycerin into the rams. If, on the contrary, the temperature falls, the cables contract and tilt up the arching a trifle more than is required. Then the watcher over the rams has to pump out a little glycerin, and the pressure on the cables is relaxed. This little place where the rams are may be considered the great artery of the work. The perfect control that Captain Eads and his assistant have over their offspring is sometimes evinced in an amusing way. The method of construction to preserve the just balance is naturally to build the tubes half way from each side of a pier at the same time, so that one half balances the other half. The engineers commenced in this manner with the pier nearest the western bank, building up, at the same time, the tubing from the western abutment. When the latter met the western half of the first pier, the extremely hot weather had expanded the metal, and the tubes would not unite. Baron Fladd immediately bought hundreds of bales of gunny bags, and packed the recalcitrant tubes in ice. All night the thermometer kept rising, but the ice did its work, and they came together so closely that you could not have seen daylight between them. The same result could have been obtained by blasts of cold air, but the Keystone Bridge Company, of Pittsburgh, who have the contract for the superstructure, were in a hurry to close the western arch, so the

THE GREAT BRIDGE AT ST. LOUIS—ERECTION OF THE SUPERSTRUCTURE.



nous manner in which the placing of the superstructure is being executed. This work is now proceeding at St. Louis, and by its novelty attracts the attention of engineers from all parts of the world. The chief engineer of this great work is Captain James B. Eads, of St. Louis, to whose fame as a man of science the success of the structure will add many laurels. It is expected that the bridge will be finished

bridge being double, the arches are double, but the principle can be more easily shown with one part; for as it is built, it is really two bridges joined together, and it could be made indefinitely broader or narrower according to requirement. The arch is composed of tubes, each twelve feet in length, joined together by most admirable couplings. There are four sets of tubes, arranged two above and two below. The

ice was used.

The workmen now thoroughly understand the handling of the tubes, and are putting them together on the eastern half at the rate of twenty-four a day. The frames, from which the long curves of tubing stand, are all inserted. These are called skewbacks, and are of wrought iron, forged in one piece of three tons—a very creditable specimen of the handi-

work of Pittsburgh. The first tube, which is very short and stout, is screwed to this with four steel bolts, five inches in diameter, which go back into the very bowels of the pier, twenty-eight feet, and are then driven through an anchor plate. This fact will give a better idea of the huge masses of masonry serving as piers than any formal statements or measurements. The men engaged in the construction belong to a class which American enterprise has called into existence. They are bridge builders, working at nothing else; and though not scientifically educated, have a rough and ready comprehension of the work they do, which tends to elevate their minds. They are trained to perfect exactitude in the smallest details. If a bolt does not fit perfectly, there is no thought of assisting it promptly with a sledge hammer; but there is an instant conclusion that, by some accident, the bolts have become mixed, and that this is not the special bolt for that particular hole. For down to the minutest scrap of iron, everything has been fitted at Pittsburgh, and must fit here. To nearly fit will not do; it must absolutely fit. The consequence of such exact training is exemplified in the conduct and manner of the men who are, without exception, the most intelligent and orderly body of workmen I have ever seen. With such men rapid progress is certain, and there can be no doubt that the arches will be completed before the end of November. But the bridge will not be finished then, by any means. The roadways have to be built upon it. The upper one will be for omnibuses, foot passengers, etc., the lower for a double tracked railway. These two will be supported by struts, the longest of which near the piers, will be 56 feet, and then gradually diminished as they approach the center of the arch. These struts will rest upon the heads of the couplings where the tubes are strongest, and, as only a direct weight comes upon them, will be able to bear five times more than the bridge company will ever permit; for the transit of trains will be entirely in the hands of the company's officers.

Molecules.

Professor Clark Maxwell lately delivered an interesting lecture before the British Association upon molecules, by which is meant the subdivision of matter into the greatest possible number of portions, similar to each other. Thus, if a number of molecules of water are combined, they form a mass of water. Molecules of some compound substances may be subdivided into their component substances. Thus the molecule of water separates into two molecules of hydrogen and one of oxygen.

The ancient atomic theory, described more than two thousand years ago by Lucretius, was that the molecules of all bodies are in motion even when the body appears to be at rest, and this is the accepted theory of today. In the case of solids, these motions are confined within such narrow limits that we cannot, even with the microscope, detect any alteration in their positions. But liquids and gases may be subjected to experiments which afford convincing proofs of molecular motion. If the gases of ammonia and hydrochloric acid, for example, be placed in a glass tube, with a stratum of air between, the lighter gas, ammonia, above, the gases diffuse through the air and produce a white cloud when they meet.

Air confined in a vessel presses, as we say, against the wall thereof. What we term pressure is simply the impact of the moving molecules against the interior surfaces of the vessel. The amount of the pressure depends upon the number of molecules of air or gas within the vessel. By the application of heat, the movement of the molecules is increased in velocity, and such increase of course causes each molecule to strike harder against the walls of the vessel; in other words, the pressure is increased; the law of such increase of pressure being as the square of the velocity of the molecules.

Dr. Joule has calculated the velocity of hydrogen molecules, at the temperature of melting ice, at a little over 6,000 feet per second. The molecules of ammonia move about 2,000 feet per second. The molecules of common air move with a velocity of seventeen miles per minute; and if they all moved in the same direction, nothing could stand such a wind. But molecules constantly impinge against each other; and by this contact, their directions of motion are incessantly changed.

Professor Maxwell has calculated the size and weight of hydrogen molecules, and finds that about two millions of them, placed side by side in a row, would occupy a length of about one twenty-fifth of an inch; and that a package of them, containing a million, million, million, million of them, would weigh 62 grains, or not quite one eighth of an ounce.

Each molecule throughout the universe, says our author, bears impressed on it the stamp of a metric system as distinctly as does the meter of the archives at Paris, or the double royal cubit of the Temple of Karnak.

No theory of evolution can be formed to account for the similarity of molecules, for evolution necessarily implies continuous change, and the molecule is incapable of growth or decay, of generation or destruction. None of the processes of nature, since the time when Nature began, have produced the slightest difference in the properties of any molecule. We are therefore unable to ascribe either the existence of the molecules or the identity of their properties to the operation of any of the causes which we call natural. On the other hand, the exact equality of each molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent.

Thus we have been led, along a strictly scientific path, very near to the point at which science must stop. Not

that science is debarred from studying the internal mechanism of a molecule which she cannot take to pieces any more than from investigating an organism which she cannot put together. But in tracing back the history of matter, science is arrested when she assures herself, on the one hand, that the molecule has been made, and on the other that it has not been made by any of the processes we call natural.

Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limit of our thinking faculties when we have admitted that, because matter cannot be eternal and self-existent, it must have been created. It is only when we contemplate, not matter in itself, but the form in which it actually exists, that our mind finds something on which it can lay hold. That matter, as such, should have certain fundamental properties, that it should exist in space and be capable of motion, that its motion should be persistent, and so on, are truths which may, for anything we know, be of the kind which metaphysicians call necessary. We may use our knowledge of such truths for purposes of deduction, but we have no data for speculating as to their origin. But at there should be exactly so much matter and no more in every molecule of hydrogen is a fact of a very different order. We have here a particular distribution of matter, a collocation, to use the expression of Dr. Chalmers—of things which we have no difficulty in imagining to have been arranged otherwise. The form and dimensions of the orbits of the planets, for instance, are not determined by any law of Nature, but depend upon a particular collocation of matter. The same is the case with respect to the size of the earth, from which the standard of what is called the metric system has been derived. But these astronomical and terrestrial magnitudes are far inferior in scientific importance to that most fundamental of all standards which forms the base of the molecular system. Natural causes, as we know, are at work, which tend to modify, if they do not at length destroy, all the arrangements and dimensions of the earth and the whole solar system. But though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation stones of the material universe—remain unbroken and un worn. They continue this day as they were created, perfect in number and measure and weight; and from the ineffaceable characters impressed on them we may learn that those aspirations after accuracy in measurement, truth in statement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created, not only the heaven and the earth, but the materials of which heaven and earth consist.

Odd Fish.

The summer's work of the American Fish Commission is of unusual interest from the fact that a large number of queer marine animals have been brought to the surface by the improved dredging apparatus employed; and, besides, much valuable information has been added to our knowledge regarding the habitat of various fishes and mollusks. A correspondent of *Forest and Stream* epitomizes, in an interesting communication, the labors of the scientists who have conducted the explorations, and we extract therefrom the following particulars regarding the progress and discoveries made: A live *Callista convexa* (a species of clam), brought up in Casco Bay, has, it seems, upset the opinion that it was extinct so far north. Quahogs, which once existed in plenty and the shells of which are found in the Indian shell mounds which cover Peak's Island on the coast of Maine, are now obtained only in a little cove in Casco Bay; while oyster shells, to which a saddle rock is but a pigmy, are thickly planted below the bottom of Portland Harbor, though as living organisms their species is now extinct.

Down in these ocean depths, the animal kingdom takes from the floral tribe the duty of embellishment, but these flowers wave their graceful petals but to entrance a victim, which, when seized, is pressed close to its mouth and then, even if larger than its captor, is swallowed whole. Holding tightly to its prey, the sea anemone gradually protrudes its stomach from its mouth; and turning it inside out, envelopes its dinner and then lies quietly waiting the death of its food and subsequent digestion. Then such portions as are not suitable are rejected, and the stomach is again stowed away for future use. The sea cucumber (*Pentacta frondosa*) is another curious creature. First found, it is a small compact gherkin; but left to itself, it swells and develops into an immense cucumber. Two magnificent specimens of a star fish known as a *Gomaster phrygianus* were found in deep water, where an almost icy temperature made for them a constant winter. They are four or five inches from point to point, and of a deep scarlet hue with a surface embossed like shagreen. Hundreds of a pale straw colored star fish (*Eleuthero discus crispatus*), hitherto esteemed very rare, were brought up from these icy depths. Three large specimens of a rare and beautiful anemone (*Urticina digitata*), the first perfect ones ever found, were also obtained, a discovery of interest from the fact that none of the species have been recorded as existing nearer the coast than George's Bank and at a depth of 400 fathoms.

Worms predominate in the hauls of the dredge. Many sorts and sizes were found, from tiny creatures, the peculiarities of which are distinguishable only under the microscope, to the grand *Cerianthus borealis*, one of the anemone family, a foot in length. All have the same style of house, and exude from their bodies a slime, which probably has chemical affinity for the lime in the water and which causes the mud to

adhere. One specimen caught had a tube around him, an inch in diameter and a foot in length. He was thrown into a basin of water where he moved rapidly about, evidently ill at ease. The next day he was lying quiet; and about his neck was a ring of mud formed from the floating particles in his prison. During the evening, he was found stretched out at full length, trying to swallow an anemone that had been imprisoned with him.

The hermit crab is a common but curious creature, resembling a little lobster, armed with powerful claws and a very thick breast plate. He is a quarrelsome customer; but unfortunately for him, the after part of his body is soft and defenceless. Left to his own resources, he is a great coward, but gets an accession of bravery when he discovers an empty univalve shell. This he examines inside and out, turning it over and over until satisfied that there is no weak place in the rear, when he passes into it tall first, and then, calmly folding his strong claws across the entrance, is ready for the fray. When a larger crab finds a shell that suits him, in which a smaller one of his own species has already taken refuge, he unceremoniously inserts a claw and drags the little one out. The shell becomes the home also of a beautiful hydroid which appears like a velvet coat of waving fibers. These, seen through a microscope, resolve themselves into a trine creature, three bodies on one stem, each with its special function to perform, making one little single life. One body absorbs food, another reproduces the young, while a third, armed with tiny jaws, defends the little community against other creatures still smaller.

Another odd specimen found was the goose fish or *Lophius Americanus*. It is about two and a half feet long, a flat, thick mud-colored, mis-shapen monster, whose small fins proclaim it not a rapid swimmer. Burrowing close to the mud, it elevates two little fishing rods, each about twelve inches in length, formed of a stiff elastic substance like the spine of a catfish. These spring from the upper part of the nose; and when not in use, lie back flat upon the head. When the first wants his dinner, however, the rods are raised at various angles and moved slowly about; on the end of each dangles a red muscular fiber which dilates and contracts like a worm. Attracted by this bait, the unsuspecting pollack attempts to appropriate it. Slowly the goose fish lowers its lip, and then suddenly engulfs the unwary victim in its mouth, which, set with great fangs, opens like an old fashioned carpet bag.

Another curious find was the egg of a skate, seemingly a dark colored case, of texture somewhat like a beetle's back, but tougher. It was shaped like a fisherman's reel, a rectangle with the ends cut out, leaving a square center with four projections on which to wind the line. The egg shell is not unusual and can be found on sandy beaches, thrown up by the tide, dried and empty, looking like the husk of some nut. The specimen found was opened, and the little creature released and placed in a basin of water, where it swam around for several days. The yolk of the egg remained attached and appeared quite as large as the fish.

Regular Eating.

Half of all ordinary diseases, says Dr. Hall in his *Journal of Health*, would be banished from civilized life, and dyspepsia become almost unknown, if everybody would eat but thrice a day at regular times, and not an atom between meals, the intervals being not less than five hours, that being the time required to digest a full meal and pass it out of the stomach.

If a person eats between meals, the process of digestion of the food already in the stomach is arrested, until the last which has been eaten is brought into the condition of the former meal; just as, if water is boiling and ice is put in the whole ceases to boil until the ice has been melted and brought to the boiling point, and then the whole boils together.

But it is a law of nature that all food begins to decay, after exposure to heat and moisture for a certain time. If a meal is eaten, and in two hours another, the whole remains undigested for seven hours, before which time the rotting process commences, and the man has his stomach full of carrion—the very idea of which is horribly disgusting.

As, then, all the food in the stomach is in a state of fermentive decay, it becomes unfit for the purposes of nutrition and for making good pure blood. Small wonder is it that dyspeptics have such a variety of symptoms, and aches, and complaints in every part of the system, for there is not one drop of pure blood in the whole body; hence, the nerves, which feed on this impure and imperfect blood, are not properly nourished and, as a consequence, become diseased. They "complain"; they are hungry—and like a hungry man—are peevish, fretful, restless. We call it nervousness, and no one ever knew a dyspeptic who was not restless, fretful, fidgety, and essentially disagreeable, fitful and uncertain.

The stomach is made up of a number of muscles, all of which are brought into requisition in the process of digestion. But no muscle can work always. The busy heart is in a state of perfect repose for one third of its time. The eye can work twice in a second, but this could not be continued five minutes. The hands and feet must have rest, and so with the muscles of the stomach; they only can rest when there is no work for them to do—no food in the stomach to digest. Even at five hours' interval, and eating thrice a day, they are kept constantly at work from breakfast until the last meal is disposed of, usually ten o'clock at night. But multitudes eat heartily within an hour of bed time; thus, while the other portions of the body are at rest, the stomach is kept laboring until almost daylight, and made to begin again at breakfast time. No wonder is it that the stomach is worn out—has lost its power of action. Many girls be-

come dyspeptic before they are out of their teens, in consequence of being about the house and nibbling at everything they lay their eyes on that is good to eat.

In the *Chronique de la Société d'Acclimatation*, M. Ruimet states that, by feeding silkworms on vine leaves, he has obtained silk of a fine red color; and that by giving the worms lettuce leaves, they have produced cocoons of an emerald green color. M. Delidon de St. Gilles, of Vendée, has also, by feeding silkworms—during the last twenty days of the larva period—on vine, lettuce, and nettle leaves, obtained green, yellow, and violet cocoons.

THE AYRSHIRE COW.—The Ayrshire is bred, and has been bred, for milk; her inheritance is all in the line of milk-producing. Her form indicates it; her records prove it. When aged and dry, the same functions which ordinarily fill the udder fill her muscles with fat; but while milking, inheritance, intensified yearly by selection, turns the energies of her system towards extracting materials from her food, and secreting the larger and richer part in the udder. As the short-horn stands with the grazier, who has tried their quality, so does the Ayrshire stand with the dairyman. By seeking improved breeds, the farmer is adding materially to the profits of his farm, for he is utilizing the great power and unerring certainty of inheritance.—*Dr. Sturtevant.*

Recent American and Foreign Patents.

Improved Apparatus for Extracting Cane Juice.

Duncan Moffat, New Orleans, La.—This invention consists in the arrangement of a holding device with the delivery rolls of the mill and the rotary cutting apparatus; also of a vat containing a secondary steaming compartment under the one into which the crushed and chopped cane is first received, containing revolving chopping and beating blades; also, stationary ones to continue the disintegrating process until the cane is reduced to pulp. The bottom of said compartment is perforated to filter the juice from the pulp as much as possible; and has a spout leading from it to conduct the pulp to an endless carrier, by which it is delivered to pressing rollers to expel the remaining juice. The two compartments of the steaming vat are separated by a valve, which is turned from time to time to deliver the cane to the lower compartment in batches, which have been subjected to the steam in the upper compartment a sufficient length of time. Below the filtering bottom of the lower compartment there is a trough, which receives the juice falling down from said compartment, and conducts it to the evaporator.

Improved Needle Threader for Sewing Machines.

Thomas Schofield, Grass Valley, Cal.—The body or handle part of the needle threader is of thin sheet metal, and the instrument may be placed in an upright position. At one end of the handle is a forward projecting guide piece which passes up and down along the side of the needle, until a hook strikes the eye of the needle and enters through it. The hook has a curved end of very small size, which takes up the thread and draws the same back through the eye of the needle. The rear part of the hook is bent in U shape, and held in a groove in handle by means of a plate and screw. A small set screw regulates the distance of the hook from guide piece, to be adjusted to needles of different thicknesses. At the other end of handle a hook and needle guide are placed in similar manner, but under a right angle to the body of the handle, so that needles may be threaded from the sides, back, or front.

Improved Propelling Mechanism for Vessels.

Lindsay Murdoch, Marble Hill, Mo.—This invention consists in a horizontally sliding frame and a bar carrying at its lower end a paddle floats sliding vertically therein and horizontally therewith. By this arrangement the paddles have parallel vertical and horizontal motions, so that they are presented to and leave the water edgewise and move against it directly in the line of the motion of the boat.

Improved Saw Sharpening Device.

John B. Drake, Goshen, Ind.—The file guide has, at one end, jaws to hold the file, and is rounded at the other to slide in a hole through an adjustable guide, by means of which it may be placed at any desired height. This apparatus is applicable to vertical saws as well as to circular saws. By means of it the file is carried in a straight line across the saw.

Improved Automatic Fire Escape for Safes.

Ira Parke, Mineral Point, Mo.—It is proposed to have a safe resting on a platform having wheels, and pivoted at one end, while the end next to the wall of the building is suspended by an easily combustible rope or other contrivance, to be destroyed by a fuse or a gun discharged against it, or burned off to let the platform fall. The platform, which is arranged in front of a trap door in the wall opening into the street, is to unfuse the door in its fall and force it open, and the door is to form a continuation of a descending track, of which the platform is the other part, on which the safe will roll into the street, and thus be saved from the fire. Fuse may be connected with the suspending rope, and arranged throughout all parts of the building, to ignite the rope or discharge the gun against it when the fire breaks out in any part of the building; and the fuse will also be arranged to communicate the alarm to the office or other apartment.

Improved Tap Holder Attachment for Beer Coolers.

Joseph Hyde Fisher, Chicago, Ill.—This invention consists of an attachment to beer coolers for packing the hole through which the faucet projects to prevent the escape of the cold air, which is composed of metal clamping rings, and a rubber packing ring, arranged in two parts, of which one is fastened to the box, and the other to the door, in connection with the tap hole.

Improved Boy's Sled.

Samuel D. Mott, Milford, Pa.—The rear ends of two springs are secured to the frame work of the sled, to the forward ends of which is attached a cross bar, in such a position that the rider, when sitting upon the sled, may rest his feet upon the said cross bar, either upon the outer or inner sides of the side frames of the sled, as may be desired. To the center of the cross bar is pivoted a small runner, which is made of a much less light than the sled, and the springs are made of such a strength as to hold the sled runner away from the ground, except when pressed down by the rider's feet, resting upon the cross bar. To the runner is attached a cross bar, to which are attached the ends of cords. By pressing the runner down to the ground with his feet, and pulling upon one of the cords, the rider can incline the runner to one or the other side, and thus guide the sled as desired.

Improved Fountain Hand Stamp.

Francis J. Coutant, New York city.—This invention relates to the construction of stamps for certifying checks and for similar purposes, having special reference to what is known as the "ribbon stamp," and consists in a fountain for the ink and in a movable pad. The shafts being immersed in ink, the ribbon is of course saturated with it. As the ribbon is drawn from the fountain it passes between two packing pieces, the object of which is to strip off the surplus ink from the ribbon and to keep the fountain closed. These packing pieces are made of elastic material, compressed by means of the metallic plates and screws. After leaving the packing pieces, the ribbon is drawn over the rollers and beneath the type plate, and then upward and into the fountain. By this invention the trouble and expense of frequently renewing or saturating the ribbons are avoided. The pad, by means of a lever, is thrown upward against the ribbon and type, instead of operating the stamp, in the usual manner, by a blow on the stem. With a pad constructed in this manner the stamping may be done with the same hand that holds the paper, or with one hand.

Improved Metal Planing Machine.

John T. Kiehn and William H. Odenatt, Philadelphia, Pa.—This machine is specially designed for planing the valve seats of locomotive and other engines, it being secured to the engine by screwing its stand bolts into the holes of the steam chest bolts when the steam chest is removed, and to adapt it for attaching it to different engines, in which the holes vary in the distance apart. The top frame or disk on which a revolving disk is arranged is provided with short radial arms for attaching the stand bolts to, which are adjustable radially and circumferentially. The feed screw is turned by a star wheel, which is brought in contact with one or more stationary pins each time it makes a circuit.

Improved Car Coupling.

August Seborg and Benjamin Van Valkenburgh, Cobleskill, N. Y.—A band which slides on a drawhead, and is operated by a forked lever. The drawhead is made in two parts, one of which is attached rigidly to the truck by means of clips. The other part is hinged, and drops down by its own gravity when unsupported. The parts are each recessed out to form the mouth and opening of the drawhead, and are held firmly together by the band when the latter is slipped forward. At the top and bottom of the flange is a loop, which the forks of the lever enter. The lever is held in position by means of a forked iron attached to the timber of the truck. The handle end of the lever is bent upward to make it convenient to handle as well as to fasten. When the handle end of the lever is thrown up to the truck, the band is thrown outward, so as to keep the drawhead closed and the coupling link confined. In this position the lever is confined by a pin in the forked iron. When the lever is thrown outward, the band is thrown back, which allows the part of the drawhead to drop down ready to receive the link of the opposite coupling.

Improved Apparatus for Graining Wood, etc.

Charles Falke, New York city.—In using the extension roller, the requisite width of the article to be grained is first taken, and the apparatus is then adjusted by loosening the handle frame, setting the female screws and shells to the desired width, fastening the handle frame again, inserting the band rollers and flexible band fitting that width. The roller is pressed over the color board, which leaves the imprint of its grain on the periphery of the cylinder. The grain marks are thence transferred to the surfaces to be grained.

Improved Nut Lock.

Daniel Sawyer, Washington, Ind.—A washer plate is placed upon the bolts before the nuts are screwed on, to which is secured one or more pieces of steel, which are made thin and fastened edgewise, and upon the upper part of each is formed a spring, standing out a little upon one side, preferably upon the side next the nut to be locked. A plate is pivoted to the pieces near one end, and is slotted so that it may be turned down upon the washer or turned back. The inner edge of the slotted plate is turned up at right angles, and the steel piece is placed at such a distance from the nut to be locked that the turned up part of the plate may rest against the side of the nut, and thus prevent the said nut from turning. By this construction, when the plate is turned down, the steel piece passes through the slot in the plate and the spring springs out over the said plate, preventing it from rising.

Improved Snow Plow.

William J. Roberts, Cold Spring, N. Y.—A revolving bucket wheel is arranged in front of the locomotive on a vertical shaft, and is revolved by means of a belt, or gearing may be substituted, from a pulley on the axle of the locomotive to the pulley on the vertical wheel shaft. The wheel is the frustum of a solid cone. The outer edges of the buckets are parallel with the side of the cone, the ends being cut on the plane of the base and upper surface of the cone. A loose upper clutch revolves with the shaft, and is dropped down by means of a screw or otherwise, and engages with the pulley clutch when it is desired to run the snow plow. As the locomotive moves forward, the wheel clears away the snow from the track and throws it to one side.

Improved Faucet Attachment.

James Church, St. Louis, Mo.—This invention consists of a cup of rubber or other elastic material, or partly of elastic material and partly of metal, combined with the faucet in such a manner that, when the barrel is tapped, by driving the cork into the barrel with the end of the faucet, the cup will prevent the escape of the liquid while the faucet is being adjusted and before it is made sufficiently tight to stop the leak.

Improved Refrigerator.

Charles Camp, Mott Haven, N. Y.—This invention consists in a removable ice box, fitted into the upper part of the smaller of two compartments of the main box, so that it may be conveniently taken out and put in when desired. The cold air from the ice chamber passes through a pipe and into a horizontal hollow shaft, and escapes through the holes in the sides of said shaft. To the end parts of the hollow perforated shaft are attached two four-armed plates, to the ends of the arms of which are pivoted the turned up ends of shelves, so that the said shelves will always hang downward and be right side up, however the shaft may be turned. This construction enables any desired shelf to be turned toward the door, so that anything can be readily put upon and taken from it. The shelves are secured in any desirable position by a long screw which passes in from the front of the box through the end wall of the said box, so that its forward end may bear against the side of the end of the shaft, and thus prevent it from turning.

Improved Washing Machine.

Arthur M. Campbell, Rine's Grove, Pa.—This invention consists in the combination of the binding frame with the suds box of a washing machine to strengthen said box against the pressure of the operating mechanism. In the U spring, in combination with the lever and the rigid arm attached to the presser board, which allows the end of the lever to be readily adjusted upon the arm to adjust the presser board to the amount of clothes to be operated upon. By suitable construction, as the presser board moves forward, the clothes are pressed between said presser board and a stationary presser board, pressing out the water, which carries the dirt with it. As the presser board moves back, the back rush of the water sweeps the clothes back from the stationary board, and turns them over so that they are operated upon by the presser each time in a different place, and are thus cleaned thoroughly in all their parts.

Improved Printing Press.

Jacob G. Peterson, Morristown, N. C.—The rollers are arranged in a reciprocating carriage, which is suspended on the type bed by the upper roller. The bearings of the lower roller are immovable in the carriage. The bearings of the upper roller are capable of moving up or down in the carriage, and have an adjusting screw by which the pressure of the rollers in the bed is regulated. The carriage has two toothed bars, extending from one side, between two wheels on the crank shaft and the presser rollers, which are mounted in stationary housings. The crank shaft being turned forward and backward by a half revolution each way will cause the presser rollers to move forward beyond the type and back again, which makes the impression on the paper. After each operation the tympan is raised, the printed sheet is removed, and an unprinted sheet is applied, and the tympan is lowered for the next operation.

Improved Quilting Attachment for Sewing Machines.

William H. Null, Blandinville, Ill.—This invention relates to an improvement in the class of machines for supporting, stretching, and moving quilts or other fabrics across the feed plate of a sewing machine; and consists in a peculiarly constructed carriage and a tilting roller frame, on which it is supported, and in devices for holding and adjusting the fabric.

Improved Plow Carriage.

Henry M. Bullitt, Louisville, Ky.—This invention consists of independent axles for the truck wheels, having a long upright arm at right angles to them inside of the wheels, said arm having a series of holes at short distances apart, and connected by a short axle, which can be shifted higher or lower by changing it in the holes. From the center of this arm the beam is hung by a crotchet hanger, and is connected by adjustable braces with the lower ends of the arms to maintain them in the upright position. The depth of the furrow is governed by the position of the suspending axle in the arms, and the plow is supported entirely above the ground, for transporting it from place to place, by adjusting the suspending axle in the top axles.

Improved Pruning Instrument.

William H. Collings, Raytown, Mo.—A pole of any desired length is made hollow to receive a wire, which passes through it longitudinally. Upon the upper end of the wire is cut a thread to screw into the shank of the saw which projects above the end of the pole, and fits into a dovetailed groove or socket in the side of a ferrule attached to the upper part of the pole, where it is secured by a set screw. By this construction, in using the instrument, the hook is passed over the twig to be cut, and the wire pulled down through the pole. The saw is operated by the reciprocating movement of the wire and pole upon each other.

Improved Self-Closing Faucet Attachment.

Robert McConnell, William Truesdell, and Frederick Mertschler, Omaha, Nebraska.—An inside collar, at the end of the faucet tube, serves as shoulder rest for a spiral spring, which coils around a tubular valve, resting with its other end against a shoulder of the same. Apertures at the end of the valve allow the liquid to pass out through the tube when that end projects outside. A solid extension of valve, of smaller diameter than the same, is threaded, and holds, by nut, a soft rubber disk and a strainer on the end of the tube. The rubber disk is of the same diameter as the tube end, the strainer fitting closely over the same. By the joint action of the spiral spring and nut, the disk is pressed firmly against the end of the tube, closing the same effectively, so that no liquid can escape. The faucet, when it is desired to draw off the fluid, is turned in far enough to strike the valve, forcing the same back, so that the disk is carried toward the inside of the vessel, and the apertures of the valve pass to the outside of the tube. The liquid enters, therefore, through the strainer and apertures into the valve and the faucet, and is easily allowed to escape.

Improved Boring and Drilling Machine.

John J. Sheridan, New York city.—This invention has for its object to furnish an improved device for drilling, boring, cutting screw threads, etc. The machine may be adjusted by means of set screws, and its base is secured to the table by bolts, so that it may be further altered in position by simply loosening the nuts of said bolts. Screws, which pass down through the base and rest against the table, enable the machine to be conveniently adjusted horizontally or plumb, and the bolts secure it firmly in place when adjusted. The upright frame of the machine is made in the form of a segment of a hollow cone, in two parts, flanged and bolted together so that the upper and lower parts may be adjusted upon each other. The tool holding shaft passes up through the hub of a bevel gear wheel, so that the said wheel may carry the said tool holder with it in its revolution, while the said tool holder may be free to move longitudinally in said wheel. The latter revolves in bearings in the frame, and engages, by a gear wheel and also by pulleys and band, with the driving shaft. The shaft is provided with two sliding clutches, and is made to carry the hand pulley or gear wheel with it in its revolution, according as one or the other of the clutches is thrown into gear. A three armed lever has forks upon two of its arms, which enter grooves in the clutches, so that one of them may be thrown into and the other out of gear by a single movement of the lever. The third arm of the lever serves as a handle. Power is applied directly to the shaft by means of another shaft meeting it at an angle and connected with it by bevel gear wheels. To the upper side of the gear wheel, through which the tool holder passes, and upon the opposite sides of the center, are attached studs, the upper ends of which are connected by a bar. To the middle part of the bar is swiveled a screw, which screws into the upper end of the tool holder, so that the tool can be fed down to its work or raised from its work by turning the said screw in one or the other direction. By suitable mechanism, each revolution of the gear wheel feeds the tool shaft down the distance of one thread of the swiveled screw. By a scribble device, when a female screw thread has been cut, the cutter may be withdrawn from said thread, allowing the holder to be run out quickly, and without danger of injuring said screw thread.

Improved Bee Hive.

George Miller, Battle Ground, Wash. Ter.—This invention consists in an improved bee hive formed of a number of cells, provided with a roof, and supported by a single shaft or post from a base. Around the foot of the post is placed a vessel to receive water to prevent ants and other insects from crawling up. The main frames are formed of an upper and a lower plate within the cells, connected at their side edges by two or more bars. In the top and bottom plates of the main frames, and midway between the side bars of said main frames, are formed grooves to receive the top and bottom bars of the single frames, so that the said frames attached to them may be drawn out conveniently and without breaking or otherwise injuring the comb, or the comb in the main frames. The bottom plates of the main frames are slotted, to give free passage ways to the bees. The lower or inner ends of the cells are closed with plates, which are secured in place by buttons pivoted to the partition walls. The buttons are semicircular in form, which enables them to be turned to release one plate without releasing the other.

Improved Propulsion of Vessels.

George Boucher de Boucherville, Quebec, Canada.—This invention consists in an improved wave motor for turning the propeller screw of a ship, vessel, or boat. A heavy platform is suspended by pivoted rods so as to vibrate freely with the pitching of the ship. The after rods are extended each some distance inward, and to their inward ends are pivoted bars which are also pivoted to vibratory rods which carry reversed spring pawls. These pawls move alternately ratchet wheels which are rigidly attached to independent sleeves that are loose on a shaft, and have each a large bevel wheel on the propeller shaft, which, by the motion of the two large wheels, is turned by either alternately in the same direction. The vibrations of the platform are thus utilized and transferred to the propeller. Patents on this invention have also been obtained in England and various countries on the continent.

Improved Inclinator or Grading Level.

Dr. John Thomley, Charlottesville, Va.—This invention has for its object to furnish a simple and inexpensive but efficient instrument for readily determining grades, inclinations or angles of various surfaces; and it consists in applying a graduated extensible bar to the ordinary carpenter's or mason's level, and providing such means for adjustment and clamping the same as will enable it to support the level at various inclinations and indicate the grade.

Improved Bee Hive.

John H. Stockwell, Bronson, Mich.—This invention consists in making the honey frame of a bee hive in separate sections, so as to turn like the leaves of a book, thus facilitating inspection, and in making the case in sections, locked detachably by suitable projections and recesses, to enable too large a swarm of bees to be easily divided.

Improved Gate Cock.

Albert A. Murray, Baltimore, Md.—This invention consists in a cock valve and seat, the former arranged to rotate about the stem in combination with a spiral spring that yields sufficiently to allow readily the rotation of the valve and yet to hold it in any position desired.

Improved Car Coupling.

William W. Haver, Schuyler, assignor to himself, James Atwell, of same place, and William Gates, Frankfort, New York.—The coupling pins are passed through the bumper head, and are made with shoulders upon their upper ends, which rest upon the upper sides of the bumper heads and are secured in place by pins passed through them at the lower side of the said bumper head. Upon the upper ends of the pins are formed hooks, which point toward the car bodies. The coupling link engages the cars by being dropped over the hooks of the pins. A short standard is connected with the middle part of the coupling link and receives an arm which is pivoted to said standard by a pin passing through a longitudinal slot in the said arm, to give the link the necessary play to accommodate itself to the various movements of the bumpers. The other or inner end of the arm is attached to a short shaft, which is pivoted and to which is attached a short arm, to the outer end of which is pivoted the lower end of the rod which passes up through a keeper attached to the car body. To the rod is attached a double screw to hold it in place. By this construction, by raising the rod the link will be raised from the hook pins, uncoupling the cars; and when the rod is lowered, the link will be lowered upon the hook pins, coupling the cars.

Improved Feather Renovator.

Risson B. Cooper, Monticello, N. Y.—The outer casing forms, together with the semicircular bottom of sheet metal or other suitable material, a steaming chamber, the upper part of which is of hexagonal shape and arranged with hinged lids, and perforated screens below them. A hollow shaft passes centrally in longitudinal direction through the chamber, and carries, near the side walls of the same, drums, with perforations of the sides facing toward the interior. Longitudinal strips connect the drums, and act as stirrers on their rotation. The steam is admitted to the hollow shaft from its opposite end, and passes through the perforated drums to the interior of the chamber, being led out again by means of tubes at the top of the casing. The doors are tightly closed during the steaming process, to produce a thorough cleansing of the feathers. The condensed water, together with the dirt, collects at the bottom of the chamber, and is drawn off through a dumping box. The drying chamber extends from the lowest point of the steam chamber along its full length on the side opposite the dumping box. It is provided with the entrance and exit pipes through which the steam is admitted and let out for drying the feathers after the steaming process is completed. The outer doors or lids are opened during the drying and cooling process to allow the free passage of a current of cold air through the feathers.

Improved Manufacture of Steel.

Hilaire Andre Levallois, Paris, France.—This invention relates to a compound prepared from soft iron, tungsten, and nickel, which forms a cast steel of superior quality. The proportions used are: for the first quality, soft iron, ninety-three parts; tungsten, six and one half parts; nickel, one half part. For the second quality, soft iron, ninety-five parts; tungsten, four and one half parts; nickel, one half part. For the third quality, soft iron, ninety-seven parts; tungsten, two and one half parts; nickel, one half part. The furnaces and crucibles employed are the same as those ordinarily used in the manufacture of cast steel. The tungsten and nickel are mixed together and inclosed with a suitable flux in a soft sheet iron tube, which is placed in the center of the charge, said charge being sprinkled over with a quantity of the flux, varying (in proportion to the quantity of the metal treated) between one half part and two parts of flux to one hundred parts of metal. As soon as the mass has become liquid it is run off in the usual way into a sand or metal mold, the latter being lined with a mixture of clay and percarburetted iron. Before and during the process of running off the fused metal, a vacuum is produced in the mold by covering the bottom of the funnel with a diaphragm of parchment, which is destroyed by the contact of the fused metal. When the alloy is run into a metal mold, the ingot is removed as soon as it becomes solidified. It is then annealed in a closed vessel, and allowed to cool gradually. The steel produced as above described may be hammered in the same way as ordinary steel. The flux is composed of borate of soda, calcined silice and carbonate of lime, pulverized in a mortar, mixed together, placed in small quantities in a crucible heated to a white heat, and, when liquefied, run off on a slotted cast iron plate. Finally, the flux thus obtained is crushed into small particles before it is used.

Improved Vessel for Transporting Grain in Bulk.

Francesco Demartini and John Chertizza, New York city.—Cross-stays are placed about half way between the deck and the bottom of the vessel, and are connected for the support of the sides. Stanchions are placed on each of the cross-stays, supported at right angles with the deck, and have partition boards upon each side, which divide the portion of the hold above the cross-stays into three compartments. The partition boards on the inside of the stanchions extend from the deck about one third the distance to the stays. Those attached to the outer sides of the stanchions extend from the cross-stays upward a short distance above the lower edges of the inner partition boards, so that the two boards of each set of stanchions lap past each other. The compartments are connected by the spaces between the stanchions, so that the grain may pass over the outside partitions from the outside compartments, and under the inside partitions into the central compartment. This is done as the vessel rolls and is careened. The result is, the central compartment is soon filled after the vessel commences to roll, and the grain in that compartment is retained. By this improvement, shifting of cargo, it is claimed, is so prevented that no damage can occur, and the vessel is navigated as easily as it is when laden with immovable cargo.

Improved Folding Camp Baker.

Frederick Leburn, Marquette, Mich.—The object of this invention is to provide (for the use of surveying parties, expeditions, and others, who are obliged to encamp in the field at some distance from human habitations,) an improved baker, which can be readily folded up after use. The invention consists of a main part with two side wings and a top hinged to it, which are arranged and connected by suitable rods for carrying the baking pan. The latter is placed in a horizontal position by elevating the main part by means of hinged supports. The main and hinged parts may be folded up so as to incase the pan and lock all the parts safely together.

Improved Combined Padlock.

Wm. C. Langensau, Cleveland, Ohio.—This invention relates to permutation lock and consists in novel means by which the combination of numbers may be conveniently changed. The peculiarity of this permutation lock consists in pivoting a plate on a stud that has projections which act in conjunction with notches on a subjacent plate and thus allow the changes of combination to be easily effected.

Improved Broom Hanger.

Mary A. Clifford, Boston, Mass.—There is a metallic spring loop and an open spring band, the two being connected by eyes. This band is made large enough to receive the small end of a handle, so as to hold it by friction. The loop is hung upon a nail, and thus suspends the broom.

Improved Windmill.

George Stearns, Eldorado Mills, Wis.—This invention consists of novel contrivances for causing a pumping windmill to start and stop self-acting by the influence of the water raised up into the tanks and by weights. It also consists of an ingenious contrivance for adjusting the vanes to take the wind more or less, by the influence of the wind; and it also consists of an extension of the frame to the front side of the wheel, to furnish a bearing for the front end of the shaft.

Improved Wheel for Vehicles and Mode of Detaching Horses.

Bolla B. Jones, Pillar Point, N. Y.—The tire is semicircular in form, or has its edges bent inward, so as to enter grooves in the felly. A nut is inserted in an open cavity in the felly, and a sheet metal cap is then applied over the felly at that point, and its flange covers the lateral opening of said cavity. A screw having a head passes through nut and cap. The end of the spoke tenon rests or abuts on the screw head. The sheet metal socket is divided longitudinally to adapt it to be fitted over the screw head, and is tightly clamped around the nut and around the spoke tenon by rings. When it is desired to disconnect the felly and spokes, the bands are slid off the socket, and the latter may then be sprung off the head of the screw. Another improvement in wheels by the same inventor consists in a metal plate, let into the felly in the axle of the spoke, and secured by a pin. The bearing piece for the end of the spoke is clamped on the felly by a key. The cap has flanges overlapping the sides of the felly to secure it against splitting. The bearing piece may be cast together with the cap. The spoke is slotted at the end suitably to be fitted on the plate and key, and it is firmly secured thereon by a plate bent around the spoke and secured by bands, which are driven on tight and secured by solder. An elastic washer is placed between the band and cap to lessen the shocks. The same inventor has also patented an improved device for detaching horses from shafts. Near each end of the whiffletree is attached a short arm, in the outer side of which is formed a recess to receive a projection formed upon the inner side of a similar arm, which is pivoted to the end of the whiffletree. With the pivoted arm is connected a spring so as to draw back the arm whenever it may be released. To the outer side of the short arm is attached a loop to receive the tug and prevent it from sticking upon the projection of the other arm and being carried with said arm when it is drawn back. To two levers is connected an eye by means of which the levers are operated to withdraw catches and allow the pivoted arms to spring back, releasing the tug. The eye may be operated by hand, or by a wire extending to the carriage and secured in such a position that it may be readily reached by a person in said carriage to detach the horses when desired.

Improved Mode of Operating Bellows of Furnaces.

Hugh Crumlish, Buffalo, N. Y.—This invention consists in the means for causing the bottom of the bellows to remain always parallel with the top while being moved up and down.

Improved Machine for Shaving Shingles.

Thomas H. Carter, Bremen, Ky.—This invention consists in combining with rotary radial drivers, cutting blades set in the direction of chords less than the diameter of the circle within which the driver rotates; also in the relative arrangement of regularly intervalled drivers and blades, the sets of each differing in number; also in combining rotary drivers and stationary knives with guides and springs to hold the shingle blank in operation. This machine is entirely without cog wheels, or any other mechanism so liable to get out of order, require frequent repair, and create delay as well as expense. The power required is very small indeed in proportion to the amount of work that may be accomplished. Of course, on the same principle, a large or small machine may be constructed, the number of knives and drivers, as well as other parts, being variable; but, with one horse, seventy-two thousand shingles may be shaved in a satisfactory manner, in a working day of ten hours, by careful and practiced workmen.

Improved Horse Hay Rake.

Barton J. Downing, Mitchell, Iowa.—This invention has for its object to furnish an improved horse hay rake so constructed that the teeth can be conveniently raised to dump the hay when desired by the advance of the machine. By suitable construction, when a sufficient amount of hay has been collected by the teeth, the driver with his foot pushes forward the end of a lever which throws the parts of a clutch into gear, and the movable part of said clutch is carried around with the axle. This draws a chain forward, the first effect being to raise a pawl from a rack. The second effect is to draw the upper arm of a lever forward, which raises the rake teeth and discharges the collected hay.

Improved Coal Scuttle.

Amasa S. Thompson, Little Falls, Minn., assignor to himself and Louis Vassaly, of same place. This invention relates to coal hods or scuttles; and it consists in the cover, made in two parts, which are hinged at opposite sides so as to be opened and closed by the hand.

Improved Machine for Manufacturing Carpet Lining.

Edward H. Bailey, Brooklyn, N. Y.—This invention consists of apparatus combined with the machinery used for arranging the hat and the paper sheets together, by which odoriferous substances are sprinkled upon and mixed with the hat in regular and uniform quantity while the lining is being made and before the hat is inclosed between the papers. The invention also consists of apparatus for pasting the paper to cause it to unite with the hat, gaged to the paper rolls by rollers, and caused to rise up to the paper rolls as they decrease in size by cords and weights.

Improved Wagon Seat.

Michael Likes, Mansfield, Ohio, assignor to himself and J. H. Barr, of same place.—This invention consists in providing the wagon seat with risers or supports, which are of angular form in one direction, and pivoted to the sides of the wagon box, and produced under a certain angle, so that the seat is not only thrown forward, but inclines at the same time beyond the foot board.

Improved Children's Building Blocks.

Abraham Oberndorf, Jr., Baltimore, Md.—This invention relates to blocks wherewith children may be amused and their minds instructed by the combination of said blocks so as to present the semblance of well known objects. The invention consists in making these blocks of such relative shape that, although comparatively few in number, houses, bridges, arches, chairs, rockers, cupolas, tables, fences, windmills, the letters of the alphabet, chandeliers and other articles of furniture and of an architectural character, may all be produced by their different combinations.

Improved Hay Elevator and Carrier.

Cyrus H. Kirkpatrick, Lafayette, Ind.—This invention furnishes a device for raising hay from the load, in a perpendicular line, to any required height, and then carrying it in a horizontal line to any part of the barn, after which the car is returned by a weighted cord and the empty fork lowered to the pitcher without any exertion on his part. It consists of an iron bumper and latch pivoted together and held in a car which hangs on a track suspended by hooks from the rafters of the barn. The latch has an elbow, extending downward, which is forked and forms a rest for a trip block placed on the rope; so that, when the trip block strikes the bumper and unlatches the car, the forked rest is thrown under and supports the load while traveling back into the barn. When the car returns over the load or floor, it is latched fast, the forked rest flies from under the trip block, and the fork is lowered for another load. The car slides on hard wood slides, and the track is spliceable and supportable at any point.

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, Roe, 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.

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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, Drawing, 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 needed 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:—Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MURX & 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.

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

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Builders of Ditching Machines, please send address, with description and prices, to T. Hodgson, Amherst, N. S.

Wanted—Scientific Americans from Jan. to July, 1873, and from July, 1871, to Jan., 1873, in good condition. C. A. Shaw, 110 Tremont St., Boston, Mass.

"A Combined Hand and Power Planer," for Machinists. Send for a circular, to Jos. A. Sawyer & Son, Worcester, Mass.

Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N. Y.

Notice of Removal—The American Photo Relief Printing Co. (Woodbury Process) have removed to No. 621 North 24th Street, Philadelphia, to which No. please address all orders, &c. I. Carbutt, Manager.

Stationary and Portable Steam Engines and Boilers. Send for Circular. Clute Brothers & Co., Schenectady, N. Y.

Superior to all others—Linet & Co.'s French Files. They are cheaper than English files. They are heavier, better finished, and better tempered. Send for price-list. Hemmer Foot & Co., Sole Agents, 29 Platt Street, New York.

For Sale—Second hand Planer, nearly new. Planes 4 ft. x 19 inches. Enquire at D. Friable & Co., New Haven, Conn.

Telegraph & Electrical Insts.—Cheap insts. for learners—Models and light Mach'y. G. W. Stockley, Sec., Cleveland, Ohio.

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 Wood Working Machinery of Gear, Boston, Mass.

Something for Inventors. See Ad, page 317.

Lane's Monitor Turbine Water Wheel at the Fair of the American Institute. See advert's, p. 317.

See the Barnes Foot and Steam Power Scroll Saw, at Fairs American Institute, New York, and Chicago Industrial Exposition.

Boy Gear's Improved Variety Moulding Machine. Warehouses, Boston, Mass.

For Sale, cheap—A vertical resawing machine, in good order, Roff and Huntington's make, price \$125. Enquire at St. Cortland St., in transit store, N. Y.

Brown's Coalyard Quarry & Contractors' Appliances for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 114 Water St., N. Y.

English Roof Paint, all mixed in oil ready for use, 50c. a gallon, 116 Maiden Lane, New York.

Patent Petroleum Lined Oil works in all parts as Boiled Lined Oil. Price only 50c. a gallon, 116 Maiden Lane, New York.

Tool Chests, with best tools only. Send for circular. J. T. Pratt & Co., 53 Fulton St., New York.

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.

Belting—Best Philadelphia Oak Tanned. C. W. Army, 301 and 303 Cherry Street, Philadelphia, Pa.

Mercurial Steam Blast & Hydraulic Gauges of all pressures, very accurate. T. Shaw 313 Bridge St., Phila.

Root's Wrought Iron Sectional Safety Boiler, 100 lb. in use. Address Root Steam Engine Co., 54 Avenue and 25th Street, New York.

For patent Electric Watch-clocks, address Jerome Rodding & Co., 30 Hanover Street, Boston, Mass.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

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

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

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mfg. Co., 40 Cortlandt St., N. Y.

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.

2 to 8 H.P. Engines, Twiss Bros., N. Haven, Ct.

Hydraulic Presses and Jacks, new and second hand. H. Lyon, 70 Grand Street, New York.

Damper Regulators and Gage Cocks—For the best, address Murrell & Ketcher, Baltimore, Md.

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

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

At American Institute and Chicago Exposition—Bott's Unriveted Paving, Variety Moulding and Dredging Machine. Manufactured by Battle Creek Machinery Company, Battle Creek, Mich.

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 229. Circulars free. J. W. Sutton, 30 Liberty St., N. Y.

We sell all Chemicals, Metallic, Oxides, and Imported Drugs; also, "Nickel Salts" and Anodes for Plating, 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, 25 Cedar Street, New York.

Mechanical Engineer and Draftsman.—An active and energetic man, with good address and education, wanted, as outside man, to solicit orders and make himself generally useful. Address, with references and expectations, New York Post Office, Box 2913.

\$10—A County Right, New Invention; Model, \$1.25, by Express. Address, for 30 days, I. H. Swink, Dublin, Bucks Co., Pa.

Workman's Hand Book—Indispensable to all engaged in Manufacturing pursuits. For Cabinet Makers, Upholsterers, Undertakers, Picture Frame Makers, Flint Hens, &c., it contains important information, and new receipts of great value. Price \$1.50. Mailed to any address by C. Abel, Cheboygan, Mich.

Notes & Queries

J. K. asks: How can I obtain a varnish or other liquid, that would be perfectly oil proof, and not crack when spread on a flexible surface? Soluble glass will not do.

G. W. B. asks: What is the best preparation for dyeing felt to a glossy black?

L. W. asks: How can brass be made of a permanent dark brown color without the use of paint?

G. W. C. asks: If two locomotives were placed at the summit of an incline and allowed to descend of their own gravity (all things being equal except the size of wheels, which are four feet diameter on one and six feet diameter on the other), which will reach the foot of the hill first? If either, why? (This is a good problem for some of our younger readers, and we would be glad to hear from them on the matter.—Ede.)

H. M. H. asks: How can I prepare test lead for assayer's use? I want to get it free from silver, copper, etc., and to have it as nearly pure as possible.

C. E. R. asks: How can I make ink which, if used on blue writing paper, will take the color out, leaving a clear white letter?

Answers to Correspondents

C. C. says: I wish to make a small specimen for a reflecting telescope. 1. Can I electroplate the surface of my mold with speculum metal? 2. If so, how can I polish the surface of my mirror? 3. Is there any way to determine the dip of the speculum that will be necessary to overcome all aberration? Answers: 1 and 2. Speculum metal, being an alloy of copper and tin, you cannot plate with it; but you can of course plate the surface of your mold with silver, which, when polished, gives an excellent reflecting surface. Polish with chamois leather and Paris white. 3. A parabolic form given to the mirror of a speculum will prevent aberration.

C. A. C. asks: 1. How can I bleach or whiten sponge? 2. How can I make a silver-coating solution? Answers: 1. Sponge can be bleached by first soaking it in very dilute hydrochloric (muriatic) acid to remove calcareous matter, and then in cold water, changing it frequently and squeezing the sponge out each time to remove all traces of the acid. It is next soaked in water holding a little sulphurous acid, or (better) a very little chlorine in solution. The sponge afterwards is repeatedly washed and soaked in clean water, scented with rose or orange flower water and dried. 2. You can silver brightly polished articles of copper or brass by using the following mixture: Silver dust (fine) 20 grains, alum 30 grains, common salt 1 dram, cream of tartar 3 drams; rub them together to a fine powder, make into a paste with water and rub on the surface of the copper or brass. The silver powder is made by precipitating it from a solution of nitrate of silver by means of a copper plate.

W. H. W. M. asks: What vegetable or mineral substance does the grape vine absorb from the earth in order to color the grape skins purple? Is the change due to the action of the sun? If so, what transformation does the grape go through? 2. What is the best and cheapest manner of preparing skeleton leaves for ornaments? 3. How can I remove ink from a Brussels carpet? Oxalic acid appeared to take it all out; but when the carpet dried, the dark color of the ink returned. Answer: 1. The change of color from the green unripe fruit to the purple grape is due to a molecular change, caused by the chemical action of light, or the natural organic changes in the fruit, on coming to maturity. A molecular change does not indicate any chemical change in composition. The influence of heat in effecting this change may be seen in the case of ordinary yellow and red phosphorus. Heat has effected a molecular change without altering the chemical composition. 2. Collect dry leaves and boil them for an hour or more in the following mixture: Dissolve 1 oz. washing soda in 1 quart hot water, and add 2 oz. quicklime; boil together 15 minutes, and pour off the clear portion after settling. Boil the leaves in this solution until the fleshy matter of the leaves is soft. Put the leaves then into cold water, and rub the soft portion away. Then place them for about 15 minutes in a solution of bleaching powder (chloride of lime) with a little vinegar. Lastly wash in cold water and dry. 3. Damp the spot with boiling water and rub quickly into it some finely powdered oxalic acid. Repeat if necessary.

L. H. W. asks: What will be the difference between the power of a steam cylinder three inches in diameter with six inches stroke of the ordinary construction, making two hundred revolutions per minute, and that of a rotary steam engine with the same amount of steam surface on the periphery of a seven inch drum, making four hundred revolutions per minute? Will the same proportion hold good in all sizes of engines? Answer: You can readily calculate this for yourself in any case. The power exerted by the reciprocating engine = area of piston in square inches $\times$ twice length of stroke $\times$ number of revolutions per minute $\times$ steam pressure $\div$ 33,000. The power of the rotary engine = area of piston in square inches $\times$ mean circumference of revolution $\times$ number of revolutions per minute $\times$ steam pressure $\div$ 33,000.

J. N. N. says: When a common house fly dies upon a mirror or pane of glass, it is found surrounded by a kind of opaque vapor, or substance resembling vapor, for about a sixteenth of an inch in all directions. Can you tell me the cause? Answer: It is mold or fungus that springs from the decaying body of the fly.

W. C. C. asks: Why do railroad men continually grumble about cast iron wheels, and yet cannot be prevailed upon to use any other? Answer: Cast iron wheels are considered by many railroad men to be the best. The principal objection to wrought iron and steel wheels is the cost.

D. asks: If a patent is granted for an article of product in the United States, can a party put up the same article in Canada, and export it across the water or ship it into the United States for sale on paying duty? Answer: In this country no person has the right to sell, use, or make a patented article without the consent of the patentee.

E. W. C. asks: 1. What is the greatest horse power obtainable by a turbine water wheel? 2. What is soluble glass, and how is it manufactured? 3. What is the analysis of salt? Answers: 1. The horse power capable of being exerted by a turbine wheel is limited only the height of fall, quantity of water and size of wheel. 2. Soluble glass is a silicate of potash, or of soda, or a double silicate of both. It can be made by fusing together 1 part silica and 2 parts carbonate of potash or soda, or 54 parts dry carbonate of soda, 7 parts of dry carbonate of potash and 192 parts silica. 3. Common salt is chloride of sodium, a combination of the two elements chlorine and sodium. It contains, when pure, 60 of chlorine and 40 of sodium in 100 parts.

A. R. asks: Is it true that a locomotive engine, when towed for a short distance, would fill the boiler (by suction) full of air, taking the supply through the exhaust nozzles, making the boiler a compressed air receiver, and by this means store up power sufficient to propel the engine? The engine is supposed to be in full working order, with the cylinder cocks closed. The pressure (over a certain amount) would, I maintain, be relieved by the air escaping by the way it entered. Answer: Such an occurrence might take place under certain circumstances, depending upon the direction in which the engine was moving and the position of the link.

M. H. S. asks: What is used for bronzing small cast iron pieces, so that the bronzing does not corrode or wear off? Answer: The method most commonly employed is to use a bronze lacquer. Sometimes bronze powder is put on with sizing.

D. asks: What will destroy cutch brown on silk or wool, and not injure the goods, so that a good black can be dyed on it? Answer: Wash the goods thoroughly and expose them in a close chamber to the fumes of burning sulphur, or plunge into water moderately impregnated with sulphurous acid gas. Afterwards wash thoroughly and dry.

D. J. J. says: 1. I have a blue flannel shirt with a white flannel bosom; the latter cannot be taken off, and I would like to know how to clean the white flannel without injuring the blue flannel. Will ammonia or ether do it? What will clean the blue flannel without injuring it? Answer: Wash your flannel in the ordinary manner, but immerse at once in warm water, not in cold, and let the operation of washing be done as quickly as possible. This will prevent, in some cases, the removal of the coloring matter, and also shrinkage.

G. H. asks: 1. Is there any chemical compound which will give to dark hair a permanent, natural gray color? In other words, can you destroy the vitality of the hair without injuring its growth? 2. What is the nature of the dye that some ladies use to give their hair the appearance of age? 3. Is this dye permanent? 4. Has it ever been demonstrated that explosions of boilers, not manifestly due to low water, are caused by generation of electricity or by some power greater than steam, inside of the boiler? If not, what is the accepted theory on this point? Answers: 1. We think not. 2, 3. They employ a powder. 4. Our theory of boiler explosions is that they occur because the pressure of the steam is greater than the boiler can sustain.

S. T. W. asks: What is the American standard for a horse power, and what difference is there between the American and the English standards? Answer: The English and American units for horse power are the same, namely, the work performed in raising 33,000 lbs. one foot high in a minute.

S. P. asks: If a rope has a horse hitched to each end, the horses pulling in opposite directions with a force of 500 lbs. each, what is the strain on the rope? Answer: 500 lbs.

J. S. asks: What ingredients are used to render neutral to each other two or any number of different colors of oil paint, so as to keep them from running together on water or while wet, and the process of mixing the paints with such substances? Answer: If you have in view the fastness of water colors with oil paints, a method to prevent the different colors running together is to cover the water color, when perfectly dry, with a thin coat of size, carefully applied.

J. G. D. T. asks: Does confined gunpowder, when ignited, expand gradually until it breaks its enclosure, or does it create an explosion without any gradual expansion? Answer: Expansion is necessary to explosion. In the case of gunpowder, it takes place quickly.

S. B. L. asks: How can I temper small tools? Answer: You should heat the articles to a straw color, and plunge them into water which has the chill taken off. You may be able to produce a better temper by dissolving some soap in the water. To heat to a straw color, place the articles in a pot of melted tallow, over a fire. When the tallow is heated to such a degree that it just commences to smoke, withdraw the articles, and plunge them into the water.

W. M. asks: What will take the stains of pers and apples out of linen and cotton? Answer: Wash the articles thoroughly in hot soap and water, and then apply, with a rag or sponge, a little aqua ammonia, commonly called spirit of hartshorn.

C. N. asks: Does not the use of a bucket pump, instead of a double acting one, involve the loss of over 1/2 of the power that would be available by the use of the latter? Suppose that the head be 102 feet, which gives a pressure of 43 lbs.; to this head add 10 feet, as the pump is set in the water, which will add about 4 lbs. to the lift on the bucket, the diameter of the bucket being 51 inches; 51 inches diameter $\times$ 251 = 7846, which $\times$ 49 lbs. pressure gives a load on the bucket of 11,758-23 lbs. The diameter of the plunger (being 40 inches) gives an area of 1256-64, which $\times$ 45 gives a water load of 56548-8. Answer: The double acting pump ordinarily has a check valve at the bottom of the delivery pipe, so that the head of water in the pipe is not available in the down stroke. It would appear, then, that the only loss in the bucket pump, which is not also incident to the double acting one, arises from not utilizing the weight of the bucket and pump rod in the down stroke.

W. F. S. asks: 1. Is it safe to blow off at 60 or 70 lbs., the certificate allowing me to carry 80 lbs.? The boiler is 5 years old and in good condition. 2. I am greatly troubled about keeping packing in around valve rod and piston. The engine runs very hot. It makes 250 revolutions and the packing burns out very quickly. 3. Is it easier to keep up steam with a little over one gale of water, or is it better to have the boiler full, after it once raised to the required pressure? Answers: 1. If you are in doubt about your boiler, the best plan would be to test it. A convenient method was given in our answers to correspondents, a short time ago. 2. Try asbestos packing. 3. We do not believe there is much difference in either case.

W. W. J. asks: How can I temper malleable iron, or convert it into steel? Answer: We suppose you refer to the case-hardening of iron. Heat the iron to redness, cover it with prussiate of potash, and plunge it into cold water. A better process is to heat the iron in an airtight box, containing animal carbon, which may be prepared by slightly burning horns or hoofs, and reducing them to powder. Keep the box at a light red heat, for an hour or more, and then empty its contents into cold water. Either process hardens the iron on the surface, but does not convert the whole material into steel.

R. M. says: I have a steam engine, 14 inches cylinder and 20 inches stroke, making from 100 to 120 strokes per minute, running without governor. The valve has very small lead, scarcely one thirty-second of an inch. I want to know if more lead would not give me more power, and also let the engine run more easily? About twenty years ago I had an engine of 3 feet stroke, with but small lead; I had occasion to change the run of the engine; and in doing so, I happened to give her nearly 1/4 inch lead, which made her run, I think, one fourth faster, with the same amount of steam. Answer: The proper amount of lead can best be determined by experiment, and you can probably hit upon it after a few trials.

J. says: In riding in the bed of a creek, I came across a spot that sounded hollow; no outlet could be seen; the bottom was sand and gravel, and the creek was moderately full only. What would be the result of digging? 2. Does it injure a shot gun to oil it inside? If oil is used, what kind is best? Answers: 1. If you should dig over the spot where the hollow sound was perceived, you would probably tap a cave, or natural hollow in the earth. Such are produced, especially in limestone districts, by water, which has dissolved or washed away the mineral substance which originally filled them. 2. If you use any oil for your gun, use some kind that will not oxidize or thicken, such as watch-makers' oil; and use very little of that.

F. X. M. says: Our men in the shop use soft soap to remove the grease and dirt from their hands when they quit work. This, they find, causes cracks to come; but if they dip them in vinegar just after washing with the soft soap, their hands will remain soft and smooth, and any cracks on the hands will immediately heal up. Can you give the chemistry of this? Answer: In the ordinary careless manufacture of soft soap, there is apt to be sometimes an excess of alkali or lye, above that necessary for complete saponification. This has a caustic action on the skin, making it rough, and otherwise injuring it. After using soap of this kind, washing in vinegar removes the excess of alkali from the hands. Vinegar, being an acid, combines with the alkali, forming a neutral and soluble salt.

D. F. asks: Will carburated air burn in an atmosphere of its own carbonic acid, under a pressure of 60 lbs. to the inch? Answer: No.

S. R. asks: What can be done to make gasoline gas burn steadily when a draft of air or gust of wind strikes the flame? Coal gas is not affected by winds nearly as much as that of gasoline. Answer: The peculiarity you speak of is due to chemical causes which it is difficult to obviate. Coal gas or heavy carburated hydrogen is a complete chemical compound with little or no mechanical mixture of incombustible substances. Its combustion, therefore, gives rise to a steady flame, the light being produced by incandescent particles of carbon, and a complete chemical decomposition of the hydrocarbon taking place. In carburated air, however, made by passing atmospheric air through naphtha, etc., we have merely a mechanical mixture of a hydrocarbon vapor with an incombustible gas, namely, the atmosphere. The nitrogen, by far the larger portion of the air, not being combustible, is rapidly driven off through the flame, giving rise to the flickering unstable flame of carburated air.

M. asks: What should be the form and size of the fire box for a vertical boiler (without flues) 2 feet by 1 1/2 feet, made of No. 14 iron; and what pressure will such a boiler safely bear? Answer: The boiler should have a flue all around it, extending nearly up to the top (the smoke pipe connecting at one side), and the grate should be as large as the diameter of the flue. The boiler will sustain with safety a pressure of about 35 pounds per square inch, if, as we suppose, its diameter is 18 inches.

E. E. H. asks for an explanation of our recipe for preserving cider. Answer: Read 1/2 pail of sugar instead of 1/4 part. We have since learned from the manufacturer that the sugar may be omitted, with advantage, when the juice is good. The sugar is apt to cause too great a fermentation. If sugar be added, however, experience would teach what quantity to use.

J. R. asks: When an electric battery is applied to a person for some time, and he keeps shaking afterwards as if he still had hold of the handles, is it right to apply the battery to take it off him again, or to let the electricity remain in till it goes of itself? Answer: Any trembling or shaking of the muscles or limbs after an electric shock is a sign that the shock has affected the nerves too severely, and not that any free electricity still continues to circulate in the body. Another application of the battery would only make matters worse.

J. T. asks: How is it that steam taken from a boiler will force water into same boiler, that is, force it against itself? Answer: In the action of the Giffard injector, steam is condensed, and the power previously existing in it is expended in the propulsion of the water.

G. W. asks: 1. What is Javelle water? 2. What is the easiest and most economical way of procuring oxygen gas? 3. How is soda water made? 4. Where can I get Bixham's "Chemistry"? Answer: 1. See, p. 278 vol. 26. 2. Heat the binoxide of manganese to a dull red heat in an iron retort. 1 lb. of good commercial binoxide of manganese will yield from 5 to 6 gallons of oxygen. 3. By charging water under pressure with carbonic acid gas, procured by the action of sulphuric acid on marble dust or any carbonate. 4. See our advertising columns for publishers.

C. A. D. asks: When, where, and by whom were spectacles invented, and what first suggested their use? Answer: Spectacles were first invented in the thirteenth century. Francesco Redi, in a treatise on spectacles, says that they were invented between the years 1280 and 1311 A. D., by a monk of Florence named Alexander de Spina. Muschenbroeck says that it is inscribed on the tomb of Salvinus Armatus, a nobleman of Florence, who died in 1317, that he was the inventor of spectacles. By others Roger Bacon, in England, who died in 1292, has been considered the inventor.

T. B. W. asks: If a steam boat runs eight miles in an hour, from point to point (in still water), what distance would she run with the help of a four mile current? Answer: The speed of the vessel would be increased by the speed of the current, if the resistance of the air is neglected.

J. S. H. P. asks: 1. How is carbolic soap made? 2. What proportion of the (pure) acid is used? 3. In midwinter, when the thermometer in the room stands at 30° or 32°, though clad in thick under and outer garments, we call it only comfortably warm. But in summer at the same temperature, though clad in the thinnest possible garments, we feel it intolerably hot. Why is this? Answer: 1. Carbolic acid soap is made by adding from 5 to 20 per cent of carbolic acid, according to the use to which it is to be applied. 2. We do not always feel the same degree of temperature, for example, 32° Fahr., to be invariably oppressive or hot. This is owing to the fact that the atmosphere at this temperature sometimes contains more moisture than at others. The drier the warm or hot atmosphere, the less the heat is felt, owing to the rapid evaporation of perspiration from the surface of the body. During a cold clear winter's day the air contains much less moisture than in summer, so that, although we may be in a room artificially heated to 80° Fahr. or above, it may not feel uncomfortable, the insensible perspiration rapidly passing off and cooling the body.

C. W. E. asks: How can I make an electro-magnet to be operated by an earth battery? Answer: You can make an earth battery by sinking two large plates of copper and zinc in moist earth, and connecting them by conducting insulated wires attached to each. Such a battery was constructed by Bain in 1841. You can make an electro-magnet by winding stout copper wire, covered with silk, around a piece of soft iron bent in the form of a horse shoe, care being taken that the coils are wound in the same direction around each bobbin, either from or towards the axis of the magnet. The more numerous the coils, and the greater the power of the electric current, the stronger the magnet.

W. S. B. asks: How can I anneal gold after it has been cast? Answer: We think you can do it by heating the gold, and allowing it to cool slowly.

C. R. asks: 1. What is the best and most economical constant battery? 2. I have heard of a thermo-electric battery. Is there one of practical utility? Answer: 1. Daniell's battery is recommended for constant action. It is not expensive, and no gases escape from it. It consists of a cylinder of copper, in which is placed a cylindrical vessel made of unglazed biscuit ware, or porous earthenware. Into this porous vessel a rod of amalgamated zinc is placed. The copper vessel is filled with a saturated solution of sulphate of copper with a little sulphuric acid. The porous cell is filled with dilute sulphuric acid, and on a perforated shelf, fixed to the upper part of the copper cylinder, are placed crystals of sulphate of copper (blue vitriol) to keep up the strength of the solution. 2. Thermo-electric batteries have been made of considerable power, but we know of none that have ever come into practical use.

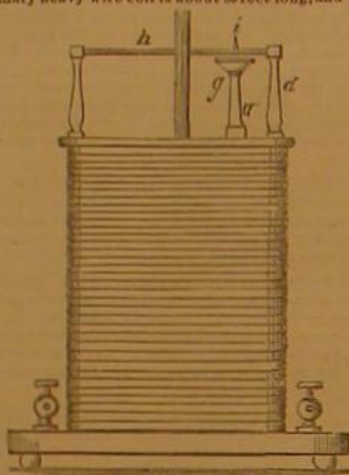
D. H. M. asks: How can I separate iron from copper and brass? Answer: If you heat the metals in a crucible, the brass will be melted first, and can be poured off.

S. asks: 1. How is aniline made from coal tar? 2. What apparatus is necessary? 3. How are bronze powders made? 4. Can you give me a good recipe for Worcestershire sauce? Answer: 1 and 3. The basic portion of coal tar or coal tar naphtha, that is, the least volatile products of the distillation of these substances, is strongly agitated with hydrochloric acid in excess. This is done on the large scale in vessels lined with lead. The clear portion of the liquid is then decanted and evaporated until acid fumes appear. It is again filtered and neutralized with potash or milk of lime and distilled. The portion that passes over at 300° Fahr. is crude aniline. By the action of bichromate of potash on sulphate of aniline, rich shades of purple and violet are produced. 2. To make a bronze powder, mix peroxide of tin and sulphur, of each 2 parts, an ammoniac 1 part. Expose to a low red heat in an earthenware retort until sulphurous fumes cease to be given off. 4. The following recipe gives a fine sauce: Port wine and mushroom ketchup, of each 1 quart; walnut pickle 1 pint; soy ½ pint; pounded anchovies ¼ lb.; fresh lemon peel, minced shallots and scraped horseradish of each 2 oz.; allspice and black pepper (crushed) of each 1 oz.; cayenne pepper and bruised celery seed of each ½ oz. (or curry powder ½ oz.); digest for 14 days, strain and bottle.

W. W. B. says: In making gas from petroleum, there are several difficulties of which the most serious is the deposit of carbon in the shape of dry powder in the retort, and other troubles between the retort and the gas holder. Petroleum is the finest gas-making material we have, taking into consideration its price; it will yield from 6,000 to 8,000 feet per barrel, and the supply seems to be inexhaustible. It is a question of great importance to the oil producer to get a steady market for his oil, and to the people to get a cheap and good light. Both of these objects would be attained by a practical solution of this question: Can gas of good quality, and cheap, be manufactured from crude petroleum on a large scale? I say that it can, and it can be done by any mechanical arrangement to inject air and petroleum in graduated quantities into the retorts; and I also say that it will convert all the petroleum into gas of high illuminating quality and leave no carbon in any shape, either in retort or pipes. I have proposed the question to many gas men, but nobody seems to know anything about it, except that petroleum is a difficult thing to handle in gas making. I write to you to ask: 1. Will not the injection of air and petroleum into the retort convert all the petroleum into gas? 2. Would there be any deposit of carbon on the retorts or pipes? 3. Would it be a permanent gas or a mechanical mixture? 4. Would there be danger of explosion from injecting a graduated quantity of air into the retort? Answer: Petroleum being a mixture of various hydrocarbons, that is, various chemical combinations of hydrogen and carbon that are for the most part liquid at ordinary temperatures, it is obvious that it cannot be changed into a permanent gas without decomposition, or a new interchange of its elements, forming new chemical compounds. It is found that, when petroleum is submitted to a high temperature without access of oxygen, decomposition takes place, a quantity of uncombined carbon being deposited. It is evident, then, that the permanent gas formed is a hydrocarbon with a less proportion of carbon than the liquid petroleum. To convert all the petroleum submitted to heat into a gaseous body, something must be supplied that will combine with the extra carbon and form either another illuminating compound or one that can be removed by subsequent purification. When petroleum burns in the air, its elements combine with oxygen, forming carbonic acid gas and vapor of water. The injection of air or oxygen into the decomposing retorts would therefore defeat the object in view

that of making a permanent illuminating gas. It would simply cause a combustion of the petroleum core rapid than that which takes place in the open air, besides the risk of explosion. It would be far more philosophical to inject hydrogen with the petroleum into the retort, or to decompose the petroleum in an atmosphere of hydrogen. This hydrogen could be readily formed by decomposing superheated steam by means of red hot anthracite coal. Indeed, superheated steam alone in contact with the decomposing petroleum might yield a portion of its oxygen to the extra carbon, thus obviating its deposition on the retort, forming carbonic acid gas which could be removed by water. If free hydrogen were liberated, it would increase the heating properties of the flame. We simply mean here to indicate the philosophical method of experiment, bearing in mind the constitution and affinities of chemical bodies. Nothing but practical trial in this way can solve the problem of the utilization of petroleum in the manufacture of illuminating gas.

J. M. asks: How can I make an induction coil to use with two large Grove's cups? With this arrangement, can I make an electric light? Answer: You can make an induction coil as follows: In the figure, the primary heavy wire coil is about 10 feet long, and wound



round a glass tube. Outside of this is wound the second or fine wire coil of about 1,400 feet. Battery contact is broken and renewed by the rotation of a soft iron bar, A, which, mounted between two brass pillars, is placed immediately over the axis of the coil, in which is placed a bundle of soft iron wire. The current of the battery passes through the pillar A and the axis carrying the iron bar, and contact is broken and renewed by the point of dipping as it revolves into and out of mercury in the brass cup, G, on the pillar A, through which the circuit is completed. The binding screws in front connect with the ends of the coarse interior coil, and for connection with the battery. Two screws behind connect with the ends of the fine wire coil, from which the secondary current is derived, and from which shocks may be taken, water decomposed, etc. You cannot make the electric light with this arrangement. That requires that the fine wire coil should be wound round a soft iron horseshoe magnet, which is made to revolve rapidly in front of a permanent or temporary electromagnet.

J. K. asks: Is there in existence a means or contrivance to start, and keep in motion for one minute only, a machine which uses horse power? The power which runs the machine is unable to set it in motion, and cannot even assist in it. What may I employ to start the machine? Answer: We hardly get your idea; but as the question is stated, it would seem possible to apply some other power, say that of a steam engine, to start the machine.

A. L. B. says: In your answer to I. E. E., the method by which the Lexington Avenue Synagogue is lighted by electricity is incorrectly stated. The burners in the Synagogue are not lighted by the galvanic current heating a platinum wire, but by induced electricity, produced by a new frictional apparatus and condenser, contained in one small case. The electricity, generated by turning a crank, is stored up in the condenser, which, when a sufficient quantity and intensity is arrived at (depending upon the number of burners to be lighted), is discharged, producing a spark at each burner—the circuit being there broken—and ignites the gas which has been turned on immediately before the discharge.

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

J. E. H.—Siliceous earth, apparently infusorial. Infusorial earth is used as a polishing material, under the name of electro-silicon.

J. R. E.—Blue clay, a silicate of alumina.

P. S.—Hypersthene (or Labrador hornblende) with iron.

W. W. B.—Galena (sulphide of lead).

T. F. H.—Galena (sulphide of lead).

J. W. C.—Micaceous iron ore.

COMMUNICATIONS RECEIVED.

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

On Crucibles. By L. T. C.

On Silicon Steel. By C. W. H.

On Heat. By H. C. F.

On Perfect Combustion. By C. R.

On a White Blackbird. By J. S. B.

On Using Heat Twice. J. A. H. E.

On Transit on the Canals. By R. D. R.

On the Art of Inventing. By K.

On Lunar Acceleration. By J. H.

Also enquiries from the following: C. K. C.—P. W.—W. H.—W. H. S.—E. J.—E. H. K.—S. E. J.

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 October 14, 1873, AND EACH BEARING THAT DATE. (Those marked (r) are reissued patents.)

Air compressing apparatus, H. S. Pardee	143,531
Alarm and circuit, electrical, J. H. Guest	143,531
Annunciator, electric vote, T. B. Doolittle	143,579
Baking powder, bread, Kopping & Weideman	143,580
Barrel head, A. Harvey	143,571
Baton, policeman's, Beery & McDonald	143,610
Bed bottom, S. Pearson (r)	5,604
Bedstead fastening, T. W. Moore (r)	5,608
Bee hive, J. H. Shook	143,543
Belt clamp, E. Ainsworth	143,504
Belt shifting apparatus, O. H. Wade	143,736
Boiler, culinary, J. H. Corey	143,673
Boilers, dead light for steam, J. C. Hoadley	143,571
Bolt and rod cutter, L. H. Smith	143,645
Boot channeling machine, C. S. Dunbrack	143,561
Boot edge welt, J. Green	143,623
Boot heel plate, G. Rohm	143,719
Boot nailing driver, A. S. Libby	143,699
Boot soles, finishing, Fairfield & Messer, Jr.	143,682
Boots, manufacture of, W. H. Ferguson	143,657
Boots, etc., heel for, Gebhard & Schwarz	143,698
Bottle corking machine, J. Armstrong	143,606
Bottle, cosmetic, M. H. Huntington	143,627
Brick machine, D. W. Glendinning	143,569
Brush, rotary, G. Carlisle	143,666
Brush, scrubbing, C. Herold	143,595
Burg, H. K. Hazlett	143,573
Burner, oxyhydrocarbon, J. D. Averell	143,535
Caliper, W. H. Miner	143,554
Can, oil, J. G. Evenden (r)	5,597
Can, oil, W. A. Foster	143,567
Can for oils, etc., J. G. Evenden (r)	5,598
Can, sheet metal, J. G. Evenden (r)	5,599
Cans, forming seamless, M. Von Cullen	143,733
Cans, etc., filling, C. S. Bucklin	143,613
Candy cutter, F. Quinn	143,590
Car axle box, L. Schulze	143,512
Car coupling, G. Edwards	143,580
Car coupling, J. H. Payne	143,636
Car coupling, W. D. Pope	143,538
Car coupling, G. W. Putnam	143,716
Car coupling, E. R. Scott	143,730
Car coupling, J. Seelove	143,513
Car coupling, E. D. Smith	143,728
Car coupling, O. Taylor	143,646
Car wheel, A. F. Cooper	143,560
Carriage, child's, L. Havas	143,524
Carriage, child's, J. G. Kamphaus	143,521
Carriage shaft holder, A. C. Maxfield	143,582
Carriage spring, G. Hopson	143,576
Carriage top joint, J. H. Combs	143,666
Chair folding, D. N. Selleg	143,721
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Churn-dasher, I. B. Compton	143,559
Clock calendar, A. Frankfeld	143,615
Cock, J. W. Faxon	143,583
Copy holder, W. R. Carter	143,616
Corn husker, G. W. Carr	143,607
Cracker machine, J. Fox	143,586
Cracker machine, G. J. Kingsbury	143,575
Cultivator, C. M. & D. E. Hall (r)	5,601
Cultivator, wheel, Matchet & Smith	143,603
Cutter head, H. Fletcher	143,565
Cutter and planter, potato, L. J. Mewborn	143,705
Dice box, J. Twamly	143,598
Distilling pure alcoholic spirits, C. Andersen	143,654
Domino, B. Louncean	143,706
Door hanger, S. L. Bignall	143,535
Electric signaling, R. K. Boyle	143,560
Electric railway signal, S. C. Hendrickson	143,604
Engine governor, steam, C. H. Rungt	143,644
Engine, rotary steam, snaw & Baker	143,711
Equalizer, draft, W. W. Hignam	143,596
Far box, T. L. Johnson	143,602
Fence, picket, R. H. McGinty	143,622
Fire arm, revolving, Forehand & Wadsworth	143,556
Fire escape, C. Dietrich	143,677
Fire extinguisher, portable, I. C. Andrews	143,605
Forces for snouting hogs, G. Stephenson	143,707
Fumigator for hospital use, T. J. Mayall	143,538
Furnace, chimney, L. White	143,728
Gage, cloth marking, E. E. Emery	143,680
Gage, registering steam, P. Malby	143,698
Gas retort, T. Davison	143,675
Glass ware, mold for, G. H. Lomax	143,625
Globe holder, C. H. Barney	143,615
Gun, breech loading, etc., B. & W. G. Burton	143,614
Gun, machine, C. Stensland	143,720
Harness attachment, hitching, T. J. Dobbs	143,652
Harrow tooth, W. H. Platt	143,711
Harvester, T. N. Foster (r)	5,603
Harvester, T. N. Foster (r)	5,607
Harvesting machine, Baylis, Brown & Lamont	143,605
Heel finishing machine, C. W. Gidden	143,718
Heel hand tool, S. L. Hiker	143,710
Hinge, H. Manneck	143,705
Hoisting apparatus, N. S. McFarland	143,714
Hose, hydraulic, L. R. Blake	143,661
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Iron and steel, E. Peckham	143,637
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Latch for doors, locking, E. Halsey	143,690
Liquids, cooling coil for, W. Gee	143,698
Lubricator, J. McL. Power	143,628
Mall pouch holder and catcher, B. F. Bean	143,625
Malt dryer, W. W. Hughes (r)	5,605
Map exhibitor and cabinet, W. A. & G. Rice	143,711
Matter, composition of, G. T. J. Colburn (r)	5,596
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Mill, grinding, K. & S. Patterson	143,711
Stop holder, E. M. Naramore	143,632
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Needle and shuttle threader and knife, J. Black	143,714
Nut device, divided, F. A. Huntington	143,623
Ores, reducing, J. H. Boyd	143,600
Organs, pneumatic action for, T. Winans	143,602
Packing, piston, T. J. Mayall	143,705
Pan, amalgamating, I. B. Parke	143,622
Pan, evaporating, D. Watson	143,640
Paper bag machine, L. C. Crowell	143,671
Paper ruling strike, J. D. Connolly	143,613
Pavement, stone, T. D. Owens	143,597
Peat machine, Clayton & Howlett	143,611
Photographic embossing press, E. E. Barker	143,608
Photographic printing frame, W. H. Jacoby	143,577

Piano action, F. L. Trayer	143,547
Pinchers, shoemaker's, T. B. Shelly	143,594
Pipe for buildings, fire, H. Palmeri (r)	5,608
Pipe for water works, stand, G. W. Pearsons	143,711
Pipe machine, curved, R. Connable	143,620
Pipe, curved, R. Connable	143,571
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Plane, spirit, H. L. Weagant	143,707
Plowing machine, J. Utter	143,704
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Plow, L. C. Frost	143,560
Plow, snow, Sweet & Noble	143,540
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Refrigerator and cooler, C. D. Hicks	143,625
Register and indicator, E. P. Wheeler	143,601
Rein holder, J. W. Clark	143,568
Roof, fire and waterproof, J. Long	143,581
Roofing, composite, R. S. Jennings	143,697
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Sash holder, Anderson, Walden & More	143,655
Saw, jig, M. E. Weller	143,620
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Scales, bag holder weighing, A. H. Bell	143,598
Screw cutting machine, M. B. Flynn	143,655
Sewing machine corder, J. G. Powell	143,599
Sewing machine table, W. H. Boyer	143,611
Sewing machine treadle, S. B. Busfield, (r)	5,595
Sheet metal bending machine, C. F. Brand	143,558
Shovel handle, Pomeroy & Owen	143,714
Ship's sails, stay for, C. Freeman	143,568
Shutter fastening, J. A. Morris	143,585
Skins, removing dirt from, C. Turner	143,733
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Telegraph circuit, L. T. Lindsey	143,700
Telegraph regulator, L. T. Lindsey	143,701
Thill coupling, J. C. Thompson	143,590
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Trap, animal, B. F. Smith	143,727
Uterine supporter, A. C. Byam	143,615
Waffle baker, S. S. Fitch	143,564
Wagon, dumping, Greer & Thompson	143,570
Wagon seat, L. Powers	143,715
Wash bench, A. G. Emery	143,652
Washer cutter, H. E. Whipple	143,708
Washing machine, Nixon & Babcock	143,709
Watch key, Allen & Hall	143,658
Watch, double stop, A. Frankfeld	143,619
Water, purifying, G. Demally	143,676
Water traps, forming, W. A. Butler	143,603
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APPLICATIONS FOR EXTENSIONS.

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

14,360.—MAKING TINWARE.—S. J. Olmsted, Dec. 31.
14,362.—LAMP.—G. Nelson, Jan. 7.
14,367.—SINGING PIGEON.—A. Denny et al, Jan. 14.

EXTENSIONS GRANTED.

14,376.—JACQUARD MACHINE.—A. Babbett.
14,377.—HARVESTER.—E. Ball.
14,387.—HEAVY FOLDER.—L. Clark.
14,314.—SLEEPING CAR.—J. Danner.
14,343.—CULTIVATOR.—T. McQuiston.
14,342.—WEEDING HOE.—J. M. Adams.
14,367.—COVERING SADDLE TREES.—J. Macleure.

DISCLAIMER.

14,376.—JACQUARD MACHINE.—A. Babbett.

DESIGNS PATENTED.

1,356.—DOOR KNOB.—J. O. Holles, Boston, Mass.
1,357.—RUBBER BOOT.—L. L. Hyatt, New Brunswick, N. J.
1,358.—STOVE.—J. Martino, Philadelphia, Pa.
1,359.—PICTURE FRAME, ETC.—J. Nonnenbacher, N. Y. city.
1,360.—STATUE.—J. Rogers, New York city.
1,361.—KITE.—S. M. Simonds, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,488.—BLACKING.—L. Amson & Co., New York city.
1,489.—BLACKING OR GREASE.—L. Amson & Co., N. Y. city.
1,490.—BARRELS OF WHISKY.—Derby et al, St. Louis, Mo.
1,491.—CORNET SPRINGS.—F. L. Egbert, New York city.
1,492.—SHIRTS.—Kohn & Co., Philadelphia, Pa.
1,493.—BROTHERS.—J. M. C. Martin, New York city.
1,494.—CLOTHES WRINGER.—Queen City Wringer Co., Cincinnati, O.
1,495.—BAKING POWDER.—Royal Baking Powder Co., New York city.
1,496.—STOVES.—J. Spear & Co., Philadelphia, Pa.
1,497.—GRINDING MILLS.—Straub & Co., Cincinnati, O.
1,498.—RUBBER BOOTS.—Candee & Co., New Haven, Ct.
1,499.—QUICKSILVER FLASKS.—Quicksilver Mining Co., New Almaden, Cal.
1,500.—WINDOW POLISH.—H. M. Wade, Philadelphia, Pa.
1,501.—MEDICINE.—J. L. Graham, Pittsburgh, Pa.
1,502.—LUBRICATING OIL.—Leonard et al, New York city.

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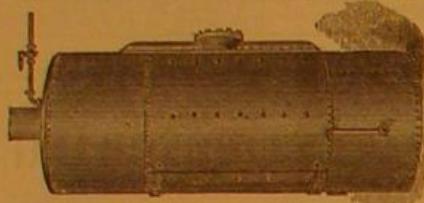
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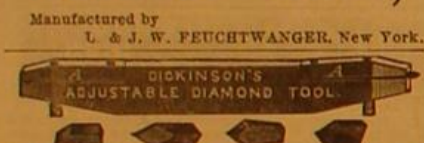
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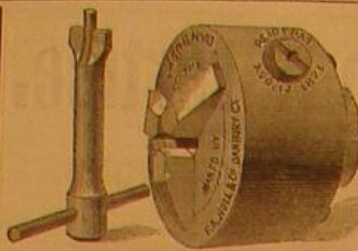
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