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IMPROVED PUMPING ENGINE FOR WATER WORKS.

We illustrate herewith one of the smaller sizes of an improved duplex pumping engine for water works, manufactured by Messrs. Dean Brothers, of Indianapolis, Ind. The steam cylinders are 16 inches in diameter, water cylinders 10 inches in diameter, and the stroke 16 is inches. The machine is capable, we are informed, of delivering 1,000,000 gallons in 24 hours; or when connections are made with hose to different hydrants, it will throw four 1¼ inches streams to a hight of 130 feet, which is sufficient for towns with from 5,000 to 8,000 inhabitants. The manufacturers construct much larger engines of the same description, capable of delivering 6 000,000 gallons in 24 hours, or throwing twelve fire streams from the mains, all working equally well in connection with the reservoir, the stand pipe, or the direct pressure system of supply. Steam is used expansively, and the larger engines are provided with adjustable cut offs. The crank shafts are connected together by a coupling, and the cranks are set at right angles to each other, so that they may run very slow without stopping, or may maintain a high speed without injury. All bearings have large areas, and have means of adjustment in case of wear; the water cylinders are lined with copper; the valve seats are made of gun metal with noiseless rubber valves, and the larger sizes of pumps have hand holes for examining or removing the valves. The piston rods are of steel, and the water piston rods are covered with brass. The crank shafts are made of hammered iron, the crank pins of steel, and the cranks of cold blast charcoal iron. Every part is made of the best material, carefully fitted. All the pipes are carried under the floor, as shown. The steam supply pipe is carried into the bottom side of the steam chest, and the exhaust pipe leads down between the pumps. The suction pipe, which is brought up between the water cylinders, has a vacuum chamber attached, which is represented between the wheels.

All the pipes being out of sight gives the engine room a very neat appearance and insures a dry floor. In front of the steam cylinders are three throttle valve stands; the center one is for running the pumps duplex, the others are for running them separately.

An important feature of this duplex pump is that it may be converted into two single pumps by uncoupling the crank shaft, which can be done very quickly. By closing the valves on one pump, the other may be run alone. This is a point of considerable advantage, especially where direct pressure is used, as the supply would be interrupted if the engine were stopped for a few minutes, and a fire might occur at the very time the engine is at rest.

We learn that this machinery has been in constant operation at Union City, Ind., night and day, for over two years, without stopping, and has never cost a dollar for repairs. The supply is there kept up by pumping directly into the mains, and in case of fire the hose is attached to the hydrants.

The following cities are also using the duplex pumping engines, which furnish the entire supply of water for fire and domestic purposes: Peoria, Ill.; Alton, Ill.; Charleston, Ill.; Brazil, Ind.; Attica, Ind. It is claimed that the engines in Peoria are showing a saving of 35 per cent in fuel over the machines previously used. And in all the other cities the machines are working with great economy, no fire engines being employed, the hose being attached directly to the hydrants. The manufacturers (whose address is at junction of Delaware street and Madison avenue, Indianapolis, Ind.), also make an excellent variety of steam pumps for general purposes.

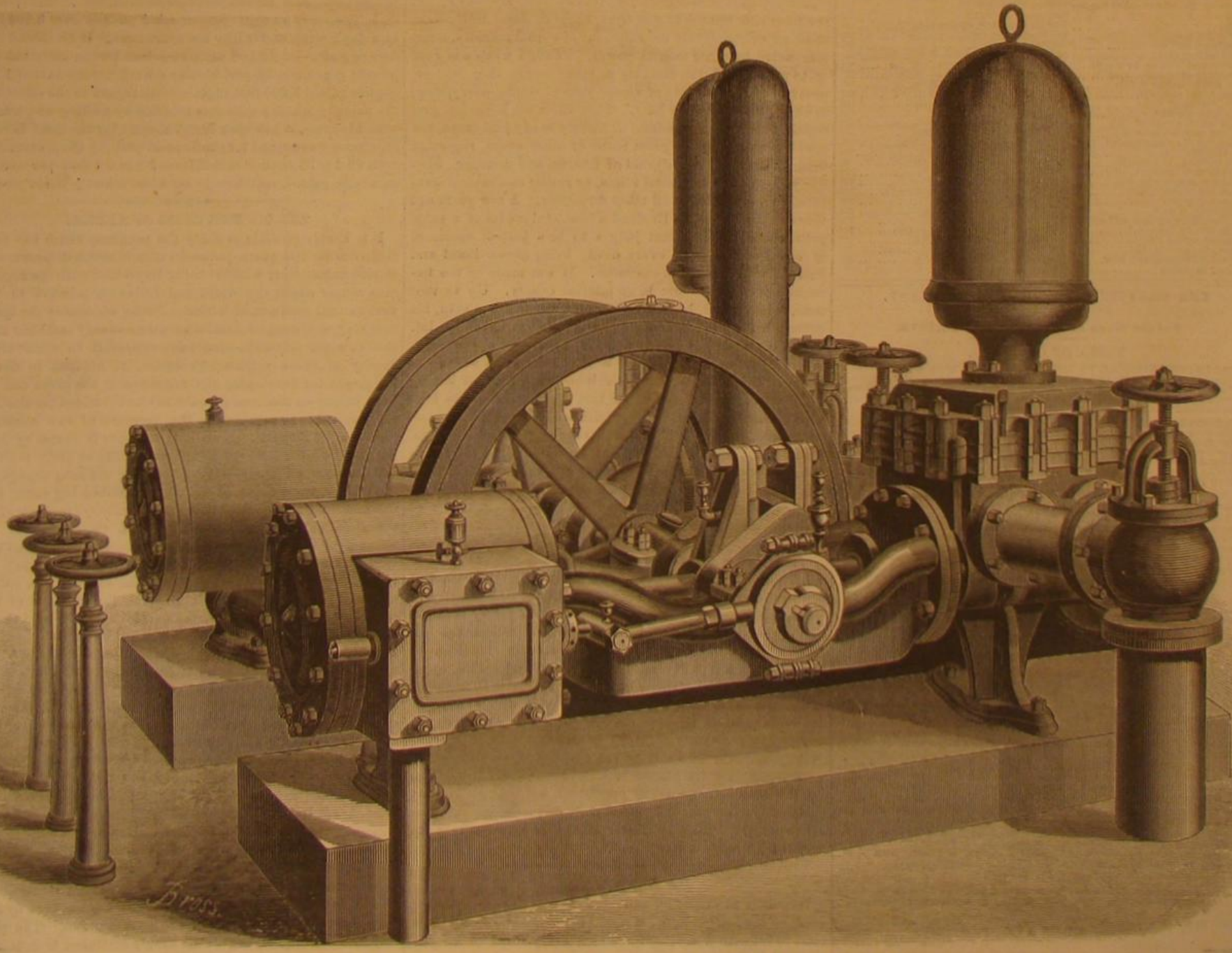
Are Nitrites in Water Caused by Bacteria?

It has generally been supposed that, wherever nitrites were found in spring or well water, they were formed by the oxidation of the ammonia. Mensel has recently proved that, in many cases at least, the nitrates were converted into nitrites through the action of bacteria. The following facts sustain this theory: Well water containing no ammonia, and, when fresh, no nitrites, but some bacteria, after standing a fortnight gave the reaction for nitrites. In this case, the nitrates were the only nitrogenous compounds in the water when it was fresh. Salicylic, carbolic, and benzoic acids, alum and table salt, in short all antiseptics and antizymotics, hinder or retard the formation of nitrites. Water containing nitrates, did not, in the presence of bacteria, produce nitrites; they appeared in from 2 to 14 days after adding some carbohydrate, as sugar, gum, or starch. A few other carbonaceous compounds convert nitrates into nitrites, but slowly and weakly. Antiseptics stop this decomposition.

Freshly distilled water, boiled with sugar and saltpeter, and sealed up while boiling, contained no nitrites after standing for weeks, because no putrefaction can take place without bacteria. Putrefying albuminous substances, brought into contact with nitrates, yield nitrites.

We do not get a correct view of the decomposition going on in wells rich in saltpeter until we look upon the nitrous acid as the direct product of decomposition. The decomposition of cellulose by means of bacteria, in the presence of nitrates, proves that saltpeter is not only direct food for the plant, but, owing to the oxygen in it, performs an important function in the soil. The decomposition process above described is a very extensive one, and elucidates the decay of plants, as well as many other operations in factories. The alkaline nitrates by themselves are not so easily reduced and if, nevertheless, the microzoa employ their combined oxygen for oxidation, there is an important difficulty in regard to the power of bacteria, because on the one hand they produce oxidation, on the other they deoxidize.

This fact may lead to a new method of combating diseases which are related to bacterian organisms.



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WHAT THE COMING MAN MAY BE.

Clever writers have frequently amused themselves and their readers by forecasting the future, and prognosticating the condition of humanity centuries hence. They have materialized, so to speak, the dreams of to-day, and pictured human life as it might be were those dreams fulfilled. In all these Utopias, however, the people, though better morally, more happy socially, more fortunate politically, and more powerful through easily predicted increase of knowledge, are yet substantially the same as the people of the present. It is assumed, apparently, that the future progress of man is to be measured by changes in his condition, not by changes in himself: that, supposing progress to go on in the future as in the past, the men of 5876 will differ from us in their personal development.

A writer of sufficient knowledge and liveliness of imagination might plan a more marvelous and, it is hardly too much to say, more probable Utopia from the standpoint of psychical rather than material development, picturing a time when the average man will be intellectually as superior to us as we are superior to the less developed man of five thousand years ago. That there has been a similar increase of human brain power during the past few thousand years is as certain as that there was a steady increase of brain bulk throughout the animal kingdom during the geological ages just preceding; and there is no physiological or other reason for believing that man may not go on perpetually increasing in mental power.

Measure the intellectual gulf between the Australian savage, barely able to count his fingers and having no numerals above two, and a Newton or a La Place, or even the average man of to-day: then suppose the whole race advanced an equal interval. Imagine a race of men so intellectual that the average man would be a Michael Angelo! The basis for such an estimate of the powers of the coming man is found, strange to say, in certain idiots.

Idiocy is commonly marked by the non-development of the physical powers, but sometimes by the non-development of all but one, in which cases a single faculty appears to receive the whole of the force evolved, and to develop enormously at the expense of all the rest. Thus we may account for the marvelous power in one direction shown by idiotic prodigies like Blind Tom, whose psychical power is wholly musical. The idiot painter known as Cat Raphael illustrates the same perversion of force in another direction. He drew and painted cats and kittens of every sort, shape, and shade, in every possible position and condition, and painted them wonderfully well, yet could do nothing else. In like manner we have calculating idiots, able to make the most elaborate calculations almost instantly but utterly unable to explain the mental operations involved. Other idiots, without reference to clock or watch, and without conception of the object or meaning of divisions of time, are able to tell the hour and minute at any time, night or day. Still others show an extraordinary development of verbal memory, unaccompanied by other mental power. Though unable to read or to understand the meaning of many words, they will repeat by sound hundreds of verses, lists of words, everything, in short, that they may hear. Then there are historical prodigies, who, though ignorant of history in any just sense, can give the date of every great battle or other event, repeating them as isolated facts, devoid of interest and meaning. Similarly there are mechanical idiots, or rather mechanical geniuses who are idiots in all other directions. A few years ago there was exhibited in England a beautiful model of a ship, pronounced by competent judges to be a perfect specimen of naval architecture, every detail being proportioned and finished with the nicest exactness. It was made by the imbecile son of a gardener in an interior county. Up to that time, it is claimed, he had never seen the sea or a ship, his pattern being a printed ship on an old pocket handkerchief. When his work was nearly finished, he visited a dockyard, and made a few changes in his work. Four years were spent on this, his second attempt at shipbuilding, his first having failed through ignorance of the fact that wood could be bent after immersion in hot water, a trick which he is said to have discovered by himself. He was taught to copy drawings, which he did with surprising exactness; yet after all, at the age of twenty-four he was described as a small headed, large pupilled idiot. So we might go over the whole list of human faculties, finding illustrations of enormous developments of each combined with the total lack or non-development of all other mental powers. The entire force of such individuals seems, as we said, to be turned into a single channel.

Imagine an organism capable of sending an equal amount of force to each and all the faculties: a type of humanity in which the average man should have the memory of some idiots, the swift and certain calculation of others, the linguistic, musical, constructive, and artistic faculties of others. Such a type of man is by no means impossible, by no means improbable. There have been prodigies in memory, in calculation, in music, in inventive power, who were up to the average in all other directions. However excessive the development of their faculties in one direction, it did not greatly impoverish them in the rest. And as, during the milleniums past, the human race has been slowly lifted from the low intellectual level of prehistoric savages, so we may reasonably infer that the race will go on increasing in mental power, until those prophetic hints of what man may be are all achieved and overpassed.

A MAN'S WORK.

How best to utilize human labor, and at the same time to produce the least fatigue, is one of those interesting problems in industrial mechanics which every inventor of machines based on man power as a motor is called upon to consider, and to which every employer of men for the sake of their brute muscular strength is obliged to give some attention. It is a common error to believe that, in order to produce a given amount of work, a man always expends a given amount of power, and to recognize this is the first step toward a correct estimation of a man's muscular capability. Appropriate rests are absolute necessities to the human machine, and it is by intermittent, not continuous, effort that its best work is produced. One man laboring ten hours and taking intervals of repose will produce more force and accomplish more work with less fatigue than another laboring eight hours with shorter or less frequent rests, the actual time spent in working in both cases being equal. But on the other hand, during the periods of absolute work regularity is a necessity, a fact clearly shown by the government of soldiers on long marches, where the drum to which the feet keep time is a wonderful agent for repressing fatigue, simply because it ensures regularity of motion. So also in rowing in a long race experience has proved the advantage of a clockwork regularity of stroke with a brief breathing spell between each pull. In fact it appears that men will naturally fall into this cadence, as witness the blows delivered by laborers with sledge hammers upon rock drills, and the peculiar timed "hup" which each will aspirate as his implement falls, or the tendency which sailors have to break into a cadenced singsong when pulling a standing haul on a rope. A more curious instance in this same regard is found in the power of dancing; nothing but the repeated rests and the regular movements will explain the ability of women, to whom ordinarily a walk of a mile in length is a severe task, to dance during a period of five or six hours, and this at a time when Nature is most exhausted, owing to deprivation of sleep.

The best application a man can make of his power is through his legs, for the muscles of those members are not only absolutely but relatively stronger than those of the arms. In other words, after work, the fatigue produced in both sets of muscles being equal, the leg muscles will have performed more useful labor than those of the arms. And further, the nearer we imitate a natural movement the better do we apply the power, therefore a walking motion of the legs, at a velocity equal to that of an ordinary gait, and applied to levers, is probably the most efficacious application of human force for steady work.

As to the absolute power of a man, expressed in pounds to be lifted or in similar terms, exact data are obviously impossible, even for an average individual. An interesting series of experiments were conducted on this subject some time ago in France, and these, we believe, give a fair approximation. The heaviest load a man of strength can carry for a short distance is placed at 319 pounds. All a man can carry habitually—as a soldier his knapsack—walking on level ground is 132 pounds, and this is an extreme load, we should judge. Or he can carry an aggregate of 1,518 pounds over 3,200 feet as a day's work, under like circumstances. If he ascend ladders or stairs—as do hod carriers—then he can carry but 121 pounds continuously, and his day's work cannot exceed 1,232 pounds raised 3,200 feet high. With regard to the effort and the velocity which a man can produce by pulling or pushing with his arms, it has been found that, under the most favorable circumstances and for continuous work, an effect exceeding from 26·4 to 33 pounds raised from 1·8 to 2·1 feet per second cannot be gained, and this is equal to about ¼ horse power.

THE OIL RESOURCES OF AFRICA.

It is hardly possible to study the progress which has been made during late years, in the art of utilization of previously wasted substances, without being impressed with the anomalous course which the world has followed, relative to the vast natural products of Africa. To the economist the question may well suggest itself whether an energy and skill akin to that which scientific men have expended in discovering sundry of these utilizing processes, if devoted to devising means for developing the resources of the great and almost unknown continent, would not have yielded results far more valuable to mankind in the increase of raw material placed at its disposal. A striking instance is found by comparing the labor devoted to the extraction of fatty matters and grease of all kinds—labor (including the long voyages of the whaler, the sinking of wells in the oil-bearing earth, and the manifold operations known to chemistry) dependent on countless varying circumstances—with the fact that for miles along the West Coast of Africa, extending between Cape Blanco and St. Paul de Loando, there are vast forests of palms, the oleaginous fruit of which has for centuries rotted unused upon the ground. The palm forests back of the coast line between Cape Palmas and Elmina are said to be practically inexhaustible; and so also, in the neighborhood of Fernando Po, immense tracts are covered with the trees. The total export of the palm oil to England exceeds, it is said, 50,000 tuns, or a value of $10,000,000 per annum; but it will readily be seen that this represents an exceedingly small commerce compared to what might be the case were the enormous resources fully or even moderately utilized. The Fernando Po oil crop, as an example, seldom equals 400 tuns per annum, although 4,000 might easily be produced.

The difficulties in the way of the development above indicated are the unhealthiness of the country, and the monopolies controlled by slave dealers. One of the latter buys the entire right to a large and valuable region by paying the King of Dahomey $10,000 a year. The iniquity of this monopoly is increased, says a recent writer, by the king binding all he traders to give palm oil to this trader at a price fixed by this king himself, without reference to market prices. The penalty of non-compliance with the king's command is decapitation. Trade is carried on by the most primitive means. In

Bonny, which is now the greatest palm oil market on the West Coast, the manila, a bronze coin from Birmingham, England, not unlike a bracelet in shape and size, is the current medium for money; in Old Calabar, the currency is copper wire and brass rods, about three feet in length and bent double; on the Guinea coast, gold dust is used, and one tribe uses strips of iron tied up in bundles of eight or ten pieces.

The fruit from which the oil is obtained grows in the form of a large cone, about the size of a man's hat. It is covered with long spines which protect the nuts, the latter being about the size of a large olive and of a deep golden color. The palm tree forests, in the midst of which most of the factories exist, are said to be very picturesque. The trees, which tower to an enormous hight, are as thick as it is possible for them to be, forming in some places large and impassable clumps, and in others opening in wide and tortuous vistas. The trunks are often covered at the lower part with tufts of lovely fern, the emerald green of whose long fronds, as they droop gracefully to the earth, forms a beautiful contrast to the somber brown of the trunks which they ornament. In the open spots in the forests, the factories, mere collections of huts, are built. In Dahomey, the nuts, when gathered, are thrown into a trough formed by marking off a small area about six feet square, beating down the earth to form a floor and enclosing it in a wall about 18 inches high. Into this receptacle the husks are thrown, to be trodden under foot by women until the husks and the oil which exudes together form a kind of putty. The mass is then thrown into vessels of hot water, when the oil rises to the top and is skimmed off. In Fernando Po, it is the practice to let the nuts rest in heaps until almost putrefied; hammering with stones follows, and then simmering of the pulp in a kettle, after which the women squeeze out the oil with their hands. The men do not engage in the manufacture, their labor ending with the climbing of the trees and shaking down of the fruit. It will be observed that the outside of the nut only enters into the process. The kernel separately yields a so-called black oil, and forms the staple of a trade with England, where the hard portion is subjected to the action of powerful crushing machines.

Oil from the palm nut, is, however, by no means the only fatty product to be obtained from rank African vegetation. No one has ever estimated the vast resources of this description, which abound in the countries bordering on the river Niger; and it is only in the shape of experimental and comparatively small exports that we get a glimpse of them. From Senegambia and Guinea come Touloncuma oil, used by the natives for anointing their bodies, and for burning in lamps, and Galam oil, a natural vegetable butter very much used in Africa for preparing food. The castor oil plant grows wild with great luxuriance in Senegambia; and throughout West Africa there is an immense yield of pea or ground nuts, which already has given rise to a large commerce. In the northern part of the continent and especially Algeria, there are enough olive trees to supply, if fully developed, the demand of all Europe. The province of Kabyle is one enormous olive tree forest. The cocoanut palm grows in immense forests in Zanzibar, where its fruit is exported to France and England, for making stearine for candles. The *trichilia capitata* on the Zambesi produces small black seeds which contain a large quantity of solid fat. The "forna" nut of Central Africa yields an excellent oil for culinary purposes, and is cultivated by the natives. A tree discovered by Dr. Kirk on Lake Nyassa also gives a rich oil, which even the natives have not utilized.

There is no doubt but that, in the gradual progression of commercial colonies for the development of the resources we have indicated, the most rapid means for opening up the interior of Africa, will be found. Such expeditions as those of Stanley and of other isolated explorers, though they may add to our knowledge of other resources, do nothing toward their utilization, but rather only show us how great is the task which civilization sooner or latter must accomplish, in overcoming the natural obstacles of a neglected continent.

ANOTHER NEGLECTED INDUSTRY---MUSHROOM RAISING.

We have never been able to understand why mushrooms are such an expensive delicacy in this country. Every variety of the toothsome fungus—even the Italian mushroom, the most delicious of all—grows wild in our pastures or can be raised in our climate with very little care. And yet, those who most use mushrooms, the hotel and restaurant proprietors, buy the French canned goods, save for a short time in the autumn when a small supply of fresh mushrooms are obtainable. French mushrooms cost all the way from 50 cents to $1 for a little can, at retail; and to buy a small basket of fresh mushrooms, even in our large markets, is rather to overtax the average pocket. Still we have picked them by the pailful in Connecticut cow and horse pastures; but the natives looked askance at our eating them; and as to cultivating the "toadstools," the idea to their mind was preposterous.

Now, with all due deference to our excellent farmers who think as above, we venture to affirm that, if a few of them would set about this cultivation on a large scale, and offer the products in the cities, they would find a ready sale, and realize quite a large profit. Occasionally a florist makes a mushroom bed in his greenhouse, and lovers of the delicacy sometimes cultivate it in a small way in their conservatories and cellars; but with the exception of the effort made by the late Professor Blot, that prince of French cooks, who came to this country as a missionary to reform us from dyspepsia-breeding pie and fried meat, we know of no attempt being made here at their cultivation on a commercial scale. The professor built wooden structures under ground, and they decayed; then he grew tired of his project and let it die through neglect, before any of its results, good or bad, could be seen. Near Paris, Blot had seen immense cases, from 20 to 60 feet in depth, filled with mushroom beds, the length of all of which beds together in one year aggregated over 21 miles; and he knew well that often a single building stone quarry, in the excavations of which the beds were located, sent 3,000 pounds of mushrooms daily into the French metropolis. No wonder, then, seeing the utter absence of the fungus from our markets, that he perceived an opening for a lucrative business in its cultivation.

The reader who may wish to try mushroom culture in a small way—which he had best do as a beginning—will find his cellar, if he dwells in the city, or any convenient outhouse, if in the country, a suitable place for a few beds. The material required is horse manure, which must be sweated by gentle and careful fermentation for a week or a fortnight, until most of the rank straw and grass is decomposed. Turn over the mass every two days, and by the end of about a fortnight it will be partially fermented, no longer offensive to smell, and in fact sweet enough to be placed in the cellar of a dwelling. An average depth of a foot or eighteen inches makes a good bed, which should be about a yard wide, with its contents well packed. The shape is immaterial. It is useless for the cultivator to prepare his own spawn, as it can be purchased very cheaply from nurserymen, at from 15 cents to 25 cents a pound. The quality, however, is important. Good spawn can be told by the minute white threads which permeate it in all directions, and these should not be too far developed. A reliable dealer will have the right kind. The spawn is first broken into bits about 1½ inches or so in cubic contents, care being taken that each piece has the white threads running through it. These fragments are planted in the manure at a depth of 3 inches, and placed about 4 inches apart. Then the bed is firmly rammed down with a spade or mallet, and about ten inches of good loam packed hard and smooth on top, the surface lastly being covered with hay or straw. Care should be taken that the cellar or outhouse selected is sufficiently sheltered, so that a constant temperature of from 55° to 60° Fah. is maintained in it. The mushrooms will appear in about six weeks, and the beds will bear for from one to three months, according to the quality of spawn, strength of manure, etc. Water only about once a fortnight and then sparingly; the temperature of the water should not be below 60° Fah.

In plucking the mushrooms pull out the stalk, as, if left, it is liable to decompose and injure succeeding crops. Instead of beds as described, the manure can be packed in boxes or tubs to within 2 or 3 inches of the surface, and loam added above. The difficulty with box culture is, however, that the heat does not remain constant, though this may be compensated for by plunging the boxes up to the rims in decomposing manure during the preliminary stages of the growth within. Mushrooms have been grown well on a warm shelf in a kitchen, and excellent crops have been obtained from beds made on shelves in a stable where the heat of the animals supplied the needed warmth. In summer it is only necessary to make a bed in the coolest and shadiest portion of the garden; this should be covered, to keep it moist and to protect it from the ravages of rats, mice, and snails, all of which will greedily eat the young fungus.

There are some valuable treatises on mushroom culture extant, from which those who contemplate extended cultivation can obtain full instructions. The cultivation, however, is so simple that very little skill is required to conduct it.

Some years ago, the Royal Horticultural Society, in England, made strenuous efforts to popularize the mushroom, and offered prizes for collections of fungi, and gave numbers of excursions and dinners in which the mushroom was substituted for meat. But little success attended these efforts, mainly on account of the difficulty found in distinguishing the genuine and safe mushroom from the dangerous and poisonous fungi, and also on account of a popular prejudice which looks upon any fungus as a mere sign of noisome decay. Of course when raised from reliable spawn, danger from eating the mushrooms is not to be apprehended; but it is unsafe to collect from pastures fungi for edible purposes unless one is familiar with the subject.

CAN WE PROTECT OUR BANK VAULTS?

Seven armed men recently entered the house of the cashier of the Northampton National Bank, at Northampton, Mass., and compelled that officer at the muzzle of the pistol to reveal the combination of his safe vault. Then they bound and gagged him and his entire family of seven persons, quietly waited until the bank's night watchman had departed, opened the vault and safe, and stole $750,000 in cash and securities. The annals of crime can show few more audacious robberies than this, nor do we know of one which has excited a wider spread feeling of insecurity or a more general distrust of all modern burglar-proof devices. Certain it is that no lock, however intricate, is safe so long as the means of opening it is in the hands of any one person; for no man, however brave, can withstand the persuasions of a night attack on his family and of a cold pistol barrel pressed against his temples in order to make him hand over his keys or divulge the information demanded. It may well be asked if seven men can plan and successfully carry out such a scheme, whether twice seven men could not perpetrate even a more gigantic robbery; and when we consider the matter in the light of the elaborate precautions taken by the thieves and their intimate knowledge, which they spend weeks in acquiring, of a marked point of attack (all detailed recently by a convict captured in a similar undertaking), it is but natural at first to doubt the safety of any bank or strong box. But on the other hand, it is reasonably certain that, if the Northampton bank people had been as vigilant as the thieves, the robbery could not have occurred; and it seems to us that, if the means which Science offers for protecting our valuables were fully used, such robberies would be impossible, or at the least be very difficult, of perpetration. Suppose, for instance, a chronometer lock had been in action on the Northamption safe. Then what would have availed the binding and gagging of the family of the unfortunate cashier, and an assault on his person, since he would have been as powerless as the thieves to enter the stronghold? At a certain time next day, when all the employees of the bank would be at their desks, the safe could be opened; until then, if properly made, nobody could stir its doors. Rendering it the duty of two bank officers, one as a check on the other, to assure themselves that that lock was in working order at the last thing before closing the bank for the night, would prevent any tampering with the mechanism; and should the lock be inoperative, the very circumstance would instantly suggest extra vigilance during the night and until the difficulty could be remedied.

Another safeguard is found in never trusting the means of opening the safe to a single individual, a plan frequently adopted in banking institutions in cities. There might be, for instance, three locks to a door; and the key or the combination which throws back each could be in the possession of a different officer, so that no one of the trio could enter alone. This would necessitate the robbers intimidating three persons instead of one. Or the knowledge of a combination might be kept a secret, by the president, for example, and the cashier possess only a key to be used in connection with the combination.

There is much safety to be found in properly constructed electric devices. Why, for example, has not somebody invented a thief catcher—a couple of metal knobs which must necessarily be turned in attempting to open a door? At night, lead a powerful interrupted battery current to those knobs. When the burglar grabs them they will grab him, for he cannot let go, as every one knows who has tried to release the handles of the simple magneto-electric machines from which itinerant scientists at country fairs offer to administer shocks for a penny or two each. The burglar, besides, will get so thorough a shaking that he would convert himself into an alarm, and yell loud enough to awaken any somnolent neighborhood. Electric wires might be laid from every door in the bank to convey an alarm, say to a police station or any other desired point; and if those wires were so placed that cutting them in advance could quickly be told through the breakage of the circuit, tampering with them could be found out in time and proper precautions taken.

It has been suggested that the next advance of the thieves will be a day attack on a bank, through the use of an exploding shell tossed in among the clerks, and a rush for the funds in the confusion. For this, the only remedy appears to be constant watchfulness, or the encasing of the people handling money in a separate armored room, and not dividing them by a mere wood and glass partition from the crowds which often congregate outside the tellers' windows. We have some banks in our mind whose counting rooms are very poorly suited to withstand an attack of the above kind.

We think that there is abundant ingenuity in this country to provide means of frustrating the smartest and most audacious of burglars; and that if inventors will set about it, devices much more efficacious even than those which have occurred to us can be produced. At any rate it is hardly time to suggest the abolition of banks, as does a daily contemporary of this city, and thus admit that we are outwitted by rascals, until we have seen what the inventors can do, and certainly not before we have fairly tried the safeguards with which we are already provided.

REMARKABLE PUMPING ENGINES.

We publish in this week's SCIENTIFIC AMERICAN SUPPLEMENT (No. 9) two pages of engravings illustrative of the remarkable steam pumping machinery, lately completed at Hammersmith, England, by Messrs. Gwynne, for the drainage of the Ferrara Marshes, Northern Italy.

The tract to be drained covers an area of 200 miles. The machinery we allude to is calculated to discharge 456,000 gallons of water per minute, or 656,640,000 gallons per day; being about six times the capacity of the Croton Aqueduct of this city, which is able to deliver 110,000,000 of gallons per day. The water delivered by these remarkable pumps forms a stream 103 feet wide and 4 feet deep, having a speed of two miles an hour; one day's delivery would fill a reservoir one mile square to a depth of 3 feet 9 inches. In view of the completion and successful operation of gigantic and economical machinery like this, the drainage of the Zuyder Zee, in Holland, which is about to be commenced, is rendered a comparatively easy task. The Zuyder Zee area to be drained is 759 square miles. Splendid models of the abovementioned machinery are to be exhibited in the British department of the Centennial Exhibition.

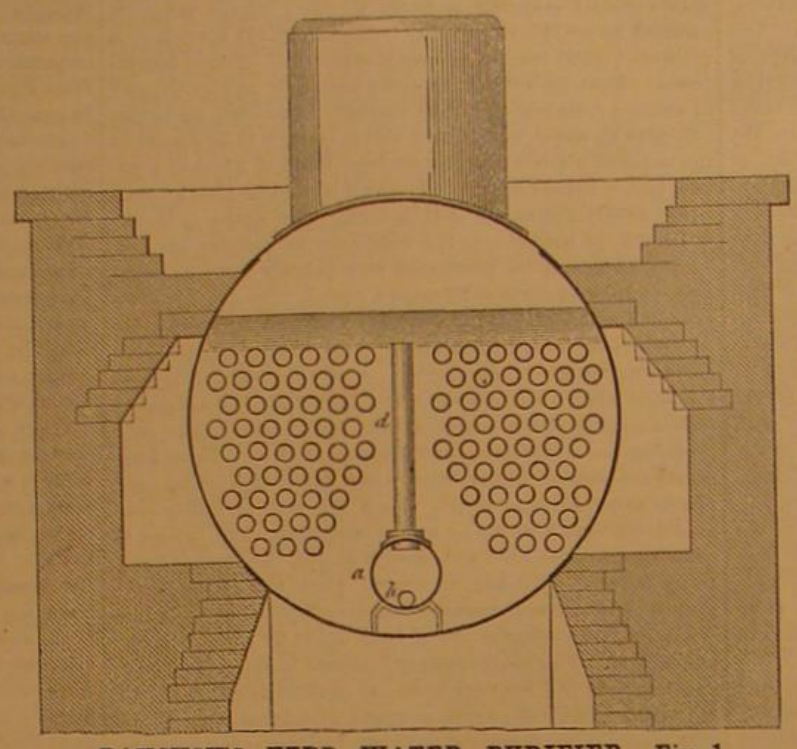
Improved Lantern Galvanometer.

In the arrangement recommended by Professor Nipher, an astatic system of needles is used, supported by silk fiber. The distance between these is four inches, and the system is placed over the lens of a vertical lantern. The image of the lower needle is thrown upon the screen. The upper one is out of focus and is invisible. The needles are deflected by two coils situated on each side of the upper needle, and out of the field of view. The distance between the coils is varied to any desired extent to adapt the instrument to the different currents. The connections are such that the instrument can be instantly used in measuring electrical resistances. The resistance can be diminished in working with the thermo-currents, or increased with ordinary galvanic currents.

NEW AUTOMATIC FEED WATER PURIFIER.

Mr. H. Paucksh, in the *Zeitschrift des Vereines Deutscher Ingenieure*, describes a new feed water purifier for steam boilers, sectional views of which are presented herewith. It consists of a cylinder, *a*, Fig. 1, which extends nearly the whole length of the boiler, and which is secured in the cover, *c*, of the passage, *b*. Arranged along the top of the cylinder is a series of tubes, *d*, vertically disposed and of such a hight as to have their upper extremities level with the top row of boiler tubes. The last tube, *f*, Fig. 2, is carried somewhat higher, and differs from the others in having an open orifice, the latter having their apertures partially closed by a perforated cover. All the tubes, *d*, are secured in the cylinder by cast iron riveted rollers, *r*, and washers of wrought iron, *t*. This arrangement admits of the easy insertion of the cylinder through the passage, *b*, while the tubes may be attached or removed by entering the boiler after the cylinder is in place.

The feed water passes in by the pipe, *e*, and rises in the tubes, *d*, after filling the cylinder, escaping at the orifices of the tubes, and gradually fills the boiler. During this time it becomes heated, and the impurities settle at the bottom of the cylinder. To remove the deposit, a pipe, *h*, the lower part of which is channeled, and which has a valve, *g*, on its forward end, is placed near the lower part of the cylinder. On opening the valve, *g*, the pressure of steam in the generator forces out the contents of the tube, together with a quantity of water, which last is, however, compensated for by the supply which enters from the vertical tubes, *d*. The last tube, *f*, through its having an open upper orifice for the admission of steam, serves to augment the force of the current which, on the evacuation of the deposit, is produced in the rear part of the apparatus, and to render the same uniform through the tube, *h*. At the same time the tube, *f*, acts as a kind of safety valve in case of obstructions choking the other tubes.



PAUCKSH'S FEED WATER PURIFIER.—Fig. 1.

New Industries Wanted.

We want in the Mississippi valley the initial step towards the following new industries of her people:

1. Linen manufacture, to save the flax now wasted, also to save the $25,000,000 annually sent abroad for linen goods.

2. The growth of sugar beets and their manufacture into sugar, to give employment to our people at home, and save the $100,000,000 in gold now paid to other nations for sugar.

3. The manufacture of earthen, stone, and china ware, to save the $10,000,000 annually paid to foreign nations.

4. Leather manufacture, gloves, etc., to save the $10,000,000 of gold sent abroad.

5. The manufacture of silk, to save $25,000,000 in gold annually sent to France.

6. The manufacture of watches, watch movements, and materials, to save the $3,000,000 in gold annually paid for these things.

7. The manufacture of tin plate to save the $13,000,000 in gold annually paid out for them.

8. We want an increase in the manufacture of cotton goods to help save the $30,000,000 in gold annually paid to support the people of other nations.

9. An increase in the manufacture of glass and glass ware, to save the $6,000,000 annually sent abroad.

10. We want an increase in the manufacture of woolen goods to give employment to our people and save the $50,000,000 in gold annually paid to support the people of other nations.

11. We want an increase in smaller manufactures of all kinds to keep the people employed and rich, and hungry for the farmer's products.

12. We want ten people where there is but one all over this fertile valley to eat our produce and save the millions annually expended in shipping it away.—*Engineering News.*

Cosina.

This is the name given to a curious new dye prepared by Dr. Caro, of Stuttgart, Germany. Whenphthalic acid, obtained by the oxidation of naphthalin and resorcin, which is prepared by heating assafœtida with alkalies, are heated together, a fluorescent substance is produced. From the latter, treated with reducing agents, fluorescin, a colorless base is derived. The new dye stuff is produced from fluorescin by treatment with bromine in combination with potash, and its solutions in alcohol are of a delicate rose color in transmitted, and a pure yellow in reflected, light. The shades produced on wool, also on silk, resemble those of cochineal. On silk, the dye shows red or yellow according as the fabric is viewed. The material is now very expensive, being worth $100 a lb.

American Potatoes Abroad.

The *Journal of the Royal Agricultural Society*, of late issue, contains a valuable article, by Mr. H. W. Bates, F.S.L., on the Colorado potato beetle. Mr. Bates thinks that the introduction of the pest into England is not at all probable, and doubtless the opinions which he advances will do much toward removing the uneasiness felt regarding, as well the restrictions laid upon the importation of, American potatoes abroad. "American potatoes," he says, "are imported into Britain only for seed purposes, and in remarkably clean condition. Newly arrived casks which I saw opened contained not a particle of refuse, and no pellet of soil large enough to contain a hybernating beetle." If, however, beetles should fly on board ship, in the harbor of New York, and find a snug lodging for the voyage, they might fly off at Liverpool; but even in this ultra-hypothetical case, Mr. Bates thinks "there is little probability of their propagating and spreading in this country."

THE surest remedy for chapped hands is to rinse them well after washing with soap, and dry them thoroughly by applying Indian meal or rice powder.

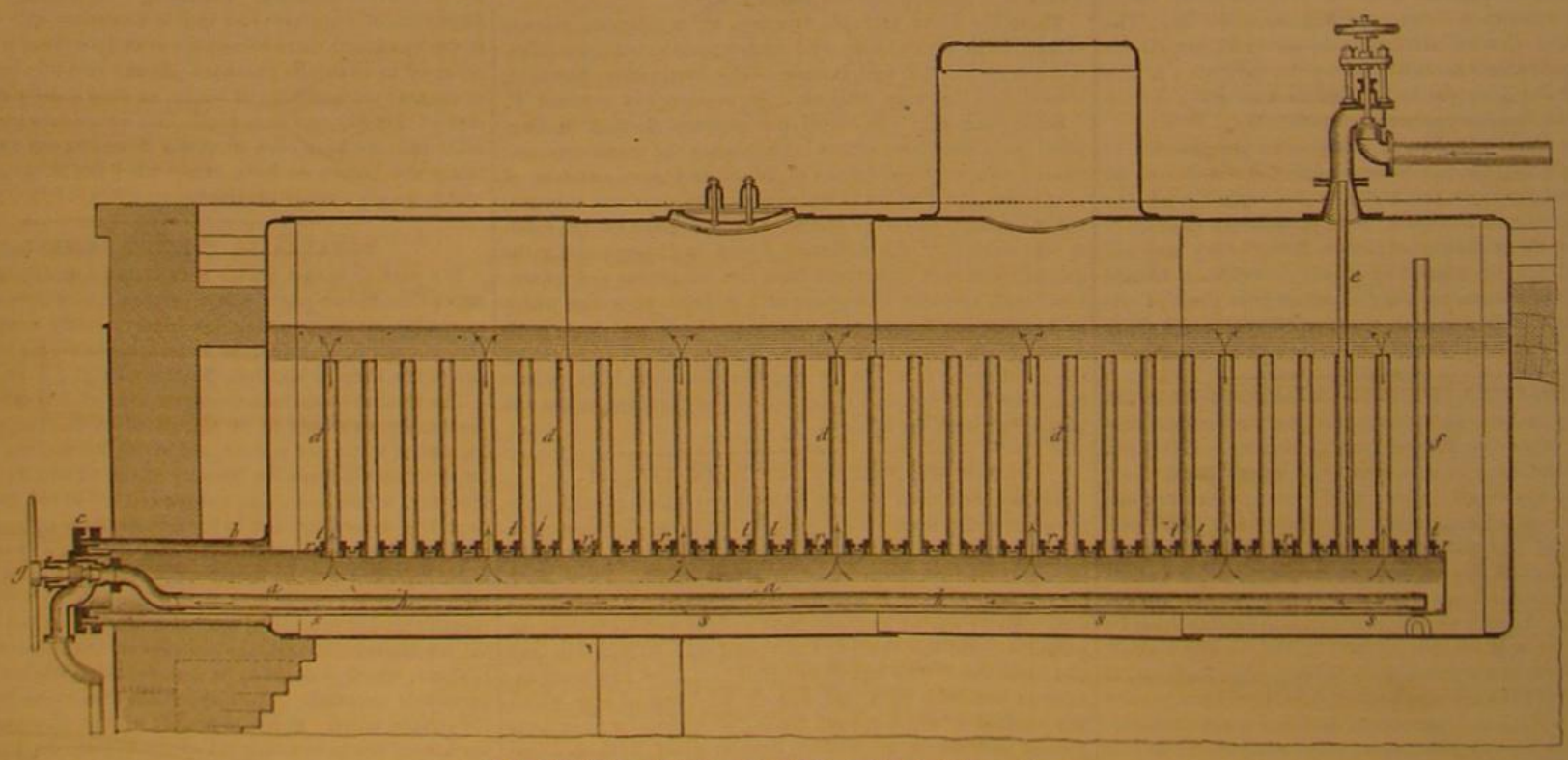
English Grease Butter.

The butter and cheese dealers of this city, who opposed oleomargarin in the markets on the alleged ground of its being used as an adulterant for genuine butter, instead of its being sold on its own merits, will seem to most people ultra-fastidious beside their English and Scotch brethren, who have permitted the existence of such an establishment as the *Glasgow News* recently has unearthed. That journal discovered a trade circular issued by a firm established in Leith and Glasgow, offering to reclaim old butter, however foul, and to return the same increased in weight, at a cost of $1.87 per cwt., in casks. Reporters, personating customers, prepared for treatment a sample of the following delectable mixture: A Coleraine butt of grease butter, sold for lubricating purposes, was purchased, and there was incorporated with it a small quantity of Russian tallow, some of which had passed through the printing office machinery, and had absorbed particles of blacklead and mineral oxides from contact with the bearings of the shafting. A common tallow candle, from which the wick had been removed, was also added. The compound and the tallow candle were carefully melted into the grease butter; and notwithstanding the offensive character of these additions, the butter was so decomposed as completely to disguise them. Thus prepared, the firkin was sent to the works, with a request that it be turned into "lumps of a bright yellow color, for sale in the English market, and with a stubble-grass smell." The firm characterized the sample as very bad, but promised to do their best with it. In the course of a few days the butter was returned re-converted, its weight on return being 51½ lbs., against 47½ lbs. when sent for treatment. Were it not for some mineral particles discovered on strict examination, it would hardly have been possible to have identified the sample, so remarkable was the change in the whole composition. These statements are verified by the city analyst, who described the original butter as "in the last stage of rottenness, having a disgusting odor, covered with green mold, and maggotty."

It was found that the establishment was doing a large business and producing 3,920 lbs. daily, which was sold over the entire kingdom. What the treatment consisted in is not explained. Oleomargarin at least was clean, and its ingredients, so far as our examination extended, were pure.

A New Crystallized Hydrate of Hydrochloric Acid.

There is an abundant crystallization produced in hydrochloric acid at —13° Fah., when a current of nearly dry hydrochloric acid gas is passed through it. The authors deduce a new way of making a freezing mixture by mixing 2 parts of snow with 1 part commercial hydrochloric acid. The temperature obtained will be —25·6° Fah. By previously cooling the acid to —5° or —4° Fah., a temperature of —31° Fah. will be reached. This is difficult to maintain, but —13° or —15° Fah. may be steadily kept by successive additions of snow and slightly cooled acid.—*MM. J. Pierre and E. Puchot.*



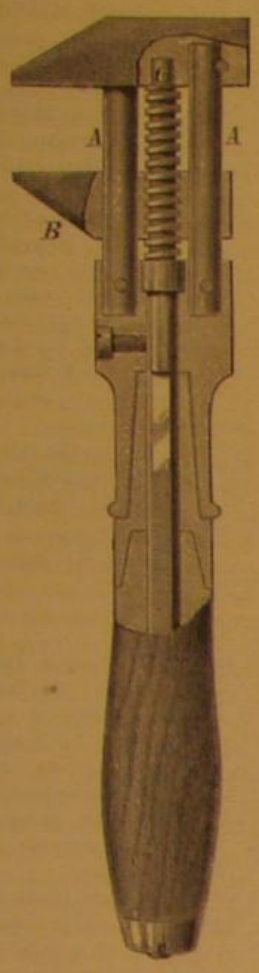
PAUCKSH'S FEED WATER PURIFIER.—Fig. 2.

THE black dogwood or the berry-bearing alder make the best charcoal, willow is next, and common alder third in rank. Small wood of about ten years growth is in all cases to be preferred for charcoal for making gunpowder. Alder and willow of this age will be probably 4 or 5 inches in diameter, dogwood about 1 inch.

THE kangaroo has been introduced on several large estates in France, and is now hunted in that country as game. It readily adapts itself to the climate.

PORT'S IMPROVED WRENCH.

We illustrate herewith a new and simple form of wrench, easily and swiftly adjustable, and so constructed as to insure strength and at the same time lightness. It is made of steel; but it is claimed that, owing to its construction and the small amount of metal therein employed, it is no more costly than an iron wrench of common form. It can be produced, we are informed, by special machinery, so that the corresponding parts of any number of wrenches of the same size may be interchangeable.



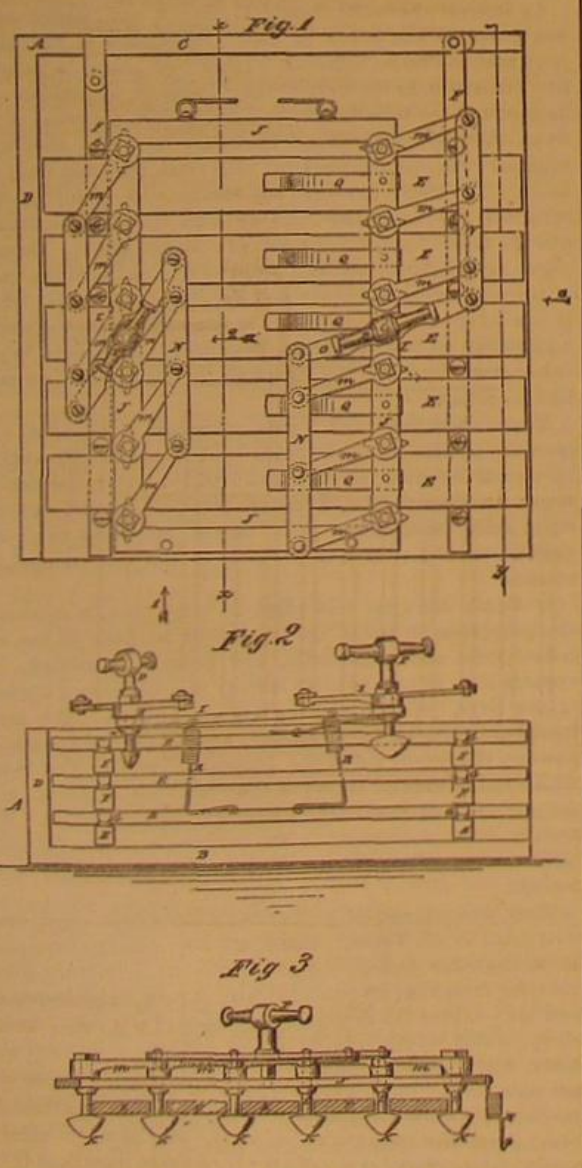
The standing jaw is secured upon two cylindrical columns, A, which are rigidly held, and which also serve as guide bars for the moving jaw, B. The latter is caused to tra verse by the screw, C; said screw passes through a female thread in the jaw, and is rotated by turning the handle in which its straight shank is embedded, and fastened by the nut shown at the lower extremity. The arrangement of the two columns or guide bars is one well calculated to give the tool strength and stiffness, since, when strain is applied, neither bar can bend without the other also bending; and this is a condition which the construction renders practically impossible. The screw acts as an additional bar, re-inforcing the others.

The device as a whole, as the engraving plainly shows, is ingeniously simple, and it appears to be abundantly able to withstand severe strain.

Patented November 30, 1875, by Mr. Henry Port, of Staten Island, N. Y. For further information relative to sale of rights or of wrenches, address Mr. John A. Amrein, Sinking Spring, Pa.

IMPROVED LATHING MACHINE.

Mr. Charles B. Trimble, of New York city, has recently patented the apparatus illustrated herewith, the object of which is to facilitate the operation of lathing buildings for



plastering. It consists of a case for holding the lath in position, and of a machine for clamping and taking up the lath and placing them on the wall or ceiling.

Fig. 1 is a top view of the clamp laid upon the first tier of lath in the case, the left hand clamp being turned to clamp one end of the lath, the other clamp being ready to be turned. Fig. 2 is an edge view of the case and clamp, looking in the direction indicated by arrow 1. Fig. 3 is a vertical section of Fig. 1, looking as indicated by arrow 2, from the line, *x x*. A is the case, composed of bottom, B, and two sides, C D, of square or rectangular form, and of sufficient hight to contain one or more tiers of lath, arranged as shown in the engraving. E is the lath, which is about 4 feet in length, about 1½ inches wide, and ⅜ inch in thickness. These pieces are arranged in the case in the position they are to occupy when nailed on the wall or ceiling. The tiers of lath rest on hinged bars, F, and are separated by the wedge shaped pins, G. On the bottom of the case are two stationary bars, H H, over which the other bars rest, as seen in Fig. 2. The lath, being thus placed in the case, are taken up by the clamps, and laid upon the joist or studs, in the same position they occupied when in the case. There are two sets of gripes, I I, which are arranged to support each of the ends of the lath. These clamps are attached to an oblong frame, J, and consist of a series of buttons, K, Fig. 3, having shanks, L, which pass up through the frame, and receive each an arm, *m*. These arms are connected together by means of the flat bars, N. The bars are attached to the central bars, O, to the middle of which are attached the handles, P, by means of which the central bars, O, and the arms are turned. These bars, O, and the handles, P, are placed in the middle of the opposite sides of the frame, J, so that the frame, J (with clamps), will balance when lifted. One half of the arms, *m*, of each clamp extends outside and half inside of the frame, J, so that when the handles are turned the arms are thrown in opposite directions, but so as to turn all the buttons, *k*, in one direction, to either take up or release the laths. As seen in Fig. 3, a tier of lath is supported by the buttons. When the buttons are turned so that their sides are parallel with the lath, the latter are released. Q are springs attached to one or both sides of the frame, J, the ends of which bear upon the separate pieces of lath to hold them in place. R R are spring hooks to be used in lathing overhead, which engage with the firrings on the ceiling for supporting the frame, while the other end is held up by the bottom engaging with the lath already on. "By means of this apparatus," says the inventor, "labor and time are saved, as the lath can be laid very expeditiously, and the spaces between them are made of uniform width."

IMPROVED SUBMERGED CURRENT WHEEL.

The water motor illustrated in the annexed engraving is intended to be entirely submerged, to be operated by the action of the current or tide

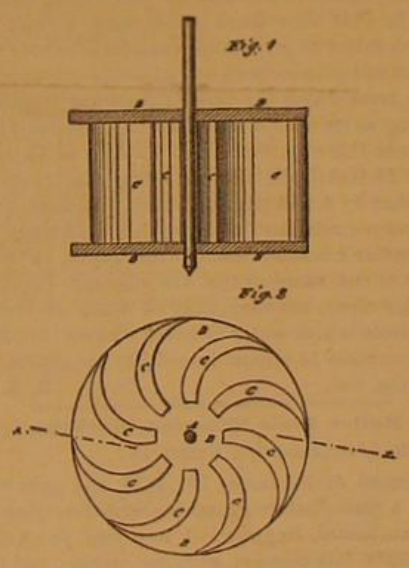


Fig. 1 shows a cross section of the wheel, taken through the line, *x x*, in Fig. 2. Fig. 2 is a top view, with the cover removed. A represents the shaft to which the wheel is attached, the lower end of which is designed to revolve in a step in a simple frame secured in the bed of the stream. The upper end of the shaft is designed to extend above high water mark, and with it is connected the gearing to give motion to the machinery to be driven. To the shaft, A, at suitable distance apart, are secured two disks, B, between which the buckets, C, are placed, and to which the upper and lower edges of said buckets are attached. The buckets are vertical, are thicker at their inner ends, taper to an edge at their outer ends, and are curved, as shown in Fig. 2. The inner ends of the buckets, C, do not extend quite to the center of the shaft, so as to leave a clear space around the shaft, A. With this construction, the water will enter at one side of the wheel, and escape at the other side, giving it an impulse both times, and will rotate the said wheel in the same direction, in whatever direction it may be flowing.

Patented November 23, 1875. For further particulars, as to sale of patent, etc., address Mr. John J. Hill, Hayden's Ferry, Arizona Territory

The Scientific American in the Pulpit.

An esteemed correspondent, writing from St. Louis, Mo., states that, in one of the Catholic churches there, during an interesting discourse upon the best methods of avoiding evil influences and promoting practical goodness, the speaker took occasion to caution his hearers against the reading of trashy papers. "If," said the preacher, "you want a first class paper, get the SCIENTIFIC AMERICAN. The proprietors of such journals are public benefactors." To which, we have no doubt, a quarter of a million of our readers will heartily say: Amen.

A SIMPLE FORM OF BLOWPIPE.

The simple method of obtaining a continuous self-acting blast for blowpipe work, shown in our illustration, was devised by J. Landauer, of Braunschweig, Germany, and described in a late number of the *Berichte der Deutschen Gesellschaft zu Berlin*. It consists of two spacious bottles, A and B, connected by an india rubber tube, C. One, A, is filled with water and placed on a shelf above the working table; the other, B, is closed by a perforated rubber stopper, from which a tube, D, leads to the blowpipe, E, supported on a standard, G. As the water flows from A to B, the air in B is compressed, and a jet of air is driven across the flame of a Bunsen burner, F.



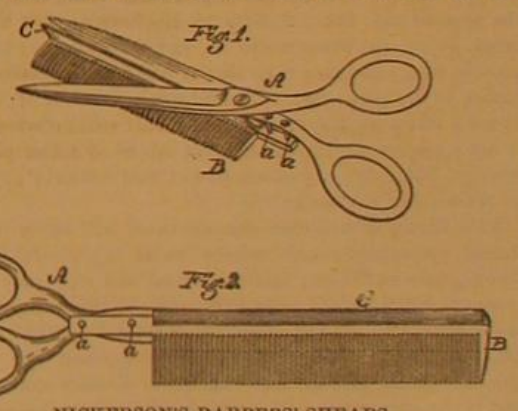
With bottles that hold 7½ pints each, a constant current of air of 0·016 inch diameter is produced, which lasts for 10 minutes. At the end of this time it is only necessary to reverse the bottles in order to put the blast again in operation. With a convenient fall of 35 inches, a reducing flame may be obtained 3·15 to 3·50 inches long, and an oxidizing flame 2·7 to 3 15 inches long.

If bottles with holes at the bottom are not at hand, ordinary bottles can be employed, connected by tubes running to the bottom, like siphons. In this case the air must be sucked out of the tube, C, before beginning to work. The flow of water, as well as the current of air, may be regulated by pinch cocks with screws, or even by a common spring clothes pin. The advantage of this blast is that all the materials are at hand in every laboratory.

IMPROVED BARBERS' APPARATUS.

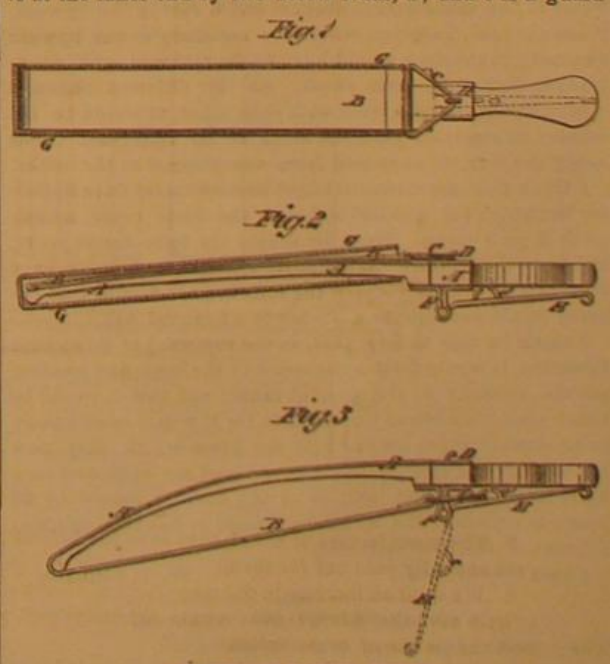
We illustrate herewith two recently patented inventions for facilitating barbers' work, the first of which is an improved combination of shears and comb. The device is the invention of Mr. Samuel Nickerson, of Gallatin, Tenn., and consists of a comb secured to the side of one of the blades; and a guard or shield is placed between the blade and comb, serving to govern the length at which the hair is cut, and to present the same properly to the blades.

Fig. 1 represents a perspective view of the shears, and Fig. 2 a side view of the same A is an ordinary pair of



NICKERSON'S BARBERS' SHEARS.

shears, and B is a straight hair comb, arranged outside of and parallel with one of the shear blades, and secured thereto at the inner end by two screw studs, *a*; and C is a guard



MAXSON'S RAZOR STROP.

plate, extending from the back of the comb, over which it is clasped, inward to the edge of the shear blade, as represented in Fig. 2. The parts are arranged to hold the comb and the blade parallel with each other, while the screw studs are so arranged that by turning them, the distance between the

blade and comb may be increased or diminished at will. The guard plate, having its edge curled over in the manner shown, is simply slid endwise upon the comb, so that it may be readily removed when desired. In use, the hair is caught upon the comb, and the shears operated in the ordinary manner, the comb serving to present the hair in proper and even shape to the blades, and also, when rested upon the head, to govern the length at which the hair is cut, rendering the same uniform and smooth.

The second illustration shows an improved razor strop, the invention of Mr. John Maxson, of Scott, N. Y. Fig. 1 is a front view of the strop, closed, the case being again shown in section. Fig. 3 is an edge view of the same arranged as a convex hone. The object is to furnish a strop which may be used as a haul strop, a straight hone, a flexible convex hone, and a spring strop.

A represents the stock of the strop, which is faced with leather. To the forward end is attached the end of a loose strop, B, of the same length and breadth as the face of the hone, A, to the free end of which is attached a ring, C, to hook upon a hook, D, attached to the forward side of the handle, and also to hook upon the hooks, *e'*, formed upon the lever, E. The lever, E, is pivoted to a stud or bracket, F, attached to the handle, so as to leave room for the hooks, *e'*, when the lever, E, is turned back against the handle, and to allow the lever to turn so that the tension of the strap, B, will lock it in place, the ring, C, being made large enough to pass over the rear end of the lever, E, and over the bracket, F, Fig. 3 When the strap is to be put into the case, G, the strap, B, is turned forward upon the face of the hone, A, and the ring, C, is hooked upon the hook, D, which prevents the face of the hone from being rubbed by the case, G. This is also the adjustment when the strap is to be used as a haul strop. By detaching the ring, C, from the hook, D, and throwing the strap, B, back, the instrument is a straight hone. By swinging the lever, E, forward, passing it through the ring, C, passing the said ring into the hooks, *e'*, and drawing the lever, E, back, the stock, A, is bent to form a flexible convex hone, to enter the hollow of the blade and keep the edge thin; and at the same time the strap, B, being brought under tension, becomes a spring strop for setting the edge.

Correspondence.

A Second Channel for the Erie Canal.

To the Editor of the Scientific American:

I have a suggestion to make for increasing the capacity of the Erie Canal; and although it involves a large oulay, I believe the State would be justified in adopting it,at least for a part of the distance, say from Buffalo to Rochester. I propose to separate the downward bound from the upward bound boats, thereby having a distinct and separate channel for each; to effect this, I would have the work commence at the west end, at Buffalo, and dig another canal, alongside of the present one, from Buffalo to Rochester, Let the new canal be of the same width as, and 3 feet deeper than, the present one, and make it so that it will have a descent of 7 inches to the mile; this will establish a current of water of about 3 miles per hour; and then a boat will go,where speed is not a matter of importance, at about 3 miles per hour without requiring any steam power, and without any swell or washing of the banks.

This theory of a double channel canal will apply to other canals, or parts of canals, where water is plentiful and the down grade sufficient; and the speed and size may be increased or diminished so as to conform to the topography of the country and the requirements of commerce, the engineers being guided by experience. I have suggested this size for the Erie Canal, because one channel is already constructed; and if the authorities will dig the other of the same width and 3 feet deeper, it will,I think,be of the proper proportion. It should, however, accommodate such a brig as those which sail the Lakes; and the brig could draw 8 feet of water in the down grade channel and 6 feet in the upward. Some changes, however, would be necessary in the upward channel; the bridges would have to be removed, and drawbridges erected in their stead. As the different channels would seldom be on a level with each other, it would be necessary to construct partition locks at all important towns along the way, so as to lock from one channel to the other.

I think this improvement might be constructed from Buffalo to Rochester for $35,000,000, and the State could accomplish it in 5 years. Then, by saving the tolls for 20 years, the State might construct a similar distance further east at a similar cost, always keeping the tolls at such figures that the canal would not become a burden in a financial way.

I claim for this theory that, in the eastward or downward direction, it would double the speed of the boats and quadruple the capacity of the present canal; and that it would be much more convenient for boatmen,for it would enable them to transport freight for one half the price which they now do, and pay the same tolls. I have based my estimates on a knowledge of the topography of the country gained by 20 year's experience; and would be pleased to have the opinions of some of the local engineers.

Sioux Rapids, Iowa. W. T. CROZIER.

A Cheap Refrigerator Wanted.

To the Editor of the Scientific American:

As ice water is a necessity, I suggest that some one of our manufacturers of paper pails should put into the market an ice cooler, made of paper with a jar of glazed pottery inside, with sawdust between the two vessels. Such a utensil would be within the reach of all as to price. and paper being a good non-conductor of heat, it would be far superior to the metal of which most coolers are now made. I made one last summer from a large paper box, in the manner above described. In the next office to mine, with similar temperature, there was a cooler made with an outside of tin, zinc-lined, and filled in with charcoal. Each morning a similar quantity of ice was put into each. The result was that, at about 4 P. M. every day, the ice in the metal and charcoal cooler had disappeared; and in the paper and sawdust one, there was ice left on the following morning.

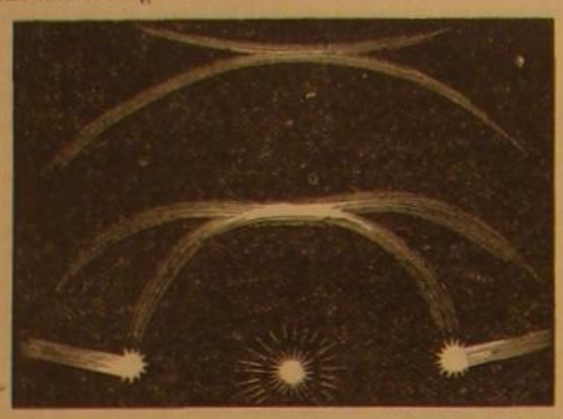
If any manufacturer of paper pails avails himself of this suggestion, I shall be paid for making it, and will have an opportunity of replacing the homemade one I now have with one more ornamental.

Cottonwood Springs, Neb. C. H. ROBERTS.

A Solar Phenomenon.

To the Editor of the Scientific American:

I inclose a diagram of a solar phenomenon which appeared on January 31, at 10:30 A. M. The day was warm and spring-like. At night the air turned cold, and a light snow fell. The intersecting circles over the sun formed an Indian bow,



and showed the prismatic colors very brightly. The halos extending from the sun dogs were long and straight, their outer ends being higher above the horizon, as represented in the engraving. C. O. HOWARD.

Waukon, Iowa.

Bored or Driven Wells.

To the Editor of the Scientific American:

Some time since I noticed in your journal the question: "Are not bored wells a failure, on account of the small cistern they have for holding water?" The following are a few facts on the system as used in California.

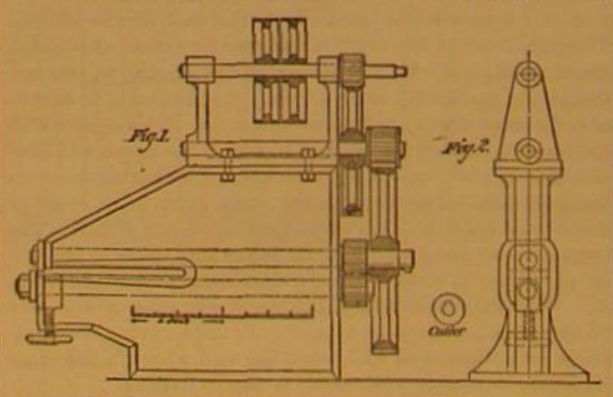
We have been in the business of well boring here for 18 years, and in that time have never seen a well properly bored,which failed to give an inexhaustible supply of water. We have on our place a well of 6 inches diameter and 35 feet depth, from which the largest hand fire engine in the city, running at its utmost speed, had a plentiful supply. At some shops in this city, there are two wells of 13 inches diameter and 75 feet depth, situated 6 feet apart, in which are two six inches by 4 feet pumps, working almost constantly at 24 strokes per minute. At a woolen mill there are two more, of similar diameter and 35 feet depth, in which are two pumps of the same size as the others. In the Sacramento Valley alone, are thousands of wells of from 3 to 10 feet deep, from which water is being drawn for irrigation and other purposes in almost incredtble quantities.

Sacramento, Cal. R. A. ROSE.

Boiler Plate Shearing Machine.

To the Editor of the Scientific American:

In your issue of December 18, 1875, you gave us an engraving of a plate-shearing machine with revolving cutters, made at Manchester, England. I now send you a sketch of one I had made last summer at these works; and it is now running daily, cutting straight or circular work, in iron up to one quarter of an inch thick, and giving good satisfaction. The main shafts are made of steel, and the lower one has a set screw below the box to raise or lower the cutter for



different thicknesses of iron. The two small gear wheels are made of wrought iron, and the other four of cast iron. We run the cutters at about seven turns per minute.

JAMES ORCHARD.

Schenectady Locomotive Works, N. Y.

Destructive Boiler Explosion.

To the Editor of the Scientific American:

On January 25, 1876, an upright boiler exploded at Barnet, Vt. It was in the cellar of a shoe peg factory, and the concussion shattered the building in a fearful manner, the boiler (8 feet long by 3½ feet diameter, with seventy-five 1¼ inch flues) going up through two stories and out through the end of the building into the road, 90 foot in all. The power of the explosion was so great as to throw a dryer in the second story out of its place and drive it, through a double boarded floor, up against the rafters, breaking in its course a cast iron shaft 5 inches diameter, and also breaking four sticks of timber 8x9 inches, and taking two floors clean out; and much other damage was done.

At the time of the explosion there were 16 persons in the building, 8 of them being women, within twenty feet of where the boiler went up; but, happily, no one was killed or hurt. The boiler was run, by a boy of no experience, in a blundering way. Steam was made only for heating and drying.

The explosion was caused, I think, in this way: Around the foot of the boiler there was a space of two inches between the outside plate and the firebox, which was two feet high. The boiler had not been blown off for two weeks or more, and the water that supplied it came from a very muddy brook, and must have filled the bottom full of fine dirt; and this dirt, caking on the fire sheets, caused the firebox to get red hot and bulge out, and then the water above, coming in contact with the red hot iron, caused the explosion.

If any one who has boilers or machinery desires the safety of himself, his work people, and his property, he should invest $3.20 in the SCIENTIFIC AMERICAN, and he would do away with much blundering and many disasters.

Barnet, Vt. GEO. H. KIDNEY.

[For the Scientific American.]

A NEW MEDICAMENT.

Boldo is the name given in Chili to a small aromatic tree indigenous to that country. It was first described by Molina, in 1782, under the name of *peumus boldus*. Jussien, in his "Natural System of Botany," places the boldo in the family of the *monimiaceæ*, under the name of *boldea fragrans*. M. Baillon,in the "Histoire des Plantes," now in publication in numbers in Paris, restores Molina's designation, *peumus boldus*. The sub-order to which the tree belongs consists of only eight genera, chiefly natives of South America.

The boldo, always green, grows alone and is not found in forests. Its leaves are in pairs, opposite and unfurnished with stipula. In drying, the leaves become of a reddish brown. The flowers are disposed in upright clusters (cymes), the stem of one cluster being the end of the branch, the others being axillary, or springing from the junction of the leaves. The flowers are of a yellowish tint on a white ground, and are in marked contrast with the brilliant green of the foliage. The bark of the tree, thin, and wrinkled longitudinally, gives out a very pronounced aromatic perfume. The flowers are dicœcious, that is to say, unisexed, with the two sexes growing on different trees. The flower has a calyx proper or perianth; and in the male flower the receptacle has numerous stamens. The female flower has from three to five free carpels, each with one cavity, the ovary containing a single ovule or seed germ. The fruit is about the size of the berry of the hawthorn, with a very hard stone.

An interest above its botanical history and classification was given to the boldo in 1869. Specimens of the plant were sent to France, attention having been called to its curative properties, as not unfrequently happens, by accident. A flock of a sheep were tainted and dying with a disease of the liver. The hedge about the enclosure in which they were confined was one day prepared with fresh branches from the boldo. The sheep devoured the leaves with avidity. The repairs of the fence were kept up with the same material, and the flock of sheep recovered and became sound. On such vague reports,no serious data could be founded as to the value of the remedy, or the mode and circumstances under which it can be applied. Careful and systematic experiments were undertaken by MM. Dujardin, Beaumetz, and Claude Verne. Other practitioners in the hospitals of Paris have pursued like inquiries.

Messrs. Beaumetz and Verne submitted to chemical analysis the specimens of the plant sent to them. Treated in succession by ether, alcohol, and distilled water, the results were: An essential oil, a bitter principle named boldina, citric acid, lime, sugar, gum, tannin, and some thick and dark aromatic matter, due probably to the oxidation of the essence.

In South America, this plant is often used in infusions, the properties of which are (analogous to those of tea and coffee) tonic and diaphoretic, and promote digestion. It appears also to be a popular remedy in syphilis and diseases of the liver. All parts of the tree are utilized. The green leaves are used to flavor sauces; and dried and reduced to powder, the leaves serve the purpose of snuff. The wood, which burns slowly, makes a charcoal high in favor with the smiths, and the bark is used for tanning skins. The fruit is eaten, the stones of the berries are strung for necklaces and bracelets, and from the kernels a fixed oil is extracted.

Many pharmaceutical preparations have been experimentally tried by M. Verne. These are two extracts (one alcoholic, the other aqueous), an essential oil, a tincture (little differing from that prepared in Chili), a wine which possesses in a high degree the aromatic properties of the plant, and a sirup, which would seem to be, on account of its agreeable taste, easy of administration. The essential oil has so strong an odor and so sharp a taste that it is found necessary to inclose it in pills or capsules. Each contains eleven centigrammes (a little more than two grains) of the oil. Preparations in the form of a tincture or elixir make a pleasant change for the invalid in his habitual disgust for medicines. Experiments upon Guinea pigs and dogs have been made in the laboratory of M. Vulpian; and the results have been drowsiness and a lowering of the temperature, without serious effects upon the organism

M. Beaumetz has prescribed preparations of the boldo as a diffusible tonic in chlorosis, anemia, and debility of various organs, and as a restorative to patients convalescent from typhoid fever. The results obtained have been very marked. In such cases, the appetite has been stimulated and the digestion improved; and in instances where quinine could not be endured, the boldo has satisfactorily answered. But the new remedy must be administered with caution, since, in over doses, it provokes vomiting. While the experiments, made so far, are not absolutely conclusive, the boldo may be received as a bitter aromatic tonic and a remedy, which, hitherto unknown to medicine, may claim, if its results continue favorable, an honorable place in the pharmacopœia.

PRACTICAL MECHANISM.

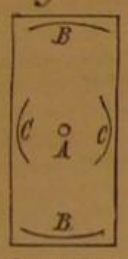
BY JOSHUA ROSE.

NUMBER XLII.

LINING OUT CONNECTING RODS.

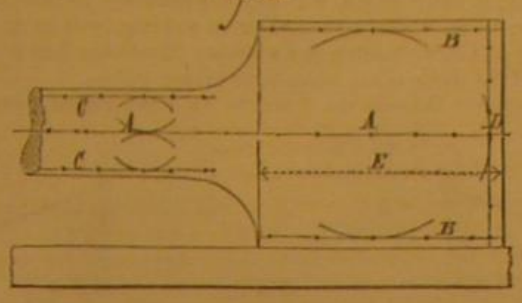
Connecting rods, so large in size as to be cumbrous to handle, are generally made by forging the ends to which the strap is attached by themselves, and afterwards welding them to the body of the rod: the advantage being that the machine work done to the rod ends can, in that case, be done in small machines and at a higher rate of cutting speed than would be possible if, the rod being solid, its whole body had to be chucked in order to operate on the ends only. If any finishing is required to the body of the rod, it is in such case done after the rod ends are welded to it and made true to the already finished block end of the rod. If, however, the rod is forged solid, the whole of the marking-off should be gaged to suit the body of the rod. For instance: If the stem of the rod is round, the marking-off of the ends should be performed from a center marked off true with the round stem and on the end face of the rod. The first operation should in this case be, after marking off the said center, to put the rod in the lathe and face off the block end faces, thus giving us a face, at each end of the rod, true with the stem of the rod, and therefore useful not only to receive the marking off lines but also as a face whereby to true the other faces on the block or stub end. If the ends are forged separately from the body of the rod, it is better to face off one of the side faces, and to mark off on that side face. To mark off a rod end that is forged solid with the stem of the rod, we proceed as shown in Fig. 210, A representing the center, true with the body of the rod; B B shows the diameter of the rod end struck with the compasses from the center, A, and C C, the thickness of the rod struck in like manner. If there should not be sufficient metal on the block end to permit the marking-off to be performed from the center, A, when true with the body of the rod, that center must be moved sufficiently to allow the rod end to be cleaned up; this is, however, to be avoided if possible, for the following reasons: If the body of the rod runs much out of true, the turning of it in the lathe will be a slow process, because such rods are liable, from their length, to spring in consequence of the pressure of the cut. Hence it is not practicable to take heavy cuts along it; and if in consequence of the body of the rod running much out of true, it cannot be cleaned up at one cut, the tool will scrape, during the first cut, against the scale, necessitating that the cutting speed of the tool be much less than it otherwise need be.

Fig. 210.

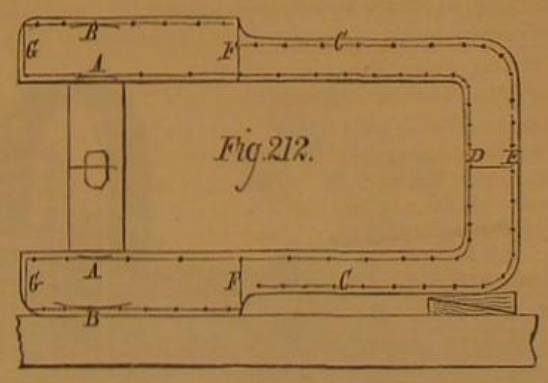


After the segment of circles, B B and C C, in Fig. 210, are struck, which may be done before setting the rod on the marking-off table, the rod should be set on the marking-off table with one of the broad faces downwards, and with the scribing block needle point placed level with the mark, C, on the upper face; and the rod should be tried along that face to ascertain if there is sufficient metal to clean it up all across. The scribing block should then be carried to the other end of the rod, and tried with the upper mark, C; and that being found correct, the scriber point should be set to the lower mark, C, at each end of the rod; and thus the two lines across the rod end, representing the thickness thereof, may be drawn by the scribing block at each end of the rod. The lines representing the breadth of the block end of the rod may then be drawn by simply placing a square on the surface table, with the edge of the square placed in each case level with the extreme diameter of the segments of circles, B B, Fig. 210. No other lines in this case will be required, because the rod ends, having been turned in the lathe, give the machinist two true faces whereby to set the rod at each chucking. If the rod ends are not welded to the rod, the better plan is to have one of the broad surfaces on each rod end surfaced up in a planing machine, and to then perform the marking out on the surfaced faces. The marking out should be made about true with the stem of the rod, as shown in Fig. 211. The surfaced face is to be set, by a square, to a right angle to the marking-off table face; and the center line, A A, of the stem is found from the body of the stem, and carried from end to end of the forging as a guide to set the work by, the lines, B B or C C, being too short to serve the purpose. These latter lines are struck equidistant from A A. The line, D, should be struck with a square resting on the marking table, and any surplus metal should be taken off the end face rather than out of the corner where the butt joins the stem; because it is easier to take the metal off the end than out of the shoulder. The round corners need not be marked, it being preferable to make a gage to shape them to. The edges thus marked being shaped off, the thickness of the butt end may be marked off by a scribing block, the planed surface of the butt end lying flat on the marking table. The strap should first have one face surfaced, and then a center face should be placed between the jaws, being made just sufficiently tight to be held, and not so tightly as to sensibly spring the jaws open; otherwise, while the thickness of the jaws would be marked off correctly, the width

Fig. 211.



between them and their outside diameter would be too small when finished. The strap should then be placed on the marking table, and marked as shown in Fig. 212, the lines, A A, B B, and C C, being marked off to the required widths apart and equidistant from the center line, marked across the centerpiece and across the crown of the strap, at D E. The center of the center piece having been obtained from the inside of the jaws, and carried across, at D E, after the strap is set upon the table with the inside faces of the jaws parallel with the face of the table, the width between the lines, A A, should be marked less than is the width of the block end on which they fit, for the following reasons: A connecting rod strap will, by reason of its shape, spring open between its jaws very easily indeed; and were the width between the jaws made the same as that of the block end of the rod, the strap would fit very loosely to its place. It is therefore necessary to make allowance for this in the width between the jaws of the strap, making them narrower than the block end of the rod. The amount of this allowance depends upon the size and stoutness of the strap, an ordinary proportion being about one sixteenth of an inch to a strap five inches wide between the jaws. This amount of allowance will enable the strap to spring over the rod end, and be a good fit, that is to say, not so tight but that it can be easily pulled off by the hand, and not so loose as to fall off of its own weight if unsupported. Then, again, any ordinary amount of metal removed in fitting the strap to the rod end will not seriously affect their fit together. Now it is obvious that, if the rod end faces on which the jaws of the strap fit are made parallel to each other, the strap, in being sprung on, would spring open so that its jaws would only touch the block at its entrance end, the end of the jaws standing open from the block end. To obviate this, the block end faces, B B, in Fig. 211, are made slightly taper, that is to say, about one thirty second of an inch or rather less in a length of six inches, the diameter of the end being the smaller. It is not necessary to mark so small an amount of taper in the marking, it being sufficient to run the center punch dots a little inside the line at the end of the block on each side. The lines, A A, in Fig. 212, representing the inside jaw faces, should also be a little taper, first to allow of fitting the strap



to the block end, and next to make the fitting of the brasses into the strap an easier operation. It is obvious that, if the inside jaw faces of the strap are parallel with each other, so soon as the brass is reduced to the size of the top of the strap, it will slide clear down to its bed; whereas, if those faces are made a little wider apart at the open end than at the crown end, the brasses, after entering at the open end, will have metal sufficient to be taken off them before being let down to the crown to permit of their being fitted nicely to the strap. For these reasons, the faces of the strap, A A, in Fig. 212, are made wider apart, in the proportion of nearly one sixteenth of an inch of taper to a strap having a jaw twelve inches long. The line, D, in Fig. 212, representing the amount of metal to be cut out of the crown of the strap, should only need that sufficient metal come off to allow that face to just true up: because it is an awkward face to operate on, and it is much easier to take any surplus metal off the outside crown of the strap, as represented by the line, E, in Fig. 212. The lines, F F and G G, are marked at the requisite distance from the crown, D, of the strap, with a square resting on the face of the marking table. The round corners and curves are marked off with the compasses, using the blocks of wood shown in our lesson on marking-off a double eye, previously given. The finishing, however, of such corners, both in the machine and in the vise, is usually done to a small sheet iron gage. Such corners can, it is true, be cut on a slotting machine table to a correct curve without the use of a gage; and there are many shaping machines with special attachments for the same purpose. Slotting machine work is, however, comparatively a very slow process; and in most cases it is found, in the end, more expeditious to shape out small corners with the cross and the up-and-down feed of the machine than to bother with such attachments.

Useful Recipes for the Shop, the Household, and the Farm.

To clean Britannia metal, use finely powdered whiting, 2 tablespoonfuls of sweet oil and a little yellow soap. Mix with spirits of wine to a cream. Rub on with a sponge, wipe off with a soft cloth, and polish with a chamois skin.

The best way to clean the inside of old iron pots and pans is to fill them with water in which a few ounces of washing soda is dissolved, and set them on the fire. Let the water boil until the inside of the pot looks clean.

To remove freshly spilt ink from carpets, first take up as much as possible of the ink with a teaspoon. Then pour cold sweet milk upon the spot and take up as before, pouring on milk until at last it becomes only slightly tinged with black. Then wash with cold water, and absorb with a cloth without too much rubbing.

Scorches made by overheated flat irons can be removed from linen, by spreading over the cloth a paste made of the juice pressed from two onions, ½ oz. white soap, 2 ozs. fuller's earth, and ½ pint vinegar. Mix, boil well, and cool before using.

Brown and black are the only fast colors in book-binding cloth. Red, green, and blue are the next nearest to fast colors. In calf binding, yellow or tan is the only color that will not fade. It wears best. Blue calf wears and rubs white. Purple and wine colors fade very quickly if exposed to light. Claret is greatly superior to the last named, and is nearly fast.

The following recipe for whitewash is recommended by the Treasury Department to all lighthouse keepers. It answers for wood, brick, or stone. Slake about ½ bushel unslaked lime with boiling water, keeping it covered during the process. Strain it, and add a peck of salt, dissolved in warm water, 3 lbs. of ground rice put in boiling water and boiled to a thin paste, ½ lb. powdered Spanish whiting, and 1 lb. clear glue, dissolved in warm water; mix these well together, and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and when used put it on as hot as possible, with either painters' or whitewash brushes.

The best time for felling timber is when the tree contains the least sap, and that is the case in midsummer and midwinter. In general, all soft woods, such as elm, lime, poplar, and willow, should be felled during winter. Oak, alder, beech, and pine are better cut in summer.

A Useful Invention for Weavers.

Chambers' Journal has a brief account of Barker's patent self-acting punching machine for repeating Jacquard cards. In the ordinary machine, a skilled workman must be employed during three weeks or a month to fit it up and get it in working order. The new machine, which can be packed in a small box, is always ready for working, and will prepare from 12,000 to 20,000 of the perforated cards in a day while the old process will not produce more than 1,200. Another advantage consists in the rapidity with which changes of fashion may be followed. A manufacturer will bring out new designs for each season; and if any of them meet with success, he will frequently be able to take large orders, if he can execute them with dispatch. Aided by the new machine, he can get cards for a large number of looms in a day or two, instead of being weeks over them as in the old system, and can thus start his looms quickly and send his goods into market in time for the season.

American Quicksilver.

Mr. J. B. Randol, general manager, gives the production of the New Almaden mine for the year 1875, in flasks of 76½ lbs. each, as follows:

Months.	Flasks.	Months.	Flasks.
January	850	July	1,200
February	800	August	1,100
March	1,033	September	1,200
April	850	October	1,250
May	1,005	November	1,700
June	1,050	December	1,500
Total			13,648

The total product of the mine for 1874 was 9,084 flasks, making the increase this year 4,564 flasks, or nearly 50 per cent.

Eating Rats.

An English contemporary suggests that the health of sailors and the comfort of life on board ship would be promoted if the practice were introduced of eating the rats which swarm in most ships. There is really no reason why rats should not be eaten as well as rabbits and squirrels. They are clean feeders, and extremely particular as to keeping their bodies free from dirt. Rats which have existed in the hold of a grain-carrying ship might be a toothsome delicacy.

A Huge Clock.

The celebrated clock at Westminster (London, England), has 400 square feet of dial surface. The minute hands are 11 feet long. Although the hands are all counterpoised, the entire weight of hands, counterpoises, tubes, and wheels which has to be moved at every beat of the pendulum is not less than 1½ tuns. The going weight is 1½ cwt., and the clear fall is 170 feet. It takes five hours to wind this clock up by hand. Huge as the great machine is, it shows an error of less than 1 second on 83 per cent days in the year.

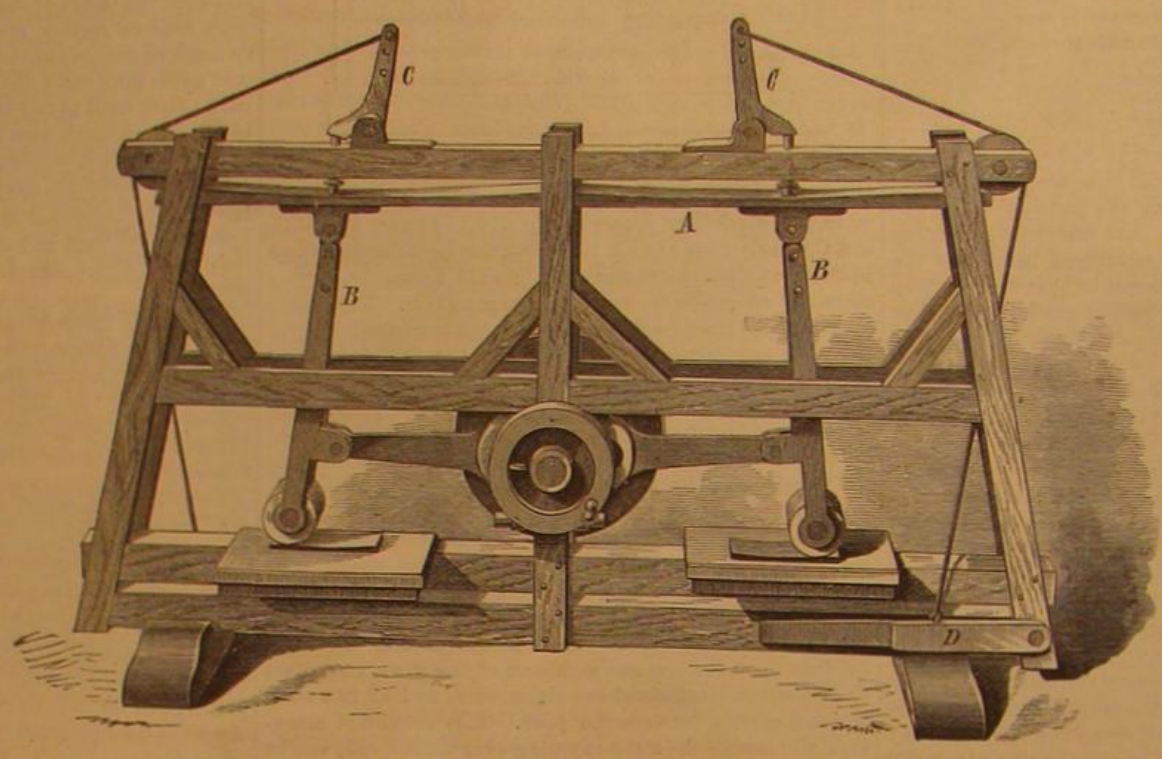
IMPROVED LEATHER-DRESSING MACHINE.

The annexed engraving represents a novel machine, designed to dress leather by the pressure of moving rollers. Either of these rollers may be adjusted or thrown into or out of action at will, independently of the other, and each has an independent depressing device, by which more or less force can be applied.

The apparatus consists of a main frame, in the top of which there is mounted a spring bar, A, which is supported only at its ends and at its middle. To the under side of this bar are hinged the upper ends of two hanging rods, B, on the lower extremity of each of which is attached a roller. These rollers work over the face of curved stationary beds, as shown, and their rods are actuated by connections from two eccentrics or equivalent devices, driven by a transverse shaft. In the top of the frame are two sliding pins, which are pressed down upon the spring bar, A, by the short arms of the elbow levers, C. Cords from the long arms of these levers lead down to foot levers, one of which is shown at D. When the machine is in operation the two rollers are carried to and fro above the beds, being suspended clear of the same in order to permit the introduction and adjustment of the leather. The attendants, after placing the latter, bring down the rollers, with more or less force, by pressing the treadles with their feet.

The two rollers always move in opposite directions, so that the strain and reaction caused by the change of direction or movement of one is overcome by the other. They may be very easily governed, and their pressure regulated without interfering with the continuous action of the machine.

Patented January 4, 1876. For further information, address the inventor, Mr. W. H. Rosensteel, Johnstown, Cambria county, Pa.



ROSENSTEEL'S LEATHER-DRESSING MACHINE.

WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

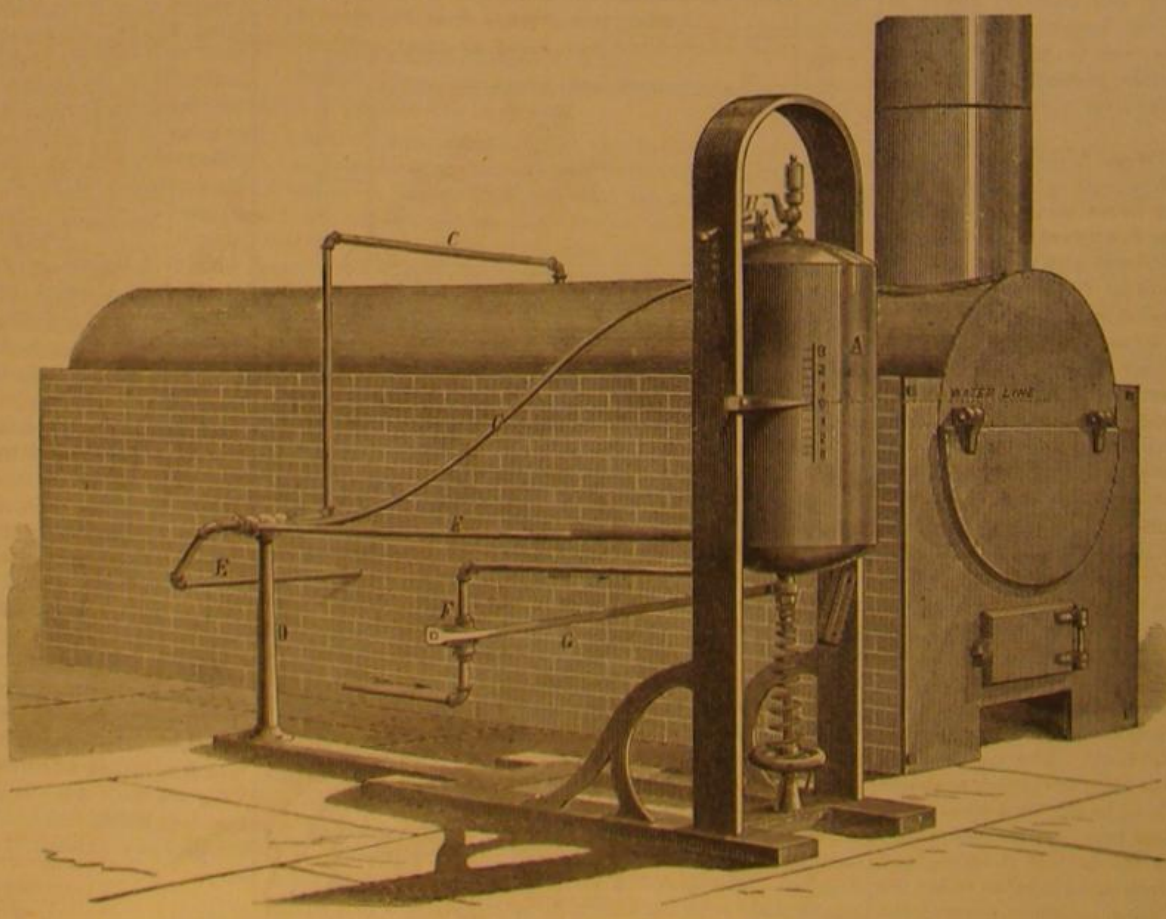
We illustrate herewith a new automatic apparatus for regulating the supply of feed water to a boiler so as to maintain a constant level therein, and which also is arranged to sound an alarm whistle in case of the supply falling short. The essential feature of the device consists in a tank communicating with the boiler, and in which the water stands at the same level as in the latter. This tank, with its contents, is balanced by an upward acting spring; and therefore, when said contents are increased or diminished, the fact is indicated by the falling or rising of the tank, plainly shown upon a suitable index. The movement of the tank governs the valve which admits water to the boiler.

In the annexed engraving, A is the tank, which travels in curved guides in the U shaped frame. It is supported by the strong spiral spring shown, the tension of which may be regulated by the hand wheel, B. C is a pipe communicating with the steam space, and passing over an elbow on the stand, D. E leads from the water space, and is similarly connected with the stand. Both of these pipes, by this arrangement, readily turn on the elbows as the tank rises and falls. They are continued, as shown, from the stand, D, respectively to the upper and lower portions of the tank. Consequently, the water in the tank will always stand at the same level as that in the boiler. F is the feed water pipe leading into the latter, and having a valve, to which is attached a lever, G, which is secured to the lower part of the tank. A pointer is fastened to the U frame and rests near a graduated scale on the side of the tank, so that, when the latter rises or falls, the distance it has moved may be readily observed. The zero of this scale corresponds to the proper water level (dotted line) in the boiler.

When the water rises above the water line, the increased weight will cause the tank to fall and operate the lever wrench, G, and so shut off some of the water. When the supply in the boiler falls short the diminished weight in the tank will allow of the rising of the latter and the operation of the lever in the opposite direction to let on the water, so that the boiler will thus be fed uniformly.

At the top of the tank is situated a valve lever, which is to be fastened under a hook when the valve is closed. Should the feed pump cease, from any cause whatever, to do its duty, the tank will rise, and a tripping rod, H, suitably adjusted in the U frame, will trip the hook and so release the valve lever, which, by the action of a spring, will fly up and so open a valve leading to a whistle. The latter then sounds until the pump again resumes its proper action.

Patented through the Scientific American Patent Agency, November 9, 1875. For further information, address the inventor, Mr. Dexter Cook, Elmira, Fulton county, Ohio.



COOK'S WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

Spontaneous Generation an Impossibility.

Professor Tyndall has lately read before the Royal Society a very important paper "On the Optical Deportment of the Atmosphere, with reference to the Phenomena of Putrefaction and Infection"—a lengthy title, says the *English Mechanic*, but one which does not adequately convey an idea of the subjects treated. It has been known for some time that air might be rendered free from floating particles by passing it through fire, acids, or cotton wool; and the Professor showed, not very long ago, that air thus purified will not transmit light, and a glass chamber filled with it remains dark, when placed in a beam of concentrated light, simply because there is nothing to reflect or scatter, or in other words to render visible, the light. Since then Professor Tyndall has discovered that air enclosed in a glass chamber and left undisturbed for three or four days deposits all the floating particles and becomes optically clear and dark to the beam of light. In this paper, Dr. Tyndall has apparently put the finishing stroke to the hypothesis of spontaneous generation, for he shows that solutions confined in chambers of optically pure air remain unaltered for months, while portions of the same or of similar solutions, when exposed to the atmosphere, swarm with bacteria in a few days. From his experiments, Professor Tyndall concludes that spontaneous generation is an impossibility, and that putrefaction and infection would be unknown in an optically pure atmosphere. We defer comment on these important conclusions until the full text of Professor Tyndall's lecture, with the record of his experiments, reaches us.

Rheumatism Recipes.

The *Journal of Health* has recently patiently collected all the recipes for rheumatism floating through the papers, and spreads them before its readers in the following: "Rochelle salts. Guaiacum. Rub with chloroform liniment. Sleep with your head toward the north. Nux vomica. Wear a chest protector Nitrate of potash. Nitrate of sodium. Fowler's solution of arsenic. Sleep with a big dog, and give it to him. Kill a big dog, and, after taking out his intestines, put your feet where they came from. Magnetism. Galvanism. Bromide of ammonium. Iodide of ammonium. Mustard plasters. Spanish fly plasters. Bromide of potassium. Iodide of potassium. Lemon juice. Sage tea. Wear sulphur in your shoes. Hard rubbing. Oleate of mercury. Common soda. Capsicum. 'Radway's Ready Relief.' Wear silk. Wear flannel. Wear buckskin. Gin and hemlock. Reynolds' specific. Make a necklace of the knots produced by the sting of an insect on 'Golden Rod,' and wear it next the skin. Citrate of lithia. Exercise and keep it off. Keep as quiet as possible. Colchicum. Morphine. Water cures. Angel's rheumatic gum. Pray fervently. Soft soap bandaged with flannel. Do not eat meat. Do not eat eggs or potatoes. Eat anything you please. Opium. Do not smoke at all. Smoke all you like. Take camphor. Drink nothing but beer. Do not drink anything but whisky. Do not drink anything at all. Do not leave the house. Take a ride out whenever you can. Carry a piece of alum in your pocket. Take Turkish baths. The Turkish bath is one of the worst things for rheumatism. De Soto spring water. Acetate of potash. Burdock seed. Bathe in hot water with pearlash in it. Bathe in cold water frequently. Do not bathe at all until you are nearly well. Catnip tea. Wrap fresh lamb's entrails around your neck. Drink brandy. Brandy is very bad for rheumatism. Sleep next to flannel. Go to Arkansas Hot Springs. Go to Doolittle Springs—to Saratoga, to Florida, to Bermuda, to the Sandwich Islands, to California, to the South of France, to Mexico, to the Azores, to South America. Wear a horse chestnut in your left hand breeches pocket. Wear a potato in the other. Take 'Constitution Water.' Take carbolic acid. Wrap joints with cotton, and cover with oiled silk. Glen Flora water. Get out on the prairies. High land is best for rheumatism. Balm of life. Magnetic salve. Rub with kerosene. Mustang liniment. Read Job. Put on hot poultices. Apply hop mashes. Do not swear. Put mustard plasters over the heart. Drink Friedrichshall bitter water. Seidlitz powders. Take a quart of alcohol with a dozen lemons in it. Take spirits of turpentine. Rub with spirits of turpentine. Slippery elm poultice. Electric oil."

A New Insecticide.

At a recent meeting of the Royal Horticultural Society attention was called to a new insecticide, which consists of camphor dissolved in methylated spirits to saturation, and mixed with soft soap to the consistence of cream. When diluted so as to be fit for use with a syringe, this has been found an efficacious substitute for fumigation in the case of mealy bug, scale, red spider, etc.

A VERY common reason for the failure of muck, when used as an absorbant or in compost heaps, is that it has already taken up all the water it can hold. It should therefore be thoroughly dried before forming into compost heaps. In building the heap, place muck and manure in thin layers, and use about twice as much muck as manure.

A CAUCASIAN WILD GERANIUM.

There are many geraniums, at present confined almost exclusively to botanic gardens, which, says *The Garden*, might be advantageously grown as ornamental plants in ordinary garden establishments; and among these, one of the most effective is that of which the accompanying engraving is an illustration. It is a beautiful Caucasian variety, named *g. platypetalum*. It grows wild in the Talish mountains, and is closely related to *g. sylvaticum*, from which, however, it only requires a superficial examination to distinguish it. It is of a stronger growth than that kind, and its flowers, which in color resemble those of *g. pratense*, attain, as will be seen by the engraving, which represents them in their natural size, much larger dimensions. This charming geranium is more especially valuable, both in large and small gardens, inasmuch as it is easily increased, both by division of the stem and by means of seed. In addition to this it is extremely hardy, and thrives in almost every kind of soil. It is, as will be seen, covered with soft, spreading hairs. The stem is erect and angular; the stipules broad; the leaves heart shaped and denticulated, and having from five to seven oboval obtuse lobes; the peduncles, which carry from two to three flowers, are covered with glandulous hairs, as also is the calyx, which has awn-like sepals. The petals, which attain double the length of the sepals, are two or three lobed; the stamens and carpels are slightly hairy, and the seeds glossy. The flowers, which are pendent previous to opening, remain erect during the time they are in bloom, a period lasting from May until July. Among all kinds of geraniums, *g. platypetalum* is one of the best for growing in clumps, in which it produces, when in full bloom, a striking effect, its flowers being large and produced in great abundance. It is a remarkably fine variety, and should always be cultivated where it is possible.



GERANIUM PLATYPETALUM.

Washing Flannels and Linens.

To whiten flannel, made yellow by age, dissolve 1½ lbs. of white soap in 50 lbs., soft water, and also ⅔ oz. spirits of ammonia. Immerse the flannel, stir well around for a short time, and wash in pure water. When black or navy blue linens are washed, soap should not be used. Take instead two potatoes grated into tepid soft water (after having them washed and peeled), into which a teaspoonful of ammonia has been put. Wash the linens with this, and rinse them in cold blue water. They will need no starch, and should be dried and ironed on the wrong side. An infusion of hay will keep the natural color in buff linens, and an infusion of bran will do the same for brown linens and prints.

THE EXTERMINATION OF THE PHYLLOXERA BY ALKALINE SULPHO-CARBONATES.

The sulpho-carbonates discovered by M. Dumas to be a specific against the ravages of the phylloxera, the parasitic insect which at one time bid fair to desolate all the vineyards of France, are formed by the combination of a mono-sulphide with the sulphide of carbon. In order to prepare them, the mono sulphide is dissolved in water or alcohol. To this solution the sulphide is added, and the whole is agitated, generating the sulpho-carbonates. Previous to their general application to vines, these substances were merely laboratory products, but recently in France they have been made industrially in large quantities and at low cost.

The alkaline sulpho-carbonates (potassium and sodium) are in the state of a dry salt, deliquescent and of a fine reddish yellow color; but it is often difficult to obtain them in that condition. More frequently they are to be had in a liquid state of solution, more or less concentrated, and marking from 33° to 40° B. The sulpho-carbonate of barium, on the contrary, is obtainable solid, and in the state of a yellow powder, sparingly soluble in water.

The useful application of the alkaline sulpho-carbonates to the cure of attacked vines requires, 1st, that all the infested surface may be treated; 2d, that the toxic action may be carried sufficiently deep in order to reach all the phylloxeras. These two conditions combine for the complete destruction of the parasite. It is necessary, moreover, that the remedy should act in the most economical manner. The best means of obtaining a perfect diffusion of the poison in the soil consists in the use of water as a vehicle. The quantity of water employed may depend upon the degree of humidity of the earth and upon expected rains; but the use of some water is necessary. From experiments conducted at Cognac, in France, and many times repeated throughout that country, it appears that, to apply the sulpho-carbonate solution, square excavations should be made in the soil, about 3 inches deep and 30 inches wide. As all the infested locality must be treated, these holes should be made sufficiently near together that the earth partitions between them shall become soaked after the liquid is poured in. The bottom of the excavation, it is hardly necessary to state, should be horizontal, so as to afford the best opportunity for the solution to infiltrate *uniformly* into the earth; and this should be borne in mind when the natural level is inclined. The holes should be brought up close to the base of the vine treated. The above done, about 2½ ounces of the sulpho-carbonate, at 40° B., is mingled with any quantity of water, in the ordinary watering pot or other vessel, thoroughly mixed, and the whole poured into one hole. Repeat this for every hole made, the area covered by the whole number of excavations of course being that under run by the roots of the vine. Then return the earth about the base of the vine and pour on plenty of fresh water, so that the poison will be forced deep down to all the roots. The annexed illustration, which we extract from *La Nature*, and which is copied from photographs, will give an idea of the effect of treatment with sulpho-carbonate of potassium. The two feet of vines shown formed part of a single attacked group, in which the parasite had existed for three years, and they had reached about the last stage of the disease. In March, 1875, one half of the selected group was treated with the chemical, the other left to its fate. In the treated portion, it should be noted that, out of 260 vines, 60 were already dead. Up to July the vegetation of the vines, without growing any weaker, had not improved; and it was not until the beginning of August that the leaves began to grow green and the shoots to elongate. Meanwhile, the vines not treated were daily perishing. In October, two average vines, one from each portion, were selected and reproduced, as stated, by photography, for the purpose of the present illustration. The vine on the left has very short branches, and its radicular system is almost destroyed; it may be considered, in fact, as dead. That on the right, which was in similar condition to the other before treatment, is evidently considerably improved, new shoots appearing and new roots being thrown out, so that it may be predicted that by next year it will have regained its former vigor.



EFFECT OF SULPHO-CARBONATES ON VINES.

The water necessary as a vehicle for the poison, in order to conduct it into the soil, is really a disadvantage; and besides, the most suitable season for the application of the sulpho-carbonates is during the rainiest period, when the earth is already soaked with water. Then, however, the quantity of water actually added as a solvent may be reduced to its minimum.

In order that the remedy may produce its best effect, there should be no delay in using it. Apply as soon as the disease becomes apparent. In the majority of cases, however, judging, as many will, from the harvest, few will have any fears of the malady during the first year of its existence; for it is now known that the plant, although strongly attacked, will still go on bearing; but during the second year, the disease will show its effects and require prompt treatment. Even then, however, if there be no further delay, the vines will not materially feel the ravages of the insect.

It is well to remember, in taking into consideration the cost of the chemical—and that, at present, is a rather indefinite matter—that the sulpho-carbonate of potassium is an excellent manure, and that it is quite probable that the excess of crop gained will largely repay the expense of treatment. It is reasonably certain that, in the sulpho-carbonates, the long sought remedy against the terrible vine disease has been discovered; but, on the other hand, with the exception of the facts above detailed, little is known or understood regarding its practical use, so that in that respect a promising field lies open for future investigators.

Radiant Heat as a Motor for Automata.

Among the many suggestions which have been advanced relative to the way in which automata may be caused to work without the aid of a confederate of the exhibitor hidden in the apparatus itself, some ideas offered by Professor Proctor, in an essay in his recently published "Science Byways," deserve credit for superior ingenuity.

He argues that, while it is possible that chess may be played by a machine, it is utterly impossible that cards can be, and hence an automaton like Psycho, supposing no person to be inside, is merely a curious deception. We have only to discover the trick which infallibly exists, and all is clear. One very plausible and novel way of performing the juggle, Professor Proctor finds in the invisible heat rays radiated from a concealed hot body. A metal globe filled with boiling water will retain sufficient heat to answer all the purposes of an exhibition of ordinary duration. This globe may be placed as near as possible to the automaton, of course out of sight of the spectators, and so arranged with reference to a concave mirror that its radiated heat rays are brought to a focus on the figure. A screen of blackened quartz, which would not obstruct the passage of the rays, might be used to hide the globe, or a lens of the same material might be employed to converge the rays, in lieu of the mirror. By a simple mechanical arrangement, a confederate located anywhere in sight of the exhibitor could so govern the mirror or lens that the focal point of the rays could be directed on any desired spot on a given surface of the automaton. The latter has before it thirteen cards, and its performance consists in lifting one of these cards at its proper turn during the game. This purely mechanical operation is not at all difficult to execute, since the movements are few and simple—involving only the turning of the body until the arm is in position to descend and seize the proper card. If thirteen buttons existed on the machine, by touching any one of which the apparatus would take a different position and then operate, the intervening devices (clockwork being the motor) could easily be imagined. The trick would be then to touch the button without detection, even under the closest scrutiny; and this is the operation which Professor Proctor proposes that the focussed heat rays shall perform. For buttons substitute thirteen thermo-electric batteries, any one of which will generate a current of electricity when heated even to a very small degree, and direct the heat rays on each at will. Then the one which the rays strike will, by its current, change a stop or otherwise affect the general mechanism, to make the figure take up the card to which that particular battery corresponds. Information is conveyed to the confederate, by any prearranged system of signals, from the exhibitor, who watches the game; and thus the automaton might be worked in a way to which even an examination of its interior would fail to give a certain clue.

Hanging Investigations.

Professor Haughton, of Dublin, has recently described some investigations undertaken by him with a view of discovering which was the most certain mode of death, the long drop or short drop in hanging. The results are that the most comfortable method of hanging is to be sure of a rope of sufficient elasticity, to place the knot under the chin with a running noose, and to drop about 10 feet.

THE *Medical Times* says that the test employed for selecting the men for the British Arctic Expedition consisted in making each candidate stand with his bare feet on a cube of ice. Those who endured the longest were chosen.

The Uses of Aluminum.

When we consider the excellent qualities possessed by this metal, its color, its brightness, its unchangeableness in air and in sulphuretted hydrogen, that it is not injurious to the health and can be worked into any shape, it seems remarkable that it has found so little use, and that the great hopes, which greeted its preparation according to Deville's process, are so far from being fulfilled. The price of aluminum would be considerably less if it were made in large quantities, as it depends on the price of sodium, the manufacture of which could also be conducted more cheaply if there were a certain and large demand for it. But there is at present no such inquiry for it. The advantages of vessels made of aluminum are not so evident and conspicuous as to be able easily to overcome old habits. At the London Exhibition of 1862, numerous articles of aluminum were exhibited; the Paris Exhibition of 1868 and the Vienna Exposition of 1873 showed that the interest in this "silver from clay" had died out.

Aluminum made by Deville's process was used at first for ornaments and other *articles de luxe;* on account of its lightness the tubes of opera and spy glasses were made of it. In physical apparatus and all fine instruments where weight is an objection, aluminum replaces other metals with advantage. Saber sheaths and dagger handles have been made of it. The eagles on the flag staffs of the French army are about 4½ lbs. lighter since they have been made of aluminum. As the metal can be drawn out to the finest wire, it has been used for embroidery, lace, fringe, and other decorations. They have some advantages over the same articles when made of silver, being lighter, and they do not tarnish.

Nevertheless, the use of aluminum has, as we have said, greatly diminished. Aluminum jewellery is scarcely seen at the present day. Opticians still use it for spy glasses and the like. Recently it has been much employed for surgical instruments. In the *atélier* of C. Schmidt, in Berlin, a considerable quantity is consumed in the manufacture of splints.

Although there is no mistaking the fact that the high expectations, with which the appearance of aluminum filled the public mind, have not been fulfilled, yet the aluminum industry has a safe guarantee of its existence in the use of the metal for aluminum alloys, which are capable of the most extensive use on account of their excellent qualities.

Aluminum will alloy directly with most metals, generally with strong heat, which may increase up to the glowing point. Small quantities of other metals affect the properties of aluminum, while, contrawise, small quantities of alumi num change the properties of other metals.

The alloy of aluminum with copper, aluminum bronze, is of the greatest importance in the arts. According to Tissier, as little as 1 per cent of aluminum, added to pure copper, considerably increases its ductility, makes it more fusible, and gives it the property of completely filling the mold, making a dense casting, free from air bubbles. At the same time the copper becomes more capable of resisting chemical reagents, increases in hardness without losing malleability, and unites in itself the most valuable qualities of bronze and brass. The color of the alloy is almost a copper red.

A copper alloy with 2 per cent of aluminum is used in the studio of Christofle, in Paris, for works of art. It works well under the chisel and graver.

The true aluminum bronzes, namely alloys of 90 to 95 per cent copper with 10 to 5 per cent aluminum were first made (says R. Wagner) by John Percy, in 1855. They became generally known through the researches of Deville.

For the preparation of this alloy, perfectly pure copper must be employed. If to a quantity of melted copper there be added one ninth its weight of aluminum, the two metals unite energetically, with the evolution of so much heat that the crucible, if it be not exceedingly refractory, softens and sinks together. The bronze obtained is at first very brittle, but by frequent resmelting increases in strength and ductility; the right degree is determined by hammering out a piece after each fusion. As a rule, two or three refusions suffice. Probably the amount of aluminum sinks somewhat below the original 10 per cent. Aluminum bronze with 5 or 10 per cent aluminum possesses a color very like that of gold. The alloy with 10 per cent has the color of green gold, an alloy of gold and silver. The alloys polish beautifully, make perfect castings, and possess great strength: according to Anderson's experiments, an average of 75,618½ lbs. per square inch. They are also very flexible, and, at temperatures from a dark red heat to near the melting point, perfectly malleable. The castings are perfectly sharp, and can be worked more easily than steel. This bronze engraves nicely, is easily rolled into sheets, and offers greater resistance to the air than other bronze, brass, silver, cast iron, and steel.

These excellent qualities give it a number of uses. In the construction of physical, geodic, and astronomical instruments, it is far preferable to all other metals. In jewelry and articles of art and luxury, it is employed in large quantities. Many kinds of house utensils are made of it, and it is also adapted to journal and axle boxes. Gun and pistol barrels, as well as rifled cannon, have been made of it, and have done excellent service. At present the high price of aluminum bronze alone prevents its general use for arms. Morin (who has probably gone out of the business now) furnished these bronzes at the following rates: 10 per cent aluminum, $6 60 per lb.; 7½ per cent aluminum, $5.50 per lb.; 5 per cent aluminum, $4 40 per lb.

These prices are four or five times as tin bronze. In articles where the price of the raw material is of little consequence as compared to the value of the work, as in physical instruments and the like, the aluminum bronze is always to be preferred.

In England, kettles made of aluminum bronze are employed for making preserves and ices from acid fruits. Morin & Co. manufacture weavers' shuttles of bronze, which, of course, do not oxidize so readily as steel. Cambrien recommends this alloy for type casting. Type made of it can be used 50 times as long as those from lead and antimony. Hulot employs it for the bed of perforating machines for perforating postage stamps. Lange, in Glasshütte, Saxony, makes watch mainsprings of an alloy of 5 parts aluminum and 90 parts copper, or of 100 parts aluminum and 5 parts silver. The advantages possessed by such springs over steel springs are that they do not rust, are not magnetic, nor so brittle, but are very hard and elastic.

Aluminum alloys not only with copper but with most other metals. It does not unite with lead or with iron. R. Wagner therefore suggests the possibility of aluminum being employed for desilvering argentiferous lead.

An alloy of 100 parts aluminum and 5 parts silver can be worked like pure aluminum, but is harder and takes a fine polish. An alloy of 5 parts aluminum and 100 parts silver is almost as hard as coin silver, and has the advantage of containing no metal that is poisonous, or that alters the color of the silver. Such an alloy has been recommended for coin age, but in vain.

Small coins of pure aluminum, which can be stamped nicely, would be proof against mistake and deception on account of their lightness. Aside from the fact that the price of aluminum would vary with its increased product, another chief objection to its introduction into coinage is that the people cannot separate the idea of weight from the idea of a valuable metal.

Aluminum alloyed with 4 per cent of silver is used by Sartorius, of Göttingen, for making the beam of analytical balances, for which its lightness and unchangeableness especially fit it.

An alloy of 99 parts by weight of gold and 1 part of aluminum is very hard, but still ductile; its color resembles that of green gold; 90 parts of gold and 10 parts of silver make a white and brittle alloy.

The best alloy of aluminum and tin contains 7 per cent of the latter; it works easily, polishes nicely, but on attempting to cast it a portion of the tin separates from the aluminum.

An alloy with 3 per cent zinc is, according to Débray, harder than pure aluminum, but very ductile and brilliant.

A thousandth part of bismuth makes aluminum as brittle as glass, says Tissier.

According to the same authority, aluminum will unite with mercury only when moistened with caustic alkali. The amalgam is very brittle; the aluminum in it oxidizes easily in the air, decomposes in water, and in general acts like the metals of the alkaline earths. Jehn and Hinze have found that aluminum, when rubbed with leather impregnated with mercury, oxidizes to alumina.* Perhaps an aluminum analgam was first produced.

With iron, aluminum produces an extraordinarily hard alloy. A compound of 24·5 parts aluminum with 75·5 parts iron is silver white, and does not rust in the air. On treating with dilute sulphuric acid, the iron dissolves and leaves the aluminum behind. A slight addition of 8 parts to 1,000 parts of steel imparts to it all the properties of the best Bombay wootz. Rammelsberg has, however, never found any aluminum in the samples of so-called aluminum steel analysed by him.—*Dr. Biedermann.*

SCIENTIFIC AND PRACTICAL INFORMATION.

THE SECRET OF EDUCATING FLEAS.

The editor of *La Nature* has been investigating fleas, with a view of discovering where, in those aggravating insects, resides the capability of being educated. His conclusion is radical; he says they cannot be educated, and that all the tricks so ingeniously exhibited by self-styled trainers are merely caused by the natural efforts of the insect to escape. Any one can make them draw minute wagons or go through similar performances, if care be taken to secure them to their work so that they cannot jump. It seems to us, however, that it must require considerable skill and ingenuity to hold the lively creatures while the securing operation is in progress.

ROYAL ROAST BEEF.

The traditional baron of beef, which since time immemorial has graced the sideboard of the king or queen of England on Christmas day, weighed this year 300 pounds. An English contemporary states that it was cut from a prize bullock bred from the choicest stock on the Royal Farm. Rounds of beef weighing 80 lbs. each, and spiced, were forwarded by the Queen, also in accordance with old custom, to the courts of Germany, Austria, and Belgium. The Queen's stock farm is said to be a model establishment. It appears certainly to be a productive one, judging from the fact that the Christmas sale of fat cattle netted Her Majesty the neat sum of $15,935.

THE ARTIFICIAL BUTTER INDUSTRY.

The perennial French artificial butter has turned up again, this time under the name of *beurrine.* It has recently been patented in France, and consists of beef suet mixed with from 15 to 20 per cent oil (kind not stated) and from 5 to 10 per per cent milk. This reminds us that at present there is an open field for artificial butter in this country, the so-called oleomargarin having gone out of existence. The material met with a fierce opposition from the butter and cheese trade and from dairymen generally, on the alleged ground that it was used as an adulterant and not as a *bona fide* production. There is no doubt but that it met with very little popular favor, and probably this, together with misfortunes in business management, threw the concern eventually into financial trouble. Several well known scientific gentlemen of this city were interested as stockholders, and upon them some of the pecuniary losses fall.

*Professor Henry Wurtz, of Hoboken, had previously discovered this property.

Curiosities at Central Park.

A reporter of the *Evening Post* has been the round of the American Museum buildings, including the Zoölogical Gardens, located in Central Park in this city. We extract the following interesting observations from his report:

The Museum and Zoölogical department of live animals, and the Park in which they are located, are among the most attractive places in which strangers visiting New York can spend a half day. The new building of the American Museum will soon be finished. Contributions of fossils and other curiosities are constantly being made by our citizens and travelers. A very beautiful series of polished calc spars from England, and a large number of ores, were given by Mrs. Riley, of New York, who has also sent, for the archæological department, a number of rare implements of ancient and modern date. The Museum received a very valuable Christmas present from its president, Robert L. Stuart, namely, the library of Mr. Carson Brevoort, which cost some $15,000 and includes a large number of works on ichthyology.

A BIBLICAL DEPARTMENT.

An interesting department has been established, in which are certain of the animals that are spoken of in the Bible—a department for Bible animals. This was begun by the reception from Beyrout, in Syria, of a collection comprising foxes, wolves, some reptiles, and birds, all from the Bible neighborhood of Syria. The specimens were preserved and stuffed by students of the Protestant College in Syria, which is under the charge of the Rev. Stuart Dodge.

ANCIENT IMPLEMENTS.

The American consul at Shanghai has very kindly sent for the department of archæology a collection of implements which represent the customs of ancient times. His object is to secure specimens of typical implements that have not become modernized. China and Japan, like every country opened to civilization, show many signs of innovation.

Lately he has sent a collection of the implements used in games. Dominoes in many shapes are among them, as are also playing cards, somewhat resembling those used at the present day.

THE CAT FAMILY.

Mr. D. G. Elliot, a naturalist of this city, who has long lived in Europe, engaged in publishing his large and valuable monographs on birds and mammals, has at various times given to the Museum valuable specimens. Being a gentleman of leisure and competence, he has devoted himself to the interests of this institution, and has secured many objects of great value which were offered for sale in the large cities of Europe. One of his latest gifts is a series of specimens of the cat family. Seven specimens of cats, represented by stuffed and mounted skins, that are included in the abovementioned work, have been given to the American Museum, and now are numbered among the elegant specimens in the case assigned to the cat family. One of the largest tigers ever captured is in this collection, mounted in the manner of those in the British Museum in London.

OTHER RECENT GIFTS.

A most valuable gift by Mr. Elliott is the collection of Madagascar monkeys or lemurs, mounted in the best style of taxidermy. Another exceedingly rare and valuable acquisition from the same source is the manatee, and a skeleton of another. The above are all mounted in the manner adopted at the British Museum.

Mr. Elliott has also given several thousand specimens of skins of North American birds, a collection made especially for the use of students in ornithology. These specimens are stuffed but not mounted; they are neatly laid out and placed in drawers to be placed in the ornithological rooms of the new Museum building. One room is arranged for a chemical laboratory, and another for work requiring lapidaries' tools, etc. Rooms are assigned for the various departments of conchology, geology, etc.

Dr. Rudolph Witthaus, of this city, has given recently a valuable cabinet, consisting of several thousands of species of beetles, in addition to his gift of foreign coleoptera which the Museum has already in its possession.

Mr. William Heins, of New Jersey, a prominent business man of New York city, has found time in his leisure moments to accumulate a very large collection of foreign and domestic butterflies of some thousand species. These will find place in the Museum as soon as the new cases are ready for them.

The fact that the new building of the American Museum is absolutely fireproof, both as an isolated structure and as one entirely built of stone and metal, gives confidence to those who desire to place objects there. Specimens are admirably exhibited also, which is another inducement, everything having a place worthy of its value.

THE ZOÖLOGICAL GARDENS.

The wild animals of the zoölogical collection in Central Park seem to thrive very well, though the accommodations are not of the best. Much interest has been felt in the success of the experiment of trusting the important duties of nursing the infant king of beasts to a dog. One of the lionesses of the Park collection gave birth to two healthy kittens, and from some unexplained caused failed to give them requisite nourishment. A fine large mastiff was at hand

and the young lions were offered to her tender care. The gentle mastiff immediately fondled them and assumed the charge, and has since, for a number of weeks, nursed them with affectionate attention. The kittens are getting large and clumsy, and, in a playful mood, sometimes caress their stepmother with unsheathed claws.

There are frequently unpleasant deformities in the lions born and bred here. Their legs are too short and are sometimes bowed very noticeably. There are a number of hyenas now in the Park collection, which were reared there. They are nearly black in color when they are born.

Beside the common spotted hyena there is a striped species in the collection, which is regarded as new to Science. This creature has a stiff mane, which is erected at every movement.

THE "HAY CRITTERS."

The young camel was one of the most interesting of the creatures born in the Park. Then there are Cape buffalo calves, and the beautiful Zebu calf, and the bison calf, and several others.

Since the completion of the large new house for ruminants, or "hay critters," as they are familiarly called, the exhibition has been very fine. The equine antelope is exceedingly curious, and is rarely seen alive. Some fine elands and two antelopes, called blessbocks, are also here. Another Indian antelope, with twisted, lyre-shaped horns, has just been obtained. There is the gnu, or horned horse, also, who belongs to the antelope family.

THE SEA LIONS.

A recent improvement in the treatment of the sea lions is worthy of notice. The pond in the rear of the carnivorium, which has heretofore been used for the great wading birds, has been surrendered to the seals and such creatures. This exhibition is now one of the most entertaining. There are often six or seven large sea lions here, and they fully enjoy the ample space. They play briskly with their fellows, dive and leap, plunge in at one side of the pond and shoot out at the other. They hobble about on land, chasing each other, presenting a most grotesque appearance. One seizes a piece of ice in his mouth and tosses it in the air, catching it adroitly as it falls; another vaults upon the bottom, beneath the water, and pulls under his fellow who is quietly sleeping on the surface. It is surprising to witness the agility of these creatures on land. They chase each other very briskly around the yard, leaping much as a puppy does in his attempts to caper.

Poetical Soap.

Messrs. Water and Oil
One day had a broil,
As down in the glass they were dropping.
And would not unite,
But continued to fight,
Without any prospect of stopping.

Mr. Pearlash o'erheard,
And, quick as a word,
He jumped in the midst of the clashing;
When all three agreed,
And united with speed,
And Soap came out ready for washing.

DECISIONS OF THE COURTS.

United States Circuit Court---Fifth District of Louisiana.

PATENT STEAMBOAT STAGING AND DERRICK.—O. K. CONVERSE AND OTHERS *vs.* JOHN W. CANNON AND OTHERS.

WOODS, Cir. J.:

The complainants allege that they are the assignees of a patent issued to one A. John Bell, dated January 22, 1861, for an "improvement in steamboat staging;" that they are also the assignees of two patents issued to one Hannibal S. Blood, the first dated June 7, 1870, being "a new and useful improvement in derrick or hoisting crane, and relating particularly to a means for avoiding the labor and delay incident to handling and manipulating heavy landing stages used on steamboats and water craft by manual labor," and the second being a patent dated March 26, 1872, for an "improvement in derricks;" that all of the inventions named in said three letters patent relate to the manner and mode of manipulating and handling stages used on steamboats and water craft for landing freight and passengers, whereby manual labor is, in a great measure, dispensed with, and great economy in the navigation of such vessels effected, as well as a large decrease of expense in the navigation and use of such vessels and water craft.

That the defendants, John W. Cannon and William Campbell, the first largely interested in the steamer Robert E. Lee as owner, and the latter being her master, are using upon said boat two several machines, which are substantially in their mode of construction the same as the machine described in said three letters patent.

The bill prays for a perpetual injunction against the defendants to restrain them from infringing upon the patents owned by the complainants by the use of said machines now employed by them upon the steamer Robert E. Lee.

The answer of defendants denies any infringement of the patents held by complainants, and claims that they use an apparatus invented by one John Perkins, and patented to him by letters patent dated May 7, 1872, which differs substantially and materially from the apparatus covered by the patents owned by complainants, and is not an infringement thereon.

In passing upon the issue of infringement, the question to be determined is whether, under a variation of form or by the use of a thing which bears a different name, the defendant accomplishes, by his machine, the same purpose or effect as that accomplished by the patentee, or whether there is a real change of structure or purpose.

If the drawing introduced by the defendant constitutes a mechanical equivalent, in reference to the means used by the patentee, and it, besides being an equivalent, it accomplishes something useful beyond the effect or purpose accomplished by the patentee, it will still be an infringement as respects what is covered by the patent, although the further advantage may be a patentable subject as an improvement on the former invention. (Drummond, in Foss *vs.* Hubert, 2 Fisher 31.)

The material question is not whether the same elements of motion or the same component parts are used, but whether the given effect is produced substantially by the same mode of operation and the same combination of powers in both machines. (Story, J., in Odiorne *vs.* Winkley, 2 Gall., 54.)

In determining the question of infringement, we are not to determine about similarities or differences merely by the name of things, but are to look to the machines or their several devices or elements in the light of what they do, or what office or function they perform, or how they perform it, and to find that a thing is substantially the same as another if it performs substantially the same function in substantially the same way to obtain the same result. (Clifford, J., in Vincent Refinery *vs.* Mathiason, 2 Fisher, 602.)

The rule is, and so it has been settled, that if two machines be substantially the same and operate in the same manner, though they may differ in form, proportions, and utility, they are the same in principle. (Washington, J. in Evans *vs.* Eaton, 3 Wash., 449.)

As between a device conceded to be new and a device claimed to infringe, because an equivalent, the alleged infringer could not protect himself by showing that, although his device was the equivalent of the patentee's device in all its functions and in its construction and mode of operation, yet by other additional features it possessed other and further useful functions. Such a device, though an improvement upon the patented one, would be an appropriation of it. (Woodruff, J., in Surrem *vs.* Hall, Official Patent Reports, Vol. 1, 437.)

To constitute an infringement, the contrivances for the purposes in view must be substantially identical, and that is substantial identity which comprehends the application of the principle of the invention. (Page *vs.* Ferry, 1 Fisher, 229.)

It makes no matter what additions to or modifications of a patentee's invention a defendant may have made: if he has taken what belonged to the patentee he has infringed, although with his improvement the original machine or device may be much more useful. (Sprague, J., Howe *vs.* Morton 1 Fisher, 597.)

Applying these principles to this case in hand, there can be no doubt that the defendants have appropriated the invention covered by the patent of A. John Bell. That they have improved upon parts of the combination may be true, but they are using the idea first suggested by Bell and covered by his patent, namely, the handling of a steamboat stage by means of a rope attached to a derrick, through force applied by a power windlass.

The variations which have been made in the method of attaching the rope in the form of the derrick in the position in which the stage is placed on the deck are immaterial variations, which do not affect the question of infringement.

As the patent to Bell bears date prior to the use of stages by the Marine Brigade, or to the publication in Appleton's "Dictionary of Mechanics," the defense of want of novelty cannot be maintained. The averment that the device of Bell is not useful cannot be sustained.

All the law requires as to utility is that the invention should not be frivolous or dangerous. It does not require any given degree of utility. If the invention is useful at all, that suffices. (Cox *vs.* Greggs, 2 Fisher, 174; Hoffheim *vs.* Brandt, 3 Fisher, 218.)

The result of this view is that there must be a decree for complainants directing a perpetual injunction to go against defendants as prayed in the bill, and a reference to a master for an account of profits.

Supreme Court of the United States.

OCTOBER TERM, 1875.—PATENT SAWMILL.—CALEB IVES AND GEORGE B. GREEN, PLAINTIFFS IN ERROR, *vs.* MILTON A. HAMILTON, ADMINISTRATOR OF PALMER HAMILTON, DECEASED.—IN ERROR TO THE CIRCUIT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF MICHIGAN.

Mr. Justice BRADLEY delivered the opinion of the Court.

This was an action brought to recover damages for the infringement of certain letters patent granted to Hamilton, the plaintiff below, for an improvement in sawmills. The defendants pleaded the general issue, with notice of special matter, setting up several prior inventions, amongst others that of one Isaac Straub. The plaintiff's patent was dated the 5th day of December, 1865.

The defendants insist that Hamilton's patent is defective for not clearly describing the position, perpendicular or otherwise, in which the curved guides should be placed; and that if any required position can be inferred from the patent it is a peculiar one, whilst the guides of the defendants' saw are inclined at a slight angle to the perpendicular. As to the alleged defect of the patent, there is nothing in the objection. The invention claimed is an improvement on an old machine; and it is properly taken for granted that the practical mechanic is acquainted with the construction of the machine in which the improvement is made; and nothing appears in the case to show that any peculiar position, different from that of sawmills constructed in the ordinary way, is necessary to render it effective and useful. The essence of the improvement has nothing to do with the precise position of the guides. It is a combination of mechanical means to produce a rocking motion of the saw. And this combination is just as applicable to guides that have a slight inclination as to guides that are perpendicular. We think that there is no ground for either branch of the objection. The description in the patent is sufficiently specific; and the inclination of the defendants' guides cannot exempt them from the charge of infringement.

The complaint made by the defendants, that the patent is defective in not stating the nature of the curve for the guides, whether that of a circle or of some other figure, in view of the subject matter of the improvement and of the diagrams annexed to the patent, are not sufficient to affect its validity. Any good mechanic acquainted with the construction of sawmills, and having the patent and diagram before him, would have no difficulty in adopting the improvement, and making suitable curves.

The conclusions to which we have come are decisive of the case. It is unnecessary to discuss in detail the different points made at the trial, or the several instructions asked. We have examined them all, and find nothing on which to base a judgment of reversal. If Straub's patent would have revealed anything to affect the validity of Hamilton's, the parties did not see fit to spread it on the record, and therefore we have no means of deciding that question.

The judgment is affirmed.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED ISTLE MACHINE.

Guillermo Roberto Welke, Parras de la Fuento, Mexico.—The object of this invention is to produce an improved machine for making istle, or the fiber of the lechugilla, which is applied in Mexico to the manufacture of a large number of articles, as hammocks, sacks, ropes, nets, cotton bagging, wagon sheets, carpets, and similar objects. The invention consists mainly of devices for scraping the leaves, while being drawn by rollers through the scraping knives, which are made to yield to the thickness of the leaves. The leaves are placed between the scrapers up to a gage piece, and then carried with the scrapers toward the feeding rollers. Sliding and reciprocating scraping jaws are operated by suitable transmitting mechanism, by the forward motion of the scraper frame, for scraping off the ends of the leaves which are conveyed to a receiving platform, and dropped by the same to a receptacle below.

IMPROVED WIRE STRETCHER.

Seman Taber, Russel Taber, and Charles M. Morgan, Hesper, Iowa, assignors to Seman Taber, Darius F. Morgan, and Charles M. Morgan, same place.—This device is for tightening wires that have been strung up, and especially fence wires. A bent bar is held transversely with the wire to be tightened. The wire is passed between pins on said bar, and the latter is turned longitudinally with the wire. The wire is then passed into the slot of a drum secured to the bar. The drum is turned by means of a wrench, to give the desired tension to the wire, a pawl holding the drum securely in any position into which it may be turned.

IMPROVED ROTARY PUMP.

William O. Crocker, Turner's Falls, Mass.—There are two toothed pistons engaging the one with the other. The peculiar construction of the teeth of the pistons enables the said teeth to be made so small that at least one tooth may always be in contact with each abutment, while at the same time having sufficient water space. To each of the abutments are swiveled set screws, so that they may be adjusted at any desired closeness to the pistons. A vent chamber and a suction chamber are formed in each head upon the opposite sides of a line joining the shafts.

IMPROVED TACK MACHINE.

Charles P. Weaver, Norristown, Pa.—This invention relates to machines with two cutting jaws for making tacks or small nails, and consists in so combining the header lever with the crank pitman by a lever, pin, and link, that the power can be applied directly in the line of the work, thereby avoiding all lateral strain and dispensing with the usual long arms and crooked ends of the heading lever, and allowing the size and weight of tack machines to be reduced fifty per cent.

IMPROVED CAR COUPLING.

Peter C. Murray, Sloatsburg, N. Y.—This invention consists of a centrally recessed drawhead, with a stationary link attached thereto, that is coupled by the laterally sliding cross pin of the connecting drawhead, the pin being guided and locked in open or closed position by a side standard and pin rod.

IMPROVED GAS GOVERNOR.

David B. Peebles, Edinburgh, Scotland.—Between two half cases, made of cast iron, a flexible diaphragm is fixed, and a passage for the gas is made between the upper and lower chamber through the projecting part of the case. In the lower half a recess is made to receive a disk of metal not acted on by gas. In the center of this disk a hole is made, into which the conical point of a regulating screw is placed, so that, by moving it, the hole can be opened or closed. The top of the screw is surrounded by a bead forming a recess, into which wax can be run to receive a stamp for a seal. The valve, made of fusible alloy, is of a double conical shape, with a stem at one end. The other end rests in a step made in the head of the center screw, which keeps the metal disks to the diaphragm. The bottom of the burner tube acts as a valve seat, and by this arrangement the valve can be taken out for cleaning by unscrewing the burner tube, without taking the governor to pieces.

IMPROVED AUTOMATIC TELEGRAPH KEY AND REGISTER.

Lucien S. Crandall, New York city.—This is an improved automatic telegraph key and register, by which, it is claimed, the manual and mental labor in transmitting telegraphic signals are facilitated and simplified to a considerable degree, the working capacity of telegraph lines increased, and the accurate manipulation of the instrument acquired by the operator with little practice. The invention consists of a letter ring, which is divided along its circumference by insulated and non-insulated portions and separating recesses, to correspond to the characters of the Morse alphabet. A number of spring keys are arranged around the letter ring, and lettered alphabetically, to correspond with the Morse letters of the ring. A bridge at the end of each key forms, when the key is depressed, the contact of the letter ring with one of a series of needles radiating from a vertical shaft that is intermittently actuated by the magnets by a local battery. The letter ring and spring needles form the poles of the main line battery, and record the depressions of the keys by a relay magnet with an armature, having lever with recording stylus at one end, and stop pawl at the other end. The stop pawl releases a spring-acted slip wheel that throws a local actuating battery in circuit, which imparts, by two magnets with armature pawls, switch, and governor, intermittent motion to a motor wheel, connected by a partially insulated and non-insulated step with a recess and spring rider, by which the motion of the motor wheel and needle arms may be kept up after the main line circuit is interrupted, to register spaces in and between letters. The number of needle arms correspondends with the subdivisions on the letter ring and the number of teeth on the motor and slip wheels, to expose at any moment one of the needles to the action of a key. This correspondence between divisions of letter ring and number of needle arms, and of teeth on motor wheel, in connection with the intermittent motion of motor, gives a dwell at the points of magnetization and demagnetization of main line circuit. The closing of the main circuit by the key throws the local circuit into operation, which revolves the needle wheel until the local circuit is interrupted by the action of the hook pawl on the slip wheel, and the return of the needle through the recess of the letter ring.

IMPROVED MILLSTONE DRESSING MACHINE.

William B. Chase, Faribault, Minn.—This is an improvement in the class of millstone-dressing machines in which a pick or cutting tool is operated by a vibrating lever, and caused to travel over the face of the stone by means of pawl and ratchet mechanism. The construction is such that a greater or less degree of forward motion of the pick may be produced, and the operation of the same on the stone accurately adjusted and interrupted by the handle of the pick lever, the forward feeding of the pick being obtained by a screw turning lever pawl and ratchet mechanism.

IMPROVED LEVELING AND TRAMMING APPARATUS FOR MILLSTONES.

James T. Beckwith, Cameron Mills, N. Y.—This consists of a frame suspended from another frame, on which the stone rests, and is leveled by screws from below. On the suspended frame are screws, which, being adjusted in the frame when the stone is first leveled by its face, serve afterward to level the stone at any time without removing the runner. This lower frame serves for tramming the spindle. In addition thereto, a couple of plumb lines are suspended from an upper frame on the spindle through a lower one, by which the spindle may be trammed.

IMPROVED MACHINE FOR BORING AND WALLING WELLS.

Charles B. Stough, Monticello, Ill.—A wheeled frame supports a circular way, beside which is a toothed rim, which gives rotary motion to a horizontal shaft, which is mounted in a frame, the said frame being rotated by suitable power. An arrangement of rollers in the frame holds the auger shaft, which is rotated with said frame, and said rollers also allow the shaft to settle as the auger penetrates. As the auger enters, the soil passes upward to a case from which it is removed and raised to the surface by an endless bucket chain working on the auger shaft.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SLED PROPELLER.

William H. Shelton, Jr., New York city.—The sleigh is provided at both sides with slotted guides, and fulcrumed lever handles slide loosely therein. Said handles have end claws that take hold of the ice or ground, and produce, by the weight of the body, the forward motion of the sleigh or carriage on the fixed lever fulcra.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED OILER.

George W. Parsons, Salisbury, Md.—The construction of this oiler is such that it may be overturned without spilling any of the oil, and the amount of oil discharged can be readily controlled. There is an ingenious arrangement of rack and pinion mechanism inside, which ordinarily keeps the nozzle shut, but which opens the same to a degree corresponding to the distance in which the bottom of the can is pressed inward.

IMPROVED STEAM RADIATOR.

George P. Jacobs, Brooklyn, N. Y.—This is a one-piece radiator tube, having four steam ducts surrounding the central air tube, said ducts being in pairs, the two of a pair being connected, but each pair being independent of the other. By this arrangement, in addition to the increased outer radiating surface, there is a large inner radiating surface, along which an active current of air is induced.

IMPROVED LEACH.

Marion P. Wolfe and Edwin M. Henkel, Crawfordsville, Ind.—This consists essentially of an ash receptacle and leach having an inclined and channeled bottom, and a top reservoir with perforated bottom to distribute the water and draw off the lye.

IMPROVED STREET SPRINKLER.

William Westerfield, New York city.—This is a piston-shaped valve located in the main pipe connected with the sprinkling tube. The pipe which leads water from the tank enters the main pipe, and as the valve is adjusted, one or the other side of the aperture of the former water is shut off or admitted to the sprinkler. This enables the flow to be governed more conveniently.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

James L. Sprague, Hermon, N. Y.—This invention includes propeller shaped paddles which draw the cream to the center of the churn, and through suitable apertures in which air is forced through the cream. Devices are added to prevent clogging of the cream at the corners of the churn.

IMPROVED GRAIN HEADER.

Charles K. Myers and John W. Irwin, Pekin, Ill., assignors to Peter Weyrich and C. K. Myers, of same place.—In this apparatus the cutter bar can be adjusted for cutting the grain higher or lower, and can be regulated to suit varying hights of grain. There are novel devices for moving the sickle bar, and various useful improvements in construction, tending to add to the general efficiency of the machine.

COMBINED SCRAPER, CHOPPER, AND DIRTER.

Arthur L. Spence, Alma, Ark.—This machine scrapes the cotton plants, chops them, and then, by means of plows, dirts them as it advances. The new feature introduced is a device in connection with the choppers which, should they strike an obstruction, allows them to stop their motion, while that of other parts of the apparatus continues.

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Notes & Queries

J. H. P. can make a cement for mending rubber boots by following the directions given on p. 203, vol. 30.—S. A. G. will find that the fireless locomotive, described on p. 96, vol. 30, answers his description.—A. V. S. will find a description of the glass-tempering process on p. 402, vol. 32.—P. V. will find an excellent recipe for yeast on p. 183, vol. 33.—M. G. F. will find directions for hardening soap on p. 194, vol. 32.—J. J. M. and others, who inquire as to pisciculture, should address Seth Green, Esq., Rochester, N. Y.—J. A.'s query as to the relative motion of parts of a wagon wheel is answered on p. 208, vol. 31.—W. Y. Jr. is informed that we do not know the copying fluid he mentions.—J. F. M. and others, who ask as to the construction of special machines, should address the manufacturers.—A. R. W. will find a recipe for a deep black ink on p. 92, vol. 33.—W. & S. will find a recipe for a cement for filling millstones on p. 251, vol. 31.—O. C. will find a recipe for a waterproof whitewash on p. 408, vol. 24.—O. C., S. P. B., F. B. P., G. H. R., J. W. D. should consult the *Beekeeper's Magazine*, 14 Murray street, New York city.—J. W. C. will find a recipe for a good mucilage on p. 373, vol. 33.—H. H. B. will find a recipe for aquarium cement on p. 43, vol. 33.—J. J. R. will find some information as to galvanized iron water pipes on p. 218, vol. 25, and on p. 264, vol. 26.—F. J. R. will find a simple recipe for tanning hides on p. 147, vol. 30.—C. L. R. will find a recipe for invisible ink on p. 299, vol. 30.—H. B. will find a description of Professor Tyndall's respirator on p. 178, vol. 32.—G. A. McC. can convert his black ink into copying by adding a little refined sugar.—C. G. W. can repair his rubber life preserver by following the directions on p. 203, vol. 30.—J. A. will find a recipe for black ink on p. 92, vol. 33; for laundry blue, see p. 219, vol. 31.—S. R. S. will find directions for soldering of all kinds on p. 251, vol. 28.—W. L. D. will find directions for building a windmill on p. 241, vol. 32.—E P. C. will find full directions for making colored fires on p. 165, vol. 24.—L. C. K. will find answers to his questions as to small boilers and engines on pp. 225, 257, vol. 33.—J. D. B. will the dimensions of the various gages of wire on p. 363, vol. 28. For the relative prices of gold and platinum, see p. 169, vol. 33.—J. C. will find a good recipe for baking powder on p. 123, vol. 31.—J. R. will find directions for scouring castings on p. 139, vol. 31.—W. C. can utilize tinned plate scraps by the method described on p. 319, vol, 31.—J. D. will find a description of Professor Draper's method of silvering glass on p. 267, vol. 31.—J. T. W. will find a recipe for furniture polish on p. 315, vol. 30.—W. N. will find directions for coloring photographs for magic lantern use on p. 390, vol. 30.—W. K. will find directions for laying out a sun dial on p. 409, vol. 29.—R. S. can prevent mildew on canvas by the method described on p. 90, vol. 31.—F. T. will find a recipe for shaving soap on p. 251, vol. 32. The type writer is described on p. 79, vol. 27.—S. N. will find recipes for Worcestershire sauce on pp. 241, 281, vol. 26. Galvanizing cast iron is described on p. 59, vol. 24.—M. G. can make condensed milk by the process described on p. 343, vol. 30.—D. Q. can separate silver from lead by the method described on p. 138, vol. 32.—J. N. can temper millpicks by the process given on p. 202, vol. 31.

(1) O. G. says: I have charge of a pair of engines at a coal shaft, and have had a great deal of trouble by the breaking of the teeth in the cog wheels, or rather in the sections of the cogs. The breakages generally occur at the starting and stopping of the engine. The engine is 11 by 25 inches, and our usual speed is 125 revolutions per minute. How can we prevent the accident? A. Make the width of the teeth greater.

(2) J. T. H. says: We cannot get speed enough from our main shaft to run a fan for a cupola. Which would require the most power, to increase the pulley on the main shaft or to use a countershaft, to get the same speed? A. To use a countershaft.

1. I am making a small engine, 2½ inches stroke by 1¼ bore. Would ⅝ inch steam ways be large enough? A. This depends on the pressure. 2. Of what size should the fly wheel be? A. About 6 inches in diameter.

(3) H. C. S. asks: Is there any non-conductor that will not be affected by steam at 200 lbs. pressure? A. Yes, charcoal.

(4) D. H. asks: 1. Will plumbago serve to make good cores? A. Yes, if used with sand. 2. Can plumbago be molded at a core for an internal screw, so as to have a perfect thread when the iron or steel is cast? A. Not by itself. 3. What is put into pulverized plumbago or black lead to cause it to mold with facility? A. We are not aware of any substance for this purpose.

Can a good square thread of an internal screw, from ⅝ to 1½ inches diameter, be cast in iron or steel? A. No.

Is there any danger of a kerosene lamp exploding when the blaze is fluttering and shoots upwards two or three inches? A. Yes.

(5) N. H. C. says: R. R. & G. E. say that cut nails are made from bars of iron rolled into widths of the length of nails to be cut, and then they are cut crosswise. I say they are rolled in wide plates, then cut by shears across the end of the plates in widths of the length of the nail, which brings the nail lengthwise of the rolled iron. Which is right? A. You are.

(6) C. F. R. says: A pressure gage on a boiler indicates 15 lbs. Is that the pressure on a square inch of the inside of the boiler, or is the strain 15 lbs.+15 lbs., to balance the air driven out by the steam,=30 lbs., 15 lbs. of which only is available for working purposes. I hold that the latter is true. A. The total pressure is 30 lbs., and the available pressure 15 lbs., per square inch.

A tubular boiler, used to furnish steam to heat a church, has lost several tubes or flues from a sort of pinhole corrosion, the water side of the flues being very clean when taken out. I contend that the rain water is too pure and dissolves the iron away, thus weakening it, and that they should use well water, partially or even entirely, to retain their boiler longer. Am I right? A. Rain water is generally more pure and better for steam purposes than well water, and it will remove some deposits from boilers.

(7) T. E. says: I am making a wrought iron fence, which I intend to have galvanized; but I find that galvanizing will cost more than the fence. Do you know of any good substitute? A. No, not an effective one.

(8) J. N. P. asks: In putting in a heating apparatus for a greenhouse, we made rust joints with a composition of 2 ozs. powdered sal ammoniac to a keg of iron borings. Is that the best proportion? A. Sal ammoniac 1 lb., sulphur ½ lb., iron turnings 100 lbs., is the best proportion.

1. I notice on a locomotive a rod running from the cab to the base of the smoke stack, joined to a lever that runs into the smoke stack. What is it for? A. To open and close the blast pipe to assist the draft. 2. Suppose a locomotive be standing with no steam in the boiler, what is the quickest method to set the valve without removing the steam chest cover, there being no centerpunch marks? A. It cannot be properly done. 3. What is the quickest method of placing the crank of a locomotive on the exact center when she is standing on an incline? A. An answer to this question would require too much space for these columns. We may probably before long elucidate the question.

(9) M. H. C. asks: Will a rotary pump, running at a slow rate of speed, force a stream of water through a hose with a very small nozzle, without loss of power by the water striking back into the supply pipe? A. Yes.

(10) O. A. Jr. asks: In setting up motion with gearing say, from 1 revolution of driver to 36 of driven pulley with 6 gear wheels, is it best to divide the motion equally along the train, or to gain more motion on the first pair of gears? A. Gain most motion on the last pair of gears.

1. I am using best boiler plate iron for steam boilers for agricultural purposes, ¼ inch thick for shell, and ⅜ inch for heads. How much can I reduce the above thicknesses by using cast steel? A. Make the shell $\frac{3}{16}$, heads ¼ inch thick. 2. Will a boiler made of steel plates in above proportions last any longer than an iron boiler? A. Yes.

(11) T. S. asks: Is there a way to temper iron wire from No. 6 to No. 21? A. No, except by casehardening it.

(12) R. A. McC. says: 1. I wish to put a whistle on the roof of my elevator, which is 38 feet from boiler. Would a whistle work as well as at a shorter distance from boiler? A. The whistle would work well, but not as well as if close to the boiler. 2. Would felt covering on pipe be any help in regard to keeping lead pipe warm? A. Yes, felt covering would answer well.

(13) J. B. asks: Please let me know the simplest rule for finding the diameter of pulleys to run a machine at a certain speed: for instance, main shaft has 90 revolutions and pulley on machine is 14 inches diameter. What size of pulley will I require on main and counter shafts? A. Multiply the diameter of the driving pulley by the number of its revolutions per minute, and divide by the number of revolutions you require your machine pulley to run at, and the quotient will be the required size of the latter.

(14) A. S. says: My doctor pump runs from right to left, and the plungers and stuffing boxes wear to one side. I have examined the pump and found it to be correctly in line, and level. In order to put the wear on the opposite side, could I not set the eccentric of the cut-off round, so that the pump will run in the opposite direction, namely, from left to right? A. We do not think the alteration would affect the wear to one side if the parts are in line.

My partner claims that putting 3 or 4 pieces of wood in the furnace, and then putting on a heap of coal, prevents the falling through of the small coal, the grate bars being ⅝ of an inch apart. I claim that putting one piece of wood into the furnace, and putting a heap of coal on it, will prevent the waste better than his way: because in my way the coal will form a cake, which, when stirred up, will give a good fire, and thus save fuel, time, and labor. Please give us your opinion. A. If the coal cakes, either plan will answer.

(15) E. S. E. says: A practical railroad engineer sometimes dashes water into the furnace, with the result that the sulphur and offensive gas came out in the form of pure white steam. The great draft would make the furnace able to bear a constant jet of water. Can you give any reason why it would not serve as an extinguisher of the objectionable smoke, which now issues from the locomotives? A. The injection of steam into a firebox has been applied for the object proposed, with partial but not complete success.

(16) H. P. O. asks: Of what use is the air receiver on a double-acting steam pump? A. It increases the suction and makes it more uniform.

A friend says that steam at any temperature can be tested by applying a thermometer. I say the thermometer will not indicate the latent heat of steam, or steam above 212°. Who is right? A. You are.

1. We have two shafts sunk to a vein of coal, and a level driven from one to the other, a distance of 1,100 yards. The one shaft ventilates the other. The upcast shaft stands 100 feet higher on surface than the downcast. My boss says that, if there is 10 lbs. per square inch on the mouth of the downcast shaft, there must be the same on the top of the upcast. I say: No, there is not the same amount; for I assert that there is an amount of the pressure lost by friction in traveling. Which are you in favor of? A. You are right. 2. Is the current the same in each direction? A. No.

(17) J. D. B. asks: Is there any difference between the American screw gage and the American wire gage? A. Yes, and the American wire gages of various makers differ.

(18) C. B. R. says: Some time since a blacksmith was forging a large piece of iron, when some of the sparks came in contact with a piece of old lightning rod that was near the forge. At the instant of contact, there was a loud explosion, and a flash of fire by which an old man, sitting by, was severely burned. A part of the rod was turned blue and smelt strongly of sulphur. The explosive substance, whatever it was, seemed to come from the surface of the iron, which was a solid piece. It was on a clear day without any atmospheric disturbance. What caused the explosion? A. The spark was doubtless a globule of melted iron which, being thrown against the rod by blows from the hammer, naturally enough scattered in various directions. It is possible, also, that the rod was wet at the time.

(19) E. A. W. asks: Can you inform me how to place a chair on a table arranged to have endwise, sideway, and up and down motion, so that the chair will not partake of the motion of the table? A. It cannot be done.

(20) J. A. K. asks: A friend has made a kiln of bricks which are well burnt, but are easily broken, and are too soft to stand the test of time. What will make the best wash or coating for these bricks when exposed to the weather? A. If the bricks are soft and easily broken, they are not well burnt, and you will find it very difficult to treat them with any preparation that will enable them to take the place of well burnt brick. Linseed oil may prevent them from absorbing as much water as they otherwise might, and this will cause them to last a little longer.

(21) H. K. Sr. asks: 1. What is the best speed for a grindstone 5 feet in diameter, to grind plows? A. Run your stone at 300 revolutions per minute. 2. How many horse power should an engine have to drive such a grindstone? A. About 4 horse power.

1. Can you give me a good recipe for hardening plow mold boards? A. To 4 gallons of water add saltpeter 1 oz., sal ammoniac 1 oz., and salt ¼ lb. 2. Does "Wrinkles and Recipes" contain such information? A. Yes.

(22) E. T. H. asks: 1. I want to make a magnet to place in a fire alarm telegraph circuit. The circuit is composed of about 6 miles of wire, with 15 stations. Of what size shall I make my magnet? A. Make the coils of copper wire, and let the resistance be 25 or 30 ohms for each magnet. 2. In a late number of your paper, Mr. Sawyer says that it requires 10 cups of Grove's cells to heat a fragment of platinum wire. In a former number, in an illustrated description of an hydro-electric lamp, the illustration shows only 1 small cup. What is the smallest amount of battery power required to heat platinum wire to a red heat? A. That depends upon several circumstances. A single cell of bichromate battery (without porous cup) will heat from a quarter to half of an inch of No. 46 platinum wire to a white heat.

(23) H. C. E. asks: 1. Of what diameter should a steam whistle be for a boiler 30 inches in diameter by 48 inches high? A. About 2½ inches. 3. Of what kind of metal should it be made? A. Use a good composition, say copper 80, tin 16, zinc 4 parts.

1. Are spur wheels used for connecting propeller shaft to engine shaft? A. Yes, sometimes. 2 Is a shaft of patent cold rolled iron 1½ inches in diameter strong enough for a propeller 18 inches in diameter, the shaft being 7 feet long? A. It is rather too small in diameter.

(24) A. H. T. says: I have constructed a Jamin magnet, but have failed in magnetizing it on account of its peculiar shape and form, not having been able to apply the electro-magnet to the surface of the steel ribbons. Wishing to construct a magnet of great power, I ask your advice how I am to proceed in magnetizing it. What power of battery, and what form of magnet am I to use? A. We think you should be able to charge it with a bar electro-magnet. Two or three large sized cells will magnetize the latter strongly if the coils are properly constructed.

(25) I. H. C. says: How can I make a battery that will give one a small shock? A. It will require a number of cells to give much of a shock. A small electro-magnetic induction apparatus, often termed a medical machine, will suit you better. For its construction, see almost any school book on natural philosophy.

(26) A. H. asks: 1. What amount of electricity is meant by 0·02 of a weber, and how is it ascertained? A. The weber is an electrical unit by means of which electricians are enabled to convey definite information regarding the strength of a current. Its magnitude is such that the unit of electromotive force, called a volt, divided by the unit of resistance, an ohm, equals one weber; 0·02 of a weber is the strength of current usually employed on telegraph lines to work the ordinary Morse relays. 2. Does the consumption of materials in a battery vary inversely as the resistance of the circuit? A. Yes, aside from local action in the battery. 3. What relation do they sustain in that respect? A. The less the resistance, the greater the action. 4. Would it be economical to insulate the return wire of a short telegraph line? A. No.

(27) T. C. M. says: In a sheet copper vessel, the sulphate of copper solution, after being allowed to stand for a few weeks, has deposited a hard, greenish coat, which prevents the working of the battery of which it forms a part. How can it be removed? A. We have never met with this in our

experience, and are at a loss to give the information asked for without more definite knowledge of the fact. Is there not some other reason for the exhaustion of battery power?

(28) H. M. says: Forty years ago a surveyor laid down a line due north with a compass; 25 years ago another surveyor examined the same line with a theodolite, and called it N. 14° E. Recently a third has examined it, and pronounced it N. 17° E. Can the discrepancy between the two last be explained without inferring error in one or other of them? They are both astronomical surveys. The last surveyor asserts a change in the magnetic meridian. Please explain what that means, and its bearing on this case. A. The magnetic meridian is the line in which a freely suspended magnetic needle places itself when in equilibrium. There are but comparatively few places where the astronomical and magnetic meridians coincide. The latter varies from year to year, but the reason for this does not seem to be definitely ascertained. There are also slight daily variations. These are generally supposed to be caused by the sun.

(29) S. R. says: I have made a trough battery to generate a current for an electric light. The cell or trough is 24 inches x 9 x 9, and the plates, copper and zinc, are dipped into the acid. 1. Will ¼ inch apart be enough to separate the plates? A. Yes. 2. Will slips of baked wood, covered with a solution of shellac and rubber, do to separate the plates with? A. Yes. 3. What should be the size of the conducting wires? A. No. 14 copper wire will answer. 4. How can the wires be connected to the plates? A. By solder. 5. Would such a battery be good for the purpose? A. Not very. 6. Will lead pencils do for the carbon points? A. Yes.

(30) M. C. asks: 1. What is the best method of ventilating a private house? A. Do not let your furnace man use the smoke flues of the rooms for heating flues, but provide a fireplace and flue for each room independent of the heating flues, and keep said fire flues partially if not wholly open. Provide a strip of plank 3 inches wide, of the same thickness as the lower sash of the windows and of a length equal to their width; raise the lower sash, put this strip under it horizontally and bring the sash down upon it; the fresh air will now enter the room at the meeting rails of the sashes without causing bad drafts in the room. 2. What kind of furnace will be most serviceable for heating such a house? A. The best kind of heater is a hot water furnace, the next best is a steam furnace, and the worst is a hot air furnace.

(31) J. H. F. asks: Which is the most durable red stone? A. The Belleville, N. J., brown stone is a very durable stone; the Connecticut brown stone is of the finest grain and most uniform quality.

(32) C. H. R. says: In trying Mr. Edison's experiments, as shown in your paper of December 23, I find I can get all the results which you state can be obtained with an ordinary relay; and in addition I find that, by putting this relay in circuit (battery is a five cup Callaud), letting the armature rest on the core, and grasping the negative post of the relay with a pair of pliers in the left hand, and breaking circuit at same post with wire held in right hand, I get a shock, and a spark precisely like that from the magnet, as in Mr. Edison's experiments. By making the hand wet, the shock seems greater. A shock and spark can be got by touching any part of the post or pliers; and by a quick motion, the sensation is much like a magneto-electric pulsation. A. The shock is caused by the extra current which arises from the induction of the battery current on itself in the coils. This current and the so-called ethoric force are generally supposed to be identical. Possibly your magnet is not insulated from the surrounding coils.

(33) H. O. says: Having just fitted a house with black ash, will you kindly inform me of the best method of finishing it? Varnish will not do and French polish is too expensive. A. Give it a coat of shellac, and then a good coat of boiled linseed oil.

(34) J. and J. T. say: We are building a church, and a dispute has arisen about the proper shape of the elliptic ceiling. Please decide for us. The building is 50 feet x 32, with 12 feet posts. How far down on the post should the elliptic begin, and how high above the posts should it be in the middle? The strength of construction is with us a very important part. A. Your plan is defective in respect both to strength and to hearing. With a ceiling so low, you would do better to adopt an open timbered roof. You would require only three trusses; let the tie of these trusses consist of a beam 5 feet long at each end, supported upon ornamental brackets, and tied together with a 1¼ inch iron rod; let the principal rafters over these ties be arched from the projecting ends of the tie beams, and ornamented back of the arch; bring down an iron pipe from the point of the arch to cross the tie rod and fall below it and carry a chandelier; at the junction of the pipe and rod, secure one to the other, and cover the connection with an ornament. An arched ceiling is likely to cause an echo.

(35) O. A. Jr. asks: In a steam boiler whose shell is of 38 inches diameter, with a 23 inch flue running through it, 8 feet long, ⅓ of flue being in the grate and the balance in the firebox, how much effectual heating surface will there be? A. As ordinarily reckoned, the effective heating surface would be the surface of the flue in contact with the products of combustion, and half the remainder of the surfaces which these products heat.

What compound makes a good bushing for steam governor valves? A. We have known both hard brass and good cast iron to be used with satisfactory results.

(36) S. H. B. says: I want to build a skiff of common poplar planks about ¾ x 16 inches wide and 16 or 18 feet long. The boat is to be about 4½ feet wide, with two sets of rowlocks. I want it to run as fast as possible. Will you please state the way to build such a skiff? A. Probably some of our readers, who have constructed similar boats, can give our correspondent more useful information than any we can furnish. If so, we would be glad to hear from them.

(37) S. A. H. asks: What is the compressibility of air? In a tube of 1 square inch area and 1 inch deep, placed vertically, and closed at the upper end, how far would 15 lbs. pressure, plus the atmosphere, force water? A. If the temperature of the air is kept constant during the compression, the pressure varies inversely as the volume. You will find the principles relating to the expansion and compression of air in any modern text book on physics.

(38) O. T. says: I have a bent glass tube inserted into the flue leading to a boiler chimney. The tube is filled with water to a certain hight when the damper is closed: and when the damper is open, the water in one leg of the tube is depressed $\frac{7}{10}$ of an inch, and in the other leg is raised $\frac{7}{10}$ of an inch. The chimney is 100 feet high. Will you please give me a rule to obtain the velocity of the draft in the flue in feet per minute? A. We could not give you a formula from these data alone that would be very reliable. You will find considerable information bearing on the subject in Spon's "Dictionary of Engineering," vol. I, article "Anemometers."

(39) F. M. T. says: I am about to construct, of oak, a boat as follows: 56 feet long, of 8 feet beam, and 3 feet 6 inches draft. Diameter of propeller is to be 3 feet 6 inches, driven by two engines each of 7 x8 inches stroke, by steam at 100 lbs. pressure. Approximately, what speed will I obtain from her? A. If the boiler furnishes plenty of steam, you may reasonably expect to realize a speed of between 7 and 8 miles an hour in smooth water.

(40) A. H. N. says: I am about building a boat of the following dimensions: 11 feet long, 2 feet 9 inches wide, to draw about 1 foot water. I wish to propel her about 3 miles per hour by means of a twin screw, to be worked by hand. Please tell me the diameter, pitch, number, and size of blades necessary for such screws? A. Use propellers of as large diameter as you can conveniently attach, each with three blades. The pitch can be determined by dividing 400 by the number of revolutions per minute, which latter should be as large as can be obtained without introducing complicated gearing. This allows for a slip of a little more than 30 per cent.

(41) G. F. McI. says: Would it be safe and practicable to feed a boiler from the top with cold or hot water? A. It would be practicable, but not advantageous.

(42) A. C. asks: What is the best way of building a float for fowling purposes, large enough to hold two men, for use on salt water where there are waves from two to four feet high? A. It would be a good plan to make the boat very broad in proportion to its length, either decked over entirely with the exception of wells for the occupants, or provided with wide swashboards. We have seen lightly built cedar boats, about 7½ feet long and of 4½ feet beam, drawing 8 or 9 inches with two passengers, cat-rigged, with center boards. Such a boat would stand a very heavy sea when the mast was unstepped.

(43) R. I. C. says: I have a mill with a 40 horse engine driving a pair of 4 foot burrs. How much wheat should such rocks grind (making good flour) per day? A. The data are hardly sufficient for a good guess, and we would prefer to hear from you what you are doing. Perhaps some of our readers who have similar mills will also be kind enough to send us some account of their performances.

(44) J. V. S. asks: How is it that *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*? A. According to the views of modern analysts, it is a conventional rule or definition. In many works on algebra, an attempt is made to demonstrate the principle, but it is generally faulty, and must be so, if the other view is the correct one. A good illustration of the modern treatment of the subject may be found in the chapter on "Negative Quantities," in Todhunter's "Algebra."

(45) J. L. W. says: We have many driven wells in Hamilton, Ohio, and find that the common gas pipe will not last more than a year in some, while similar pipes have been in wells for a number of years, and are still good. Even the galvanized pipe will not stand in places. The soil is gravel and clay: can you explain the cause? A. If the water has an acid reaction, you cannot prevent this corrosion. In such a case, use pipes lined with lead, tin, or porcelain.

(46) L. H. J. asks: What number of Callaud cells is necessary to run a telegraph line of 3 miles, ground return, using two instruments of low resistance? A. Twelve, if the grounds are good.

(47) R. F. asks: Why is it that the telegraph cable operators at Heart's Content, Newfoundland, can tell what messages are passing over the French cable that lands at the islands of St. Pierre and Miquelon, the cables being at least 200 miles apart at their nearest points? A. They cannot do so.

(48) C. E. A. says: I have tried the experiment of connecting my telegraph machine with an alarm clock (for the purpose of making the sounder go like the hammer bell in the clock) to wake me up. I connected one wire from the machine to the bell, and the other with the brass frame of the clock, to which, of course, was connected the hammer which strikes the bell. When the hammer strikes, it completes the circuit, on the same principle as a telegraph key and thereby make the sounder click; but it did not work at all. I have on an ordinary current, so that, when the operator at the other end calls me, it wakes me up. A. The arrangement is very simple and ought to work. Perhaps you have not made the connections properly. Test them by connecting a wire across from the wire leading to the frame with the one leading to the bell, and see if the armature of the instrument will respond.

(49) P. L. S. asks: What kind of gas comes from sewers? A. It consists principally of sulphuretted hydrogen and carbonic acid gases.

(50) A. C. H. asks: When the zincs of a galvanic battery are amalgamated with mercury, and then exposed to the atmosphere for some days before using them, does the mercury evaporate from the surface of the zinc? I notice that zincs under such circumstances lose their bright silvery appearance and become dull and leaden looking. A. No. The mercury remains there, and, if the zinc is brushed, will appear bright and silvery.

(51) J. H. S. asks: 1. What is the best way of renewing the strength in a carbon plate used in an electrotyper's battery? A. A carbon plate in a battery has no power capable of being renewed. You must renew the acid when your battery becomes weak. 2. What will prevent a deposit of copper from sticking on a brass plate? A. Cover the plate with black lead.

(52) G. V. says: A friend of mine owns a pasture of several thousand acres in Texas. There is no water on the premises except a pond. In dry seasons the pond gets dry; and the distance of the nearest running water being about four miles, it causes much trouble on the ranche. He is spending a great amount of money in having holes dug in the ground in different parts of the pasture, and thinks he will get water if he only goes deep enough. Is this so? A. Perhaps he will. Water was obtained in the Sahara desert by means of driven pipes.

(53) J. E. asks: I want a place in which to keep fresh fish, packed in ice, in barrels or boxes. What would be the best plan for a building, 12 feet square and 7 feet high, so that the fish would keep for 6 days in hot summer weather? A. The ice should be kept as much as possible in a solid mass. Construct a small ice house about 8 feet cube, and provide a basement under it in which to keep the fish. The whole should be tight like an ordinary ice house, say with the frame 10 inches thick and filled in with sawdust. But ventilation and drainage should be provided; and if a current of air should be made to enter at the top and to descend through the ice and out through the basement by artificial means, it would be better.

(54) F. & S. ask: How can we color glue white? A. Boil the glue in a little water and add a small quantity of alum finely pulverized; allow to stand all night and then separate *from* the precipitate of organic matter, etc. The Cologne glue is made from offal that has been treated with chloride of lime after the usual process of liming, and is thereby bleached. It is pale but very strong. Commonly there is no acid used in the process of manufacture of glue, except those (lactic, butyric, propionic) that constitute the active principle of the oak-bark liquor used to remove the last traces of lime from the materials before boiling. In the manufacture of fine glue from bones, large quantities of hydrochloric acid are used.

(55) J. C. F. asks: Is there any kind of white composition or cement that will render a wooden vessel impervious to rain and water, so as to keep butter or lard sweet? A. Use melted paraffin.

(56) C. J. H. says: 1. On p. 268, vol. 33, you give a recipe for making ink. How shall I manipulate the ingredients? A. Boil the galls (finely pulverized) in the water for about 2 hours, occasionally adding water to supply the loss by evaporation; then add the sulphate of indigo, and finally the spices. Keep the whole for about two months in a wooden or glass vessel, which should be occasionally shaken. Then strain into bottles for use. 2. Is the sulphate of indigo used as it is sold in the shops, or should it be neutralized? If it is to be neutralized, how should it be done? A. The indigo may be obtained, already prepared, from any dealer in drugs. It is sometimes called indigo carmine.

(57) G. A. H. asks: In your issue of January 15, you state in an article headed "Spiritual Photography" that a solution of sulphate of quinine on a background will be invisible to the eye, and will yet appear on the exposed plate. What strength of solution is necessary? A. Use a strong solution of the sulphate with a little tartaric acid.

(58) G. D. asks: How can I make a first quality hard soap from lye from ashes and tallow, with other ingredients to harden it? A. The fats, oils, etc., are saponified by boiling with caustic lye for some time. A sufficient quantity of common salt is then added to precipitate the soap from its alkaline solution; the soap is then pressed to remove superfluous moisture and to give it form, and finally dried. Most of the common yellow soaps usually contain resinous bodies, sand, borax, etc., in their composition.

(59) P. A. K. asks: How can kerosene stains be taken out of carpets? A. Sprinkle good dry pipe clay over the spots and pass gently over it a hot iron. Allow the clay to remain some time in contact with the carpet, and then remove by means of a good stiff brush. Repeat the operation if the first trial proves ineffective.

(60) C. M. D. asks: What quantity of ether should be used to dissolve 3 ozs. shellac and 1 oz. india rubber? A. India rubber is so slightly soluble in ether that to dissolve the quantity of rubber you mention would require an immense quantity of very pure ether. Cut your rubber into small pieces and dissolve it in 34 ozs. hot naphtha, by constant agitation; add to this the shellac in a very fine powder, and heat the whole with constant stirring until the shellac is dissolved.

(61) J. H. C. asks: I racked a barrel of cider off twice and then attempted to fine it with isinglass. After standing three weeks I again drew it off, and found the isinglass at the bottom, like mud, but the cider is not as clear as before. Is a quantity of the isinglass held in solution, and will it eventually fine down? A. It will probably clear after some time. You added too much gelatin.

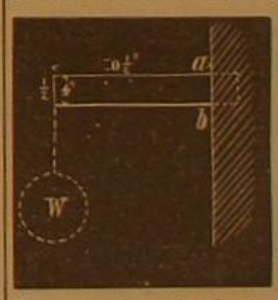
(62) T. A. H. asks: 1. Is not immersion in steam under heavy pressure one of the steps in the process of vulcanizing india rubber? A. No. 2. What amount of heat will india rubber or gutta percha, vulcanized or not vulcanized, endure when immersed in steam or water, without deterioration of its strength or elasticity? A. Caoutchouc melts in the air at a temperature of 302° Fah., with partial decomposition. It is reasonable to suppose that steam above that temperature would accomplish the same result.

(63) R. N. B. asks: Are there any adhesive properties in Irish moss? A. Yes, when it is converted into jelly.

(64) S. C. says: I have a side wheel steamer with a low pressure engine of 35 inches diameter and 9 feet stroke, cutting off at 12 inches travel of piston. It runs at 30 revolutions per minute. A vacuum occurs on the steam side of the piston when the piston has traveled 4 feet of the 9. Is there not a loss of power, and therefore of fuel, by this arrangement? A. If the engine exerts sufficient power, we do not see any objection in the arrangement, on account of the pressure in the cylinder falling below that of the atmosphere, as long as the positive pressure on the piston is less than the back pressure. It is possible, however, that the steam is for other reasons cut off too short for economical working.

(65) F. W. F. says, in reply to H. J. S., who asks as to pressure for compressing bales of cotton: In your issue of January 15, you say: "About half the pressure" or "same force." I think that you mean one half of 100 tuns when you say the same force. Do you not? Some weeks ago I asserted that a cotton press with a box 2 x 4 x 10 feet, containing 80 cubic feet, would require but ⅖ of the power that is needed by one 2 x 5 x 8 feet containing 80 cubic feet. Am I right? A. In the query referred to, the language is that of our correspondent H. J. S. We understood that the expression "half the pressure or same force" meant that there would be half the original pressure, or half the original force, or half of 100 tuns. We are sorry, however, if our answer influenced you at all in making the assertion that a press with a follower 2 x 4 would only require half the power of one with a follower 2 x 5, each compressing alike. Pressure is one thing and power is another, as we have frequently pointed out. Thus, in question 14, p. 43, when the bales were placed one on top of the other, the pressure required would be only half as great; but it would require to be exerted over twice the distance in the same time, to produce the same effect as when the bales were placed side by side.

(66) C. L. C. says, in reply to W. A. R.'s query as to the breaking weight of a bar of iron 10½ inches long, ½ inch wide, and 4 inches deep, supported at one end only with weight applied at outer end: Let l=length =10½ inches, d= depth=4 inches, b= breadth=½ inch, W=weight required to break the beam, and c=constant=to 2,400 lbs.



Thence we have, for the shearing strain, S, at the point, a b: $S = \frac{d^2 \text{ in inches} \times b \text{ in inches} \times \text{constant}}{4 \text{ times length in feet}}$.

$\therefore W = \frac{d^2 \times b \times c}{4l} = \frac{16 \times 0{\cdot}5 \times 2400}{3{\cdot}5} = 5485{\cdot}7$ lbs. This weight may only bend or cripple the beam, as the constant is the average breaking weight of a bar of iron 1 inch square and 1 foot long, supported at both ends and loaded in the middle. If the weight is equally distributed along the whole length of the beam, W will=$5485{\cdot}7 \times 2$ or $\frac{d^2 \times b \times c}{2l}$

To derive the full strength, the beam must be so secured as to prevent lateral motion, which would tend to buckle the bar before the maximum strength was reached.

(67) E. H. S. says, in reply to J. D. H., who inquires how to thicken stove patterns: It can be done by first waxing the pattern, then taking strips of muslin cut to a proper width and laying them on the pattern, so that the edges will just meet, then pressing them into all depressions, and again waxing over. This may be repeated until the required thickness is reached. I have frequently tried this and never failed.

(68) W. E. C. says, in reply to J. M. S., who inquired as to the cause of bursting his main valve when steam is turned on: I burst a 4 inch valve once in the same way, and there was no ice in the pipe. Steam turned into a pipe containing water comes in contact with the water, a portion of the steam is condensed, and a vacuum is formed, drawing the water back. The steam pressure again thrusts it forward until it arrives at the end of the pipe or valve; and the water, being nearly a solid substance, strikes the valve with nearly the same force as a mass of iron driven with the same velocity. Of course the valve is not broken at the first blow; but the blows are repeated until the

water nearest the steam is heated. This also is the cause of thumping in steam pipes used in heating buildings. An outlet for the water destroys part of the force of the blow, although there is danger then if steam is turned on too suddenly.

(69) D. L. says, in reply to J. R. A., who asked how to cure cracked heels in horses: Take powdered gum camphor ½ oz., powdered gum myrrh 1 oz., sulphuric acid 1 oz., spirits of turpentine 1 oz., and lard 1 pint. Mix thoroughly, and rub on the affected limbs once a day. Wash the legs with soapsuds, and wipe dry before using. To prevent the affection, keep your stable and lot clean, and be sure that your horse is well groomed.

(70) H. S. J. says, in reply to J. M. H. Jr., who asks for a recipe for decalcomanie varnish: For preparing a fastening varnish for sticking the pictures to the object, take 5 ozs. Canada balsam (frequently called balsam of fir) and 1 oz. each of alcohol (90 per cent) and spirits of turpentine; mix thoroughly, and let stand a few days. For finishing, use white dammar varnish, or a varnish made of bleached shellac 2 drachms, dissolved in 10 ozs. stronger alcohol.

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

X. X. Y.—All the specimens contain iron, but not in paying quantity.—J. S. B.—No. 1 is quartz sand, no emery or corundum. Sulphuret of iron is valueless.—A. M. S.—The boot lining is dyed with aniline green.—F. M. M.—The water is hardly entitled to the name of mineral, inasmuch as many natural waters contain as much mineral matter of a similar character, and are not supposed to be of a medicinal character.—R. F. A.—Your ferrotype plate is probably coated with a fine variety of japan varnish.

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 Witch Wand. By C.
On Eating Quails. By C. W.
On an Electric Shock. By J. C.
On Capital Punishment. By C. W. E.
On a Psychological Phenomenon. By A. Y. M.
On Poisonous Plants. By H. H.
On Bank Robberies. By M.
On Consumption. By I. R.
On Aerial Navigation. By E. R.
On Restoration of Life. By C. F. S.
On Puget Sound. By G. W. B.
On Thoughts on Astronomy. By W. C.

Also inquiries and answers from the following:

S. H. L. Jr.—J. P. M.—C. V. B.—D. M. N.—C. J. M. —C. F. E.—J. K.—B. L.—H. T.—A. H. T.—F. T.—T. W.—J. B.—G. P.—J. C. D.—F. K.—N. T. W.—J. J. —P. S.—G. D.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Where can hives of bees be obtained? Who sells small engines? Who sells rotary rock drills? Who sells an ice-making machine, capable of making 2,000 lbs. per day? Whose is the best railroad tie? Where can rubber-coated duck, etc., cloth be obtained?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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Water wheel, J. Haseltine (r) 6,878
Water wheel, Newman & Powell 172,645
Well point, drive, J. Dollard 172,717
Wheelbarrow, P. L. Weimer 172,802
Wind power, C. Schneider 172,784
Windlass, D. N. B. Coffin, Jr 172,556
Windmill, G. Mable 172,755
Window shades, making, M. Lachman 172,634
Wire, pressing barbs on, E. W. Mitchell 172,760
Wrench, J. R. Brown 172,551
Wringer, N. B. Phelps 172,652

DESIGNS PATENTED.

8,922.—PHYSICIAN'S CHAIR.—A. Abel, New York city.
8,923.—COFFIN HANDLES.—M. H. Crane, Cincinnati, O.
8,924.—BOOT TIPS.—J. E. Curtis, Marlborough, Mass.
8,925 to 8,927.—FLOOR CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
8,928.—CARPETS.—C. A. Righter, Philadelphia, Pa.
8,929.—CARPETS.—A. Baye, London, England.
8,930.—TOP.—H. N. Black, Philadelphia, Pa.
8,931.—WOVEN FABRICS.—A. H. Miller, Philadelphia, Pa.
8,932.—INKSTANDS.—E. W. Smith, Brooklyn, N. Y.
8,933 to 8,935.—CARPETS.—T. J. Stearns, Boston, Mass.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, January 28 to 31, 1873.

5,612.—H. A. E. Lefort *et al.*, Montreal, P. Q. Watchman detector. Jan. 28, 1876.
5,613.—J. L. Massie, Cowansville, P. Q. 1st extension of No. 4,237. Heater. Jan. 27, 1876.
5,614.—J. L. Massie, Cowansville, P. Q. 2d extension of No. 4,237. Heater. Jan. 28, 1876.
5,615.—M. MacVicar, Potsdam, N. Y., U. S. Apparatus for illustrating geography, etc. Jan. 28, 1876.
5,616.—T. J. Sloan, New York city, U. S. Thawing frozen water pipes. Jan. 28, 1876.
5,617.—W. W. St. John, Philadelphia, Pa., U. S. Piston packing. Jan. 28, 1876.
5,618.—W. A. Durrin, Wilson, Wis., U. S. Stake. Jan. 28, 1876.
5,619.—C. P. Baghott *et al.*, Hamilton, Ont. Lock nut. Jan. 28, 1876.
5,620.—M. E. Dow, Manchester, N. H., U. S. Advertising device. Jan. 28, 1876.
5,621.—J. H. Wickes, New York city, U. S. Refrigerator. Jan. 28, 1876.
5,622.—H. H. Nash, Baltimore, Md., U. S. Life-preserving stool. Jan. 28, 1876.
5,623.—F. Schorn *et al.*, Petersburg, Ont. Bed bottom. Jan. 28, 1876.
5,624.—W. P. Buckbee, Smithville, Ont. Drum heater. Jan. 28, 1876.
5,625.—H. T. Marshall, Brockton, Mass., U. S. Boot and shoe nail. Jan. 28, 1876.
5,626.—A. Syversen, Chicago, Ill., U. S. Stove pipe elbow. Jan. 28, 1876.
5,627.—C. F. Rapp, Cincinnati, Ohio, U. S. Hydrant. Jan. 28, 1876.
5,628.—C. F. Rapp, Cincinnati, Ohio, U. S. Hydrant. Jan. 28, 1876.
5,629.—C. de Quillfeldt, New York city, U. S. Bottle stopper. Jan. 28, 1876.
5,630.—S. Thomson, Malvern, Ont. Plastering. Jan. 31, 1876.
5,631.—D. Sanford, Ashton, Ill., U. S. Fireman's ladder and fire escape. Jan. 31, 1876.

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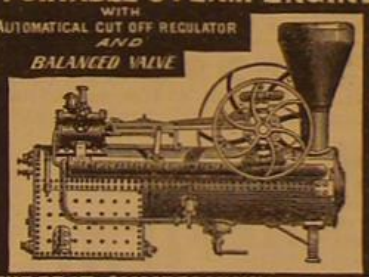
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Vol. XXXIV.—No. 10. [NEW SERIES.] NEW YORK, MARCH 4, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

AUSTRALIAN COAST DEFENCES.

Some time since, the Government of Great Britain withdrew the troops which were usually kept doing a kind of garrison duty in the colonies, and left the colonial administrations to defend themselves from any sudden attack, of course holding itself in readiness to dispatch ships and regiments to any place as soon as the news of intended or actual hostilities reached a military or naval station. The Australasian colonies have, therefore, constructed floating batteries and men-of-war for harbor and coast defence, which are, for the most part, manned by volunteers.

We publish herewith an engraving of a powerful ironclad, the Cerberus, belonging to the colony of Victoria. She cruises around the mouth of Port Philip Bay, and is powerfully armed, carrying four heavy guns throwing shot weighing 400 lbs. each. The guns are erected in two bomb proof revolving turrets; and the deck of the ship, when she is ready for action, is only about 26 inches above her water line, the vessel then drawing about 16 feet 6 inches of water. An additional revolving turret, carrying 1 gun, is placed in her bow, and a similar one in her stern. She is propelled by twin screws with four blades each, driven by powerful engines.

The Peabody Dwelling Houses in London.

According to the London *Daily News*, there are now ten blocks of improved dwellings for the poor of London, to testify of the wisdom and generosity of George Peabody. The last, still in the course of erection, promises to be the largest of all, for it stands on five acres of ground and numbers thirty-six blocks, twelve already far advanced.

Of the completed congeries of homes already opened, the latest is in Southwark street. It is a substantial building of twelve blocks, and, taking the average of four in each family, will supply house room for about one thousand persons. In each block there are twenty-two tenements, a few consisting of one room, some of two, and many of three, but each absolutely self-contained, and all as private as if they were flats in Victoria street, or in the Rue du Faubourg St. Honoré. The three room tenements consist—to take an average example—of a kitchen 15 feet by 12, a bedroom 16 feet by 14, and a second bedroom 12 feet by 16 The floors are boarded over, the walls are cemented, and all are at present beautifully white. There is a fireplace in each room, that in the kitchen being furnished with a capital oven and boiler. There are several cupboards, one in the kitchen having over it a meat safe, with doors of perforated zinc. In the passage outside is a coal bin of neat and ingenious construction, capable of holding half a ton. On each flat there is a laundry, with copper boiler, a wringing machine, and mangle. This is devoted to the use of four families, who have the privilege of occupying it by turns one day a week. Each flat has a dust shoot, the tenants having no further trouble than to open it and drop down the contents of their shovels. Nor does this conclude the list of special accommodations in these wonderful mansions. In an underground room of each tenement there is a capacious bath, to which the tenants have access without charge, and as often as they please, there being no other necessary preliminary than that of calling at the superintendent's office for the key. Gas is provided in the wash houses and through the roomy staircases, also at the expense of the trustees. The rent of a three-roomed tenement is $1 38 a week; for two rooms, $1.08, and for one room, 72c.

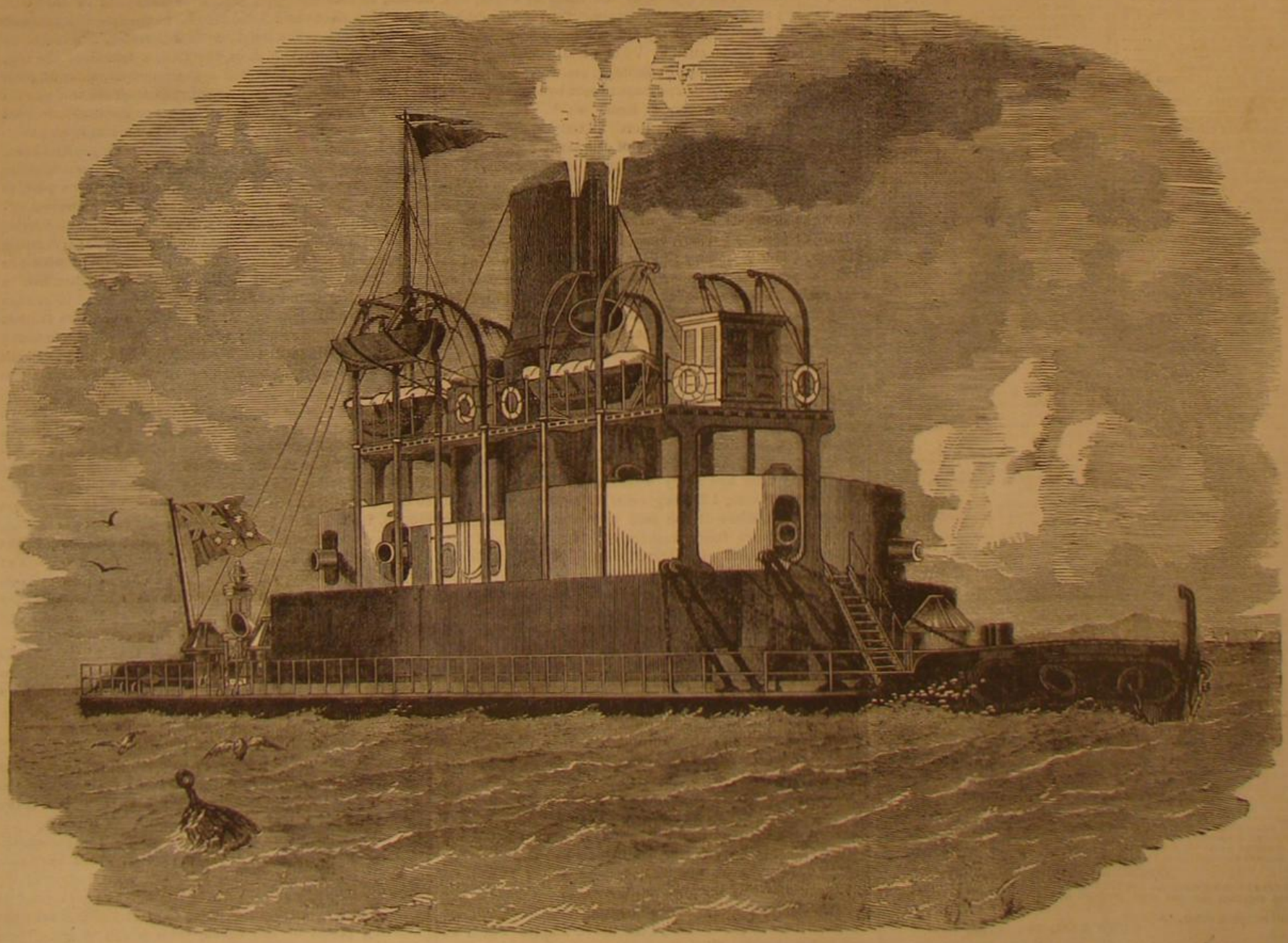
A striking feature of the management of these dwellings is the absence of arbitrary interference with the liberty of the tenants, the few simple rules enforced looking simply to the order, cleanliness, and general good of the community. Rents are insisted on weekly in advance, and the houses are always full. The tenants are strictly of the laboring classes, it being an unprinted rule of the place that no man earning more than $5, or at most $6 a week, is eligible for admission. Nothing else is required of an incoming tenant further than a voucher of his respectability, generally sought at the hands of his employer; and other things being equal, the superintendent makes a practice of giving the preference to families where the bread winner is engaged at a distance not too remote to prevent his returning home to take his dinner with his family.

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The Sardine Trade—A New Utilization of the Grasshoppers.

Itt is officially reported by the French Minister of Marine that the sardine fisheries are gradually diminishing in yield. The reason is not that the fish are becoming scarce, but that the supply of bait used, the roe of the codfish imported from American fisheries, has become inadequate to meet the demand. It has lately been found, however, that grasshoppers, pounded into a paste, imitate the roe so exactly that the most knowing of the sardines cannot distinguish the difference; and accordingly the French government has imported large quantities of the insects from Algeria in order to try the new bait on a large scale. This fact of the grasshoppers being good for fish bait might be looked into somewhat further here, and it may appear that the insects which yearly ravage our western country, may be turned to good account for catching fish indigenous to our waters.

It is interesting to learn, *apropos* of sardines, that the United States is the largest consumer of the fish, which are exported, as is well known, in tin cans packed in oil; but on the other hand, it has been discovered that fully 40 per cent of the fish which we buy as sardines are not genuine, but are young



AN AUSTRALIAN MAN-OF-WAR

sprats, mackerel, and other common species. A syndicate has lately been established in France to watch exports in the future, and prevent the sale of such fish as are not genuine and of marketable quality. The ordinary yearly production of sardines in France now reaches 500,000 cases.

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VOLUME XXXIV., No. 10. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, MARCH 4, 1876.

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THE SCIENTIFIC AMERICAN SUPPLEMENT.

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INDUSTRIAL ART.—SOME THOUGHTS FOR THE CENTENNIAL.

A correspondent, referring to our recent editorial on what working men might contribute to the Centennial, in which we deprecated nickel or silver plating on handmade metal articles, and suggested file, polishing as a more workmanlike finish, asks whether we are not opposed to ornamentation of machinery or tools, and whether we do not think that artistic design is superfluous in implements or materials meant for "solid work." To this, we reply emphatically in the negative; and we have a few remarks to offer relating to the subject, which may be timely in their bearing upon the approaching exposition of our industries. It may be laid down as an unfailing rule that, when any person is given the choice of two articles, identical in every respect save that of grace of form or beauty of decoration, the handsomer will certainly be selected. This appears to be a simple enough proposition; but when it comes to be applied to great classes of manufactured products, those who make the latter seem to forget it, or at most to accord to it but very little attention. The majority of mankind even go further in their predilection for the tasteful, and in nine cases out of ten will prefer an inferior article of beautiful design, to a really superior object of homelier appearance, the gain in beauty compensating for the lack of usefulness. Several times a year dry goods dealers heap their counters with fabrics of elegant patterns; out of a variety of styles perhaps half a dozen may be "the rage," simply because of their beauty. As a result the resources of the manufacturer are taxed to the utmost to produce the particular kinds of goods demanded, and both manufacturer and dealer gain large profits on the favored fabrics. And yet these very goods may be identical, in every thing but dye or mere pattern, with whole bales of material which the dealer can scarcely get rid of at any price. The same is true of carpets, of wall paper, of crockery and glassware, of any of the varied products into which artistic design may enter. People will pay for beauty, pay for it on a scale which cannot be measured by any standard. They may examine their purchases for other qualities never so closely, may gage durability or strength or efficiency or internal composition to hairbreadth accuracy; but artistic finish and tasteful form defy us to judge how much money is commensurable with a given amount of elegance.

Not long ago a very wealthy merchant of this city paid $60,000 for a single painting about four feet in length by less than 3 feet in hight. From a purely utilitarian point of view, the picture was a mere bit of painted canvas, useless even as a fire screen; from an æsthetic standpoint it represented a fortune. The same merchant lately paid $9,000 for a block of marble. As a hitching post, that block would have been worth its cartage to the place where it was needed; as a sculptor's masterpiece, possessing exquisite beauty, its value exceeded even the large sum paid for it. We can proceed a step further, and glance at the amounts which, as a nation, we pay out for mere beauty. During the three months ending September 30, 1875, we imported $1,749,655 worth of fancy goods, such as Vienna trinkets, Swiss carvings, etc., $310,429 worth of paintings, statuary, and photographic pictures; and to this perhaps should be added $181,665 worth of jewelry and precious metal work. In the year 1875, we imported fancy goods worth $6,005,940, figures indicating nearly threefold the value of the similar imports of 1865. So much for the beauty we buy of other nations. Let us now compare these figures with those representing the artistic articles that we sell. For the three months above mentioned our domestic exports of fancy goods amounted to $90,250, of jewelry $19,307, and of paintings, including engravings, $46,079. Fancy articles we do not find quoted at all on the yearly tables; nor have we any such industry as their exclusive manufacture. For the quarter of 1875, however, we imported $2,241,759 worth of articles valuable principally for their beauty, and exported the same to the value of only $155,636.

To carry out our examination of this subject still further, we give here a list of the numbers of all persons engaged in artistic pursuits or callings which have for their end the decoration of raw products. There are 775 painters, 250 sculptors, and 2,948 general artists, 108 teachers of drawing and painting, 2,017 architects, 1,169 artificial flower makers, 208 bone and ivory workers, 79 bronze workers, 7,558 photographers, 4,226 engravers, 569 galloon and tassel makers, 1,534 gilders, 18,508 gold and silver workers, 970 mirror and picture frame makers, 85,123 painters and varnishers, and 223 plaster molders. Total 126,265. This aggregate is a little larger than that of all the teamsters and dairymen in the country; it is very much less than that of the blacksmiths, and it about equals that of the teachers. In fact, adding together the number of teachers who educate us, and the aggregate of those whose labor involves our artistic culture and refinement, we have a sum which just about equals the total number of tailors and milliners, and is 40,000 less than the total number of clerks.

Abundant evidence, similar to the above, can easily be adduced, first, to show that we import a very much larger quantity of artistic productions than we export, and that but a very small portion of our population is devoted to pursuits of an artistic or semi-artistic nature. What is true of individuals is equally true of nations. France, pre-eminent as the designer of beautiful wares, buys of us $50,000,000 worth of iron, and machinery, and provisions, and sends us $63,000,000 worth of articles, most of which find their way to the stores of the jewelers, the china dealers, and the picture sellers. Italy sends us $2,000,000 worth of art work in excess of the $7,000,000 in staples which we send to her shores. With the exception of these two countries, which for ages have led the world in tasteful and artistic productions, our exports to every other European nation are far in excess of our imports.

In face of all this, it is difficult for any one to see how the country can be otherwise than benefited by the fostering of art culture to its full extent among our workmen. The old world is tributary to us for rough and raw products, and for new means of manufacturing them. We are tributary to the old world for the means of gratifying artistic tastes which cultivate and refine. Let us develope the artistic ability which lies in us, and we are tributary no longer. Let us make our manufactured productions as elegant in shape, as graceful in design, as those of France, and then, and not until then, will we enter in fair competition with that country or any other artistic nation in foreign markets. Nor should we imitate. Copying is but servile work; originality in design the world seeks, praises, and pays for.

The above views we commend to the careful consideration of exhibitors at the Centennial. Many people, we have heard, propose showing machines taken straight from stock without further embellishment or ornamentation; others intend to send samples of their goods irrespective of pattern or design, trusting in the intrinsic excellence of the articles to secure notice and future custom. We think this is a mistake. It costs little to ornament a machine tastefully, and discrimination in selecting the handsomest patterns is easily exercised. The advantage gained will, in a collection of such entries, be twofold: first, we will show the world that we are able to produce tasteful and artistic designs, and, second, we shall have prepared a collection of models of industrial art which will be of the greatest value as an educator and in exciting the emulation of our own people.

A RAILROAD ACROSS THE EASTERN CONTINENT.

The great feat accomplished by the United States in connecting the Atlantic and Pacific Oceans, by a railroad across the United States, is stimulating enterprise in Europe; and it is now proposed—indeed the plan is matured—to connect the Atlantic and Pacific Oceans by a railroad through Central Asia. At a conference of the geographers recently held, Colonel Bogdanowitz explained some of the details of the road, which, it is expected, will overcome one of the great obstacles to the extension of civilization, namely, the separation of a large part of Asia from Europe by vast deserts, in which no means of transit but a railroad could be of any use. A railroad alone can develop the resources of the many lands through which it would pass; and as the mineral wealth of Siberia and the Ural Mountains is well known, the exploration and mining of these regions would be encouraged, and their resources developed.

It is proposed that the road shall start from Nijni-Novgorod, in Russia, where is now the extreme eastern station in the network of European railroads; it will run along the Volga to Kazan, then up the tributary of the Volga, the Kama, to Ekaterinbourg, on the Asiatic side of the Ural Mountains, then enter Asia, proceed in the direction of Troumen and Omsk at the Irtish, cross that river, and proceed by way of Kainsk to Tomsk on the Tom, a branch of the Obi, and cross that river. Tomsk is the principal center of commerce of Western Siberia; and thence the road will run directly to Irkutsh at Lake Baikal. Thence the road is to pass to the frontier of China, and then it is no longer an exclusively Russian, but an international undertaking. And here, also, the only serious engineering difficulties commence, at the mountain range of Kinghan, which, in its northern part, is crossed by the Amoor river. This range is the greatest obstacle; and it will be necessary to pass by the Mautchooria, and to lay the road from Baikal to Verhnéoudinsk through the valley of the Selenga. Then the best route by which to reach Pekin, the capital of China, near the Yellow Sea (a bay of the Northern Pacific Ocean) has been found to be that of Tchita and Dolounor. At the southern end, the famous great wall will be crossed; it already lies in ruins in many places. The whole distance from Nijni-Novgorod to Pekin will be 4,500 miles, of which 3,800 run through Russian territory.

When this plan is closely examined, according to known topographical data, the apparent difficulties dwindle down to nothing when compared to those encountered in the western section of our Pacific Railroad. The first section, from Nijni-Novgorod to Tomsk, runs on perfectly level land (the so-called steppes), similar to our prairies. In the second section, from Tomsk to Lake Baikal, the country is rolling, and interspersed with rivers and streams; but the greatest hight is only 3,500 feet, and the largest rivers are but of very moderate width and depth. The only serious difficulties, as we have said, lie at the Chinese frontier, and they are inferior to those overcome in the Rocky Mountains and the Sierra Nevada by the American engineers.

Russia has raised in 15 years more than $1,000,000,000 with which to construct 15,000 miles of railroad, and can easily find $300,000,000 or $400,000,000 to construct a line of such value to all the civilized world.

THE EDUCATION OF CROWS.

In the battle of wits between the gamekeepers and the crows of Germany, the latter are said to have acquired the ability to count as high as six—rather more than some tribes of human savages, if travelers' tales are to be trusted.

To protect the young broods of pheasants, the gamekeepers wage unsparing war against the crows, which have consequently become exceedingly wary and good judges of the range of ordinary guns. Various stratagems are resorted to by the keepers, one of them being to erect shelters near the gathering places of the crows, from which to shoot them when they unwittingly approach. The crows suspiciously keep aloof except when they are sure of safety; but the

moment the keeper departs, they flock to their posts of observation with provoking assurance. It is found that the keepers must go to the cover in parties of six or more, then depart one by one until six have left, leaving one or more behind to take vengeance on the crows. Should a less number than six visit the shelter, and all but one leave it, the crows perform the subtraction correctly, and know that there is yet no safety for them. Beyond six, their mathematical faculty fails—or did some years ago: perhaps they have learned to count more by this time.

It seems that the crows of Maine are only half as highly educated. A farmer in that State, exasperated by the depredation of crows among his sprouting corn, lay in wait for them often and long, but without success. Then he tried the German stratagem. He took his son with him to a shanty in the field, and shortly after sent him away; the hungry birds patiently waited until the farmer also departed, then they helped themselves. The next day he took two persons with him with the same result: first one person left the field, then another, the crows cawing their approval, but remaining in their safe position; and not until the third person had been seen to depart from the field would the cunning creatures trust themselves within gunshot of the little building. The next day, half a dozen entered it. Presently one of them went back across the field. The crows mentioned the fact among themselves, but kept their distance, among the trees. Another person went away, with the same result. Directly a third emerged from the building and disappeared, the unhappy crows, having reached the end of their mathematical rope, came down in platoons to their deferred breakfast, unaware of the three armed enemies still remaining in the building, who at once opened fire upon the poor birds, whose great misfortune was that they were unable to count more than three.

A gentleman writing to the Portland *Advertiser* says that this experiment was tried repeatedly, but the crows invariably lost their reckoning when the number exceeded three.

Evidently the education of the crows of Maine has been neglected. It would be an interesting experiment to repeat the process of deception to see how long it would take them to count four, or more.

THE CENTENNIAL BILL PASSED.

The bill appropriating $1,500,000 for the purposes of the Centennial Exposition has become a law. It passed the Senate by a vote of 40 to 15, and was soon after signed by the President with the plume of an American eagle, which some patriotic individual provided for the occasion. The accession to the Centennial funds prevents, it is said, the accumulation of any debts for the completion of the buildings and grounds. The act which grants the money is coupled with a stipulation that the sum shall be repaid into the United States Treasury, without interest, out of any profits which may remain after the subscribers to the capital stock shall have been reimbursed. This is of course a contingency which may or may not happen; but in any event the stipulation is a favorable one, and will tend greatly to appease the large number of people who have been opposed to Congress extending any pecuniary aid to the enterprise.

The financial prosperity of the Exposition now being secured, it remains for exhibitors to lend their best endeavors to assist the Centennial commission in having the entire American part of the show in readiness by the opening day. Our correspondents at Philadelphia state that goods are arriving very slowly, and that present indications point to a grand rush during the month of April. This only entails extra labor upon the Exposition officials, and tends to produce troublesome confusion and dissatisfaction among the exhibitors. It is very much to be hoped that exhibitors will not follow their usual practice, at the annual fairs throughout the country, of thus waiting until the last minute before sending their entries. They will find early arrival on the field to be very much to their own and to the general advantage.

THE COLLAPSE OF THE SHEFFIELD AMERICAN STEEL RAIL TRADE.

In referring to the progress of the steel rail manufacture in this country, nearly a year ago, we took occasion to point out the rapid falling off in the importation of steel rails from England, and expressed the opinion that a still further decrease would follow. We have, moreover, long adhered to the belief that, with our vast stores of mineral wealth supplying the material, all that our people have needed is experience and knowledge in utilizing it; and as that experience and knowledge augmented, so would our reliance upon the labor of other countries decline. As matters stand now, to quote from the English *Ironmonger*, "in the management of the Bessemer plant, the Americans must be yielded the palm; and this palm was yielded even by the English steel masters themselves at their great Barrow meeting. The real truth is that the Americans have learned how to make steel rails as well, if not better, than Englishmen, and there is no good to be obtained by hiding the fact."

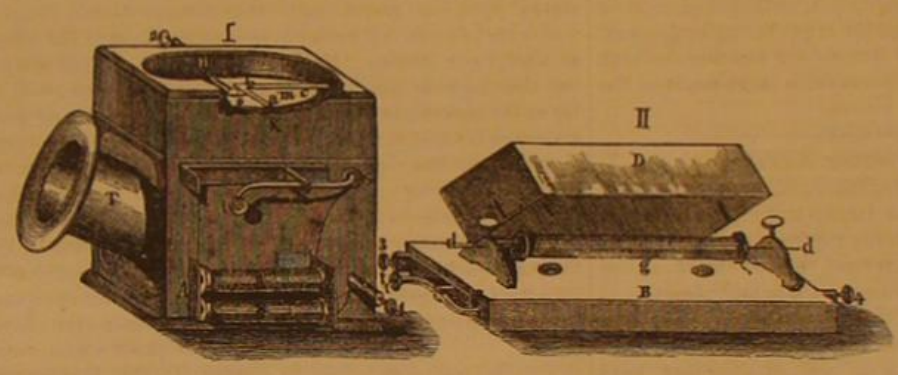
The reason of this candid admission by a leading English metal trade organ is found in the recent report of Dr. Webster, the American Consul at Sheffield. Steel makers in that great manufacturing town had felt severely the effects of a falling off in their American sales; but none, it appears, were prepared for the alarming announcement that the American market for their rails had practically closed against them. In 1873, Sheffield exported steel goods of all kinds to the United States of an aggregated value of $8,298,865; in 1874, this had fallen to $6,315,240; and the declared value of goods exported in 1875 still further falls to $3,456,160: a reduction of $5,000,000 in two years. Out of this aggregate of $3,456,160 for 1875, the value of the rails imported is but $11,505, and those rails were brought over here during the quarter ending March 31, 1875. Since that date, not a single ton of Sheffield rails has entered the country. For the last nine months of 1873 and 1874 respectively, the value of the rails imported hither was $1,311,890 and $1,136,610.

There are just four reasons for this loss of trade, which has stopped the machinery in several large Sheffield establishments. Two, namely, our high tariff and financial stress, might be urged with equal force as regards any other dutiable class of exports, and these, therefore, affect not a single branch of the latter, but our entire commerce with any foreign nation. The other two must be admitted as the more immediate causes; and these are, first, our progress, as already noted; and second, the blind conservatism, to use a mild term, of the Sheffield working men. So long as these men, through their combinations, persist in doing almost exactly as their grandfathers and fathers did to accomplish specific manufacturing results, so will they be distanced by more progressive people, irrespective of the nation to which the latter belong. Manufacturers, who employ a class of men who, again to quote an English contemporary, "display inveterate opposition to the use of modern mechanical appliances," must expect to find their productions unsought and their capital wasted; nor can they hope to compete with their American brethren, in whose more prosperous establishments the introduction of new machinery one year, and its abandonment for still further improved appliances before the twelve month has passed, are common occurrences.

THE INVENTION OF THE TELEPHONE.

BY P. H. VANDER WEYDE, M. D.

In connection with Mr. Gray's application of the telephone to the simultaneous transmission of several different telegraphic messages over one wire at the same time, and his paper read before the American Electrical Society (published on page 92, SCIENTIFIC AMERICAN SUPPLEMENT for February 5), it may be interesting for the readers of this paper to obtain some information in regard to the invention of the telephone, by Reuss. As mentioned in the article above referred to, Page and Henry observed that, by rapid magnetization and demagnetization, iron could be put into vibrations isochronic with the interruptions of the current; and later, Marian experimented extensively in this direction, while Wertheim made a thorough investigation of the subject, which induced Reuss, of Friedrichsdorf, near Homburg, Germany, to apply this principle to the transmission of musical tones and melodies by telegraph; and he contrived an apparatus which we represent in the engravings.



PROFESSOR REUSS' TELEPHONE.

The telephone of Reuss consists of two parts, the transmitting and the receiving instrument. Fig. I represents the former, and is placed at the locality where the music is produced; Fig. II, the latter, is placed at the station where the music is to be heard, which may be at a distance of 100, 200, or more miles, in fact, as far as the battery used can carry the current: while the two instruments are connected with the battery and the telegraph wire in the usual manner. One pole of the battery is connected with the ground plate, the other with the screw, marked 2 in our Fig. I, and thence over a thin copper strip, *n*, with the platinum disk, *o*, attached to the center of the membrane stretched in the large top opening of the hollow and empty box, K, intended to receive and strengthen the vibrations of the air, produced by singing before the funnel-shaped short tube attached to the opening in T. Over the platinum disk, *o*, attached to the elastic membrane, is a platinum point attached to the arms, *b c* and *b* K, while a set screw brings this point in slight contact with the platinum disk mentioned. A part of the box is represented as broken and removed, in order to show the internal construction. The strip, *a b c*, is connected with the end, *s*, of the switch, *t s*, and the screw connection, 1, at the lower right hand corner, and also, through the telegraph wire, to the instrument, Fig. II, at the receiving station, which may be situated at the distance of many miles. Here the current enters by the screw connection, 3, and passes through the spiral, *g*, surrounding the soft iron wire, *d d*, of the thickness of a knitting needle, and leaves the apparatus at the screw connection, 4, whence it obtains access to the ground plate, and so passes, through the earth, back to the battery. The spiral and iron wire, *d d*, is supported on a hollow box, B, of thin board; while a cover, D, of the same material is placed on top, all intended to strengthen the sound produced by the vibrations which the interruption of the current caused in the iron wire, *d d*, so as to make these viorations more audible by giving a large vibratory surface, in the same way that the sounding board of a pianoforte strengthens the vibrations of the air caused by the strings, and makes a very weak sound quite powerful.

If a flute be played before the opening, T, or if a voice be singing there, the vibration of the air inside the box, K, causes the membrane, *m*, to vibrate synchronically, and this causes the platinum disk, *o*, to move up and down with corresponding frequency. At every downward motion the contact of this disk with the platinum point, under *b*, is broken; and therefore the current is interrupted as rapidly as the vibrations occur. Let, for instance, the note C be sounded; this note makes 64 full vibrations in a second, and we have, therefore, 64 interruptions of the electric current, which interruption will at once be transmitted through the telegraph line to the receiving instrument, and put the bar, *d d*, into exactly similar vibrations, making the very same tone, C, audible; and so on for all other rates of vibration. It is clear that, in this way, not only the rhythm of music can be transmitted (and this can be done by the ordinary telegraph), but the very tones, as well as the relative durations and the rests between them, can thus be sent, making a full and complete melody. The switch, *t s*, Fig. I, is intended, in connection with a similar one in Fig. II, to communicate between the stations, with the help of the electro-magnet, E E, to ascertain if station, Fig. II, is ready to receive the melodies; then it gives the signal, by manipulating the switch, which is received by the attraction of the armature, A, the latter arrangement being a simple Morse apparatus, attached to the telephone.

Professor Heisler, in his "*Lehrbuch der technischen Physik*" (3d edition, Vienna, 1866), says, in regard to this instrument: "The telephone is still in its infancy; however, by the use of batteries of proper strength, it already transmits not only single musical tones, but even the most intricate melodies, sung at one end of the line, to the other, situated at a great distance, and makes them perceptible there with all the desirable distinctness." After reading this account in 1868, I had two such telephones constructed, and exhibited them at the meeting of the Polytechnic Club of the American Institute. The original sounds were produced at the further extremity of the large building (the Cooper Institute), totally out of hearing of the Association, and the receiving instrument, standing on the table in the lecture room, produced (with a peculiar and rather nasal twang) the different tunes sung into the box, K, at the other end of the line; not powerfully it is true, but very distinctly and correctly. In the succeeding summer I improved the form of the box, K, so as to produce a more powerful vibration of the membrane, by means of reflections effected by curving the sides; I also improved the receiving instrument by introducing several iron wires in the coil, so as to produce a stronger vibration. I submitted these, with some other improvements, to the meeting of the American Association for the Advancement of Science, and on that occasion (now seven years ago) expressed the opinion that the instrument contained the germ of a new method of working the electric telegraph, and would undoubtedly lead to further improvements in this branch of Science, needing only that a competent person give it his undivided attention, so as to develope out of it, all that it is evidently capable of producing.

Before leaving this subject, I wish to draw special attention to the fact that the merits of this invention consist chiefly in the absence of musical instruments, tuning forks, or their equivalents, for producing the tones: any instrument will do, flute, violin, human voice, etc. If the aerial vibrations are only conducted into the box, Fig. I, the apparatus will send the pitch as well as the duration of the different tones, with the rests between, therefore not only transmitting perfect rhythm, but a complete melody, with its long and short notes. The two parts of the apparatus may even be connected each to a separate pianoforte; and if this were done in a proper manner, a melody played on the pianoforte connected with the transmitting instrument, Fig. I, would be heard in the pianoforte, at a great distance, connected with the receiving instrument, Fig. II.

Fighting Rams.

Says a correspondent of the Ohio Farmer: "At certain seasons of the year, rams are apt to develop their combative propensities, and those who keep several of them together often have trouble on account of their injuring each other. It is well known that they always 'back-up' to get a start to butt. Stop their backing-up and you disconcert them entirely. To do this, take a light stick (a piece of broom handle will do), about 2 or 2½ feet long. Sharpen one end and lash the other end securely to his tail: the sharpened end will then draw harmlessly on the ground behind as long as his majesty goes straight ahead about his business; but on the attempt to 'back-up' he is astonished to find an effectual brake in the rear. Don't laugh and call this 'all gammon;' but if you have a butting ram, try it, and the time to laugh will be when you see him jump out sideways, and whirl round and round, trying to inspect the machine, which will keep behind him."

DR. HAUGHTON has proved that the strength of the lion is only two thirds that of the tiger.

IMPROVED CONSTRUCTION OF CONSERVATORIES.

Our illustration shows a conservatory or greenhouse built entirely of wood and glass, according to a plan originated by Mr. W. H. Lascelles, of London, England, a builder who has obtained some renown among horticulturists. The roof of the house is curvilinear, the flat panes of glass being set in frames of bent wood, their angle to the perpendicular being gradually increased as the summit of the roof is approached. The result is a structure of very ornamental appearance, which can be erected by any capable carpenter. Iron, of course, will continue to be used where the framework can be readily and cheaply obtained; but that a very graceful building can be erected without the employment of expensive materials will, we think, be shown by our engraving.



A MODEL CURVILINEAR GREENHOUSE.

A Chance for Ice Machines.

It is a fact that the ice crop this winter, along the Hudson, is almost a total failure. Ice men have waited patiently for moderately thick ice to thicken; but in lieu of this taking place, the spells of warm weather, which have succeeded the few cold snaps, have only rendered the ice still less suitable for harvesting. Thus far, we learn, about one tenth of the usual crop has been gathered. Even when a full harvest is stored, hardly a summer goes by but that complaints regarding the extortions of the large ice companies are frequent. The householder in this city paid about 70 cents a week for 30 lbs. of ice delivered daily during last summer, when an abundant store of ice was on hand. Recently the ice companies have fixed the price at 60 cents per 100 lbs.; and probably, not merely on account of the failure of the crop, but also because of the unusual influx of transient visitors to this section of the country, the cost of ice next summer will reach figures not only higher than the above but higher than ever before. A good opportunity seems to be offered for inventors of ice machines. Without doubt powerful apparatus of this description, established in New York and Philadelphia, and capable of producing large quantities of ice, could be worked during the hot months both to the advantage of the public and with large profit to the manufacturers.

New Fire-Extinguishing Apparatus.

The new and splendid building belonging to the New York *Tribune* newspaper is one of the largest and most substantial structures in this city. It is eleven stories high, built of fireproof materials, with iron beams and hollow brick arches for the floors; and it would almost be deemed necessary to provide special apparatus for the prevention of fires. But the proprietors, with a commendable desire to protect the property of their many tenants, as well as their own, have lately put in a novel fire-extinguishing apparatus which is ingeniously arranged and effective in operation. It was made by the Champion Fire-Extinguishing Company of Louisville, Ky. A number of gentlemen recently assembled in the *Tribune* composing rooms to witness the first trial of it. The engine is placed in the sub-cellar of the building, and consists of a cylindrical tank, holding about 180 gallons of water, and hung on pivots in such a way as to be inverted on the lifting of a latch rod. About 60 lbs. sub-carbonate soda are mixed with the water, and in the tank is a jar containing 28 lbs. sulphuric acid. When the tank is inverted, the chemicals are mingled together and produce carbonic acid gas, by the expansive force of which the waste water is driven out with a pressure of 150 lbs. to the square inch. From the tank to the top of the building runs a standpipe, to which is attached a stop cock and hose in each story. A wire rope, connecting with the trip, also runs through the building. In case of a fire, it is only necessary to pull the wire rope on any floor, open the stop-cock, and direct the steam on the fire, the whole occupying about 20 seconds.

In the first trial, the trip was pulled from the composing room, eleven stories above the engine, and 20 seconds afterward a stream of water charged with carbonic acid gas was pouring from the nozzle of the 50 foot hose. With an elevation of 176 feet, and a length of pipe and hose amounting to 251 feet, a stream of water was thrown horizontally 75 feet from the nozzle against a stiff wind. It was estimated by those present that the stream of water could be kept up about half an hour. Several interruptions were made, as the stream was directed from different windows. After the force of the engine was exhausted, the spectators went to the basement, and witnessed the tripping of the tank. The tank was then refilled and made ready for use, the work occupying about ten minutes.

The main point in which this apparatus is believed to be superior to all others is the quickness with which the stream can be directed on the fire after it is discovered. A single person in any story, on discovering the flames, can immediately do the work which with other engines requires the aid of additional persons, and usually a journey to another room and back again. In an ordinary building, several stories in hight, before a person could descend from the top to the basement, or warn the engineer of the danger, the fire might gain such a headway that no power could extinguish it. The apparatus is moreover simple in construction, and so made that it will not fail to act at a moment's notice, though allowed to stand for ten years without a change of chemicals. Another important advantage is that the action of chemicals, which come up mingled with the water, is such as to aid materially in stopping the fire. They do not seem to extinguish so much as instantly to smother it, and so render the charred wood incombustible. The fire does not return—even if it continues to rage a foot or two away—to the spot on which the spray has once touched it.

WASPS.

In the *Annual Register of Rural Affairs*, for 1876, we find the following article, from the pen of Professor Cook, of the Michigan State Agricultural College, on the value of the wasps in the economy of Nature, and their marvelous instinct: "If we consider as venial the injuries wrought by the strong-jawed insects belonging to the several families of the wasps, upon our grapes and other tender-skinned fruits—which sin is often laid to the bees—we may regard the wasps as wholly our friends. Not only the paper-making wasps, but also the numerous mud wasps, are without exception, so far as the writer has observed, predaceous insects. And what a strange instinct it must be that leads many of these wasps to spread for their prospective young a rich feast of tender grasshopper steak or cut-worm chops, when forsooth they never deign even to taste such vulgar viands, but only lap the more delicate sweets distilled by leaf and flower! Yet the common bee is just as wise, aye, and thoughtful too of its young, as it gathers the pollen nourishment for their sustenance, while it only tastes the delicious sweets of the hive.



Fig. 1.—VESPA MACULATA.

"The paper wasps, *vespa maculata* (Fig. 1) place the insect food in the cells with their young, while the fine mud wasps, so common around wells and muddy places throughout our country, build large, roomy mud cells in which they place the caterpillar, locust, or other insect, and then close up the cell, but not till they have left an egg with the canned meat. What a striking example of parental care thus to seal up so carefully the aliment provided for the young wasps, which very likely the parent wasp would never see! Yet in the *sphex ichneumonea* (Fig. 2) that beautiful shining wasp, with long peduncle to the abdomen, and often so handsomely colored with blue, orange, yellow, or red, we see even a more striking example of parental care. These wasps



Fig. 2.—SPHEX ICHNEUMONEA.

are possessed, like all other species of wasps, of a powerful sting; yet, when they attack and subdue their prey, preparatory to supplying the yet unborn, they never give a fatal thrust, but only paralyze their victims. These are then carried to a previously prepared hole in the ground, placed in its bottom, in company with an egg, after which the earth is filled in; and what is very curious, the wasp uses her abdomen as a beetle, pounding the earth, so that by no possibility may her prospective offspring meet with disturbance. Here, then, the grub, caterpillar, or moth is not only buried alive, but is to be eaten alive. So extraordinary is the mother's instinct of parental foresight that her yet unhatched progeny is insured not only a perfect sanctuary for a home, but also meat that is fresh and untainted."

The Effect of Waves.

It is generally believed that at a moderate depth the influence of heavy waves ceases, and that during a hurricane all is quiet a few fathoms beneath the surface. If this be correct, why should a swell show such a marked increase in hight when it rolls over the edge of soundings?

On the parallel of Cape Clear, in longitude 15° W., seamen are familiar with this phenomenon, although the depth is nearly 500 fathoms; at times it is so marked that the dead reckoning may be checked by carefully noting the increase in the depth of the hollow of the waves. Shortly after the edge of soundings is passed, the sea becomes more regular, and consequently less dangerous to deeply laden vessels.

Any one who has watched, during a moderate breeze, the commotion of the water close to a quay wall can form a good idea of the ocean when it receives its first check against the Irish Plateau; the great waves twist around each other, run up and down in heaps, and then fall suddenly, as if bereft, in a great measure, of their forward motion.

Again, it is a well-known fact that during a "norther" in the Gulf of Mexico the frailest vessels weather out the storm if they can cross the edge of the Campeachy Banks, a striking proof that, at a depth of over fifty fathoms, there is sufficient abrasion to destroy the force of the heaviest wave in a very effectual style. On one occasion the writer witnessed this remarkable fact by running from a turbulent sea into comparative smooth water in this locality.

On George's Shoals, off Nantucket, during a heavy gale, the New York pilots and masters of coasting vessels assert that sand is frequently left on deck after a sea has broken on board, although the depth of water may be twelve or fourteen fathoms. It must require an enormous amount of ebullition at the bottom to raise such a dense matter to the surface through such a distance; for a cubic foot of ordinary sea sand weighs about 100 lbs.

In this wild spot the tide, which frequently runs with a velocity of three miles per hour, would assist the lifting power of the wave if running counter to it. During a winter gale, when the strong springs are thus running, the confusion of the sea is indescribable, although the depth may be thirty fathoms. The shortness of the sea (that is to say, of the distance beween the crests of the waves) on the banks of Newfoundland, where the soundings are from 30 to 50 fathoms, is noticed by all the navigators of the Western Atlantic, as it reduces the speed of an ocean steamer more than the heavier waves of deeper water, with a similar force of wind, will do. It is evident that this can only arise from the friction of the bottom, as the waves increase in hight when deeper water is reached a short distance to the eastward.

In the Gulf Stream north of the Straits of Bemine, after a "norther" has blown a few hours, the surface of the sea is covered with lanes of weed, although only a few patches might have been seen before the commencement of the gale. As these lanes are often at a considerable distance from shoal water, which lies at right angles to the direction of the current and wind, it is evident that they must have grown near the spot where they float, and been torn from their moorings by the mechanical force of the waves.—*W. W. Kiddle, in Nature.*

Disinfection for Yellow Fever.

Whenever a case of yellow fever occurs in New Orleans, the streets surrounding the square are sprinkled with Calvert's No. 5 carbolic acid diluted in 50 parts of water. A large sprinkler on wheels is used for the roadways, and the sidewalks are sprinkled by hand. The grounds of neighboring yards are similarly treated, and the privy vaults disinfected with a solution of zinc-iron chloride. At the termination of the case by death or removal, the infected apartments are fumigated with sulphurous acid or chlorine. The extent of the ground disinfected is according to the lapse of time since the appearance of the fever. The extent of the infection along the ground is about forty or fifty feet daily, so that after some days' delay the whole square must be enclosed with a disinfecting band and the enclosed surface sprinkled.

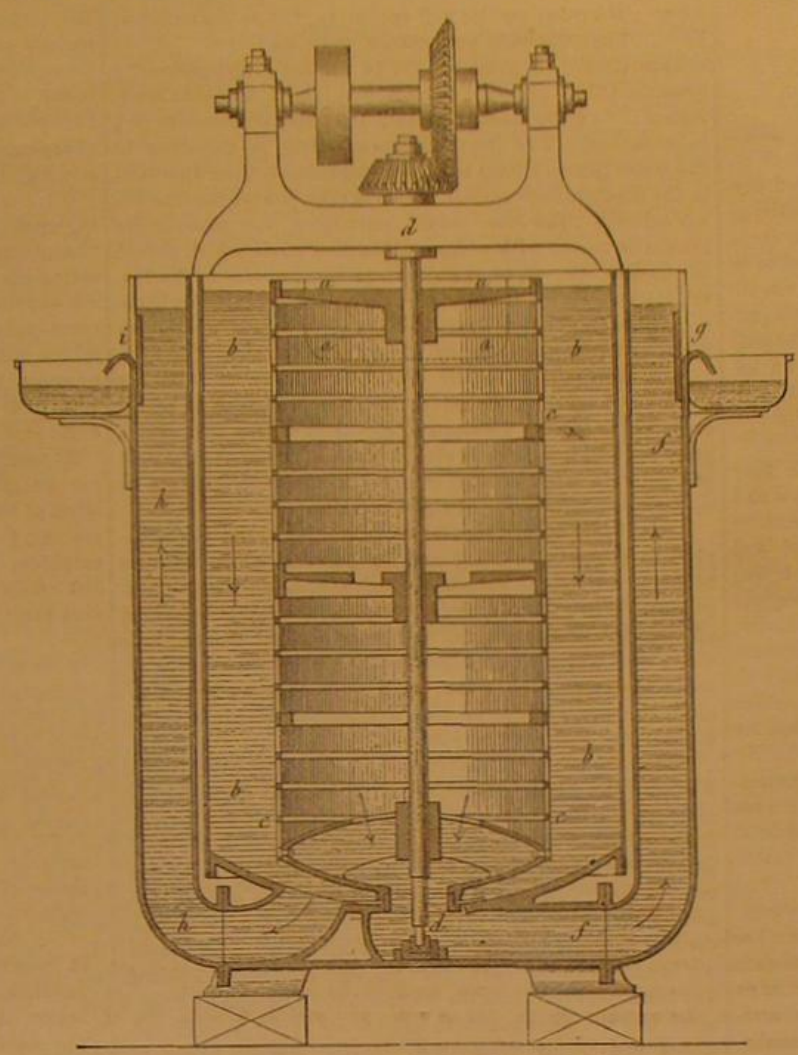
The Microscope Again a Detector of Crime.

The microscope has recently completed a circumstantial evidence against a murderer, forging the links so strongly that numerous witnesses, swearing to an alibi, were of no avail in the criminal's behalf. The latter, a Polish Jew, enticed a female of his own sect to a cornfield, and there killed her with a butcher's knife. Suspicion being directed to the man, close examination of his garments elicited, first, blood spots, second, soil and vegetable matter on his shoes, and lastly, shreds of woolen fabric sticking to his coat. To all of these substances the microscope was applied. The blood was declared to be human, and its nature and probable age determined; the soil was pronounced identical with that of the field in which the murder took place, the particles of vegetable matter were recognized as bits of corn stocks and leaves, and the identity of the dyed wool with the material of which the girl's shawl was made was established. This, together with other evidence adduced, despite the ingenious theories put forth by the defense, convinced the jury, who found the prisoner guilty, thus consigning him to the gallows.

A NEW CENTRIFUGAL FILTER.

We extract from the Belgian *Bulletin du Musée* the annexed engraving of a new centrifugal filter, devised by MM. Autier and Allaire. The construction is based on the principle that, if a cylinder be rapidly revolved in a liquid in which solid particles are suspended, the liquid will be drawn into like rotation, and will revolve with a velocity, greatest next to the surface of the cylinder, and less as the distance from the latter is increased. The solid particles in the fluid will thus be thrown away from the immediate proximity of the cylinder, leaving the liquid there in a pure condition, when, by suitable pipes from that portion, it may be drawn off. The present apparatus consists of a cylindrical receptacle, *b*, into which the liquid enters at *a*, and in which is a vertical revolving cylinder, *c*, the surface of which is of metal, and is pierced with a number of apertures. The purified liquid enters these orifices, passes through the cylinder in the direction of the arrows to the tubes, *f*, and finally is drawn off at *g*, at openings the size of which may be suitably regulated by sliding covers. The solid particles, separated from the liquid, descend in the annular space, *b*, and escape by the tube, *h*, the aperture of which, at *i*, may also be regulated as above described.

It will be observed that this is a filter without filtering material, a fact of considerable advantage in industries like paper and sugar making, which require the filtration of large amounts of liquid. The filtering surface, moreover, never being in contact with the impurities, no opportunity is offered for the discharge orifice of the pure liquid to become choked or foul. The degree of filtration, of course, depends upon the length of time the liquid is kept in rotation, and this is easily governed by lessening, as desired, the escape of the contents of the apparatus at the orifices, *g* and *i*. A device of this sort might easily be driven by the engine of a factory or other works, and would require very little power.



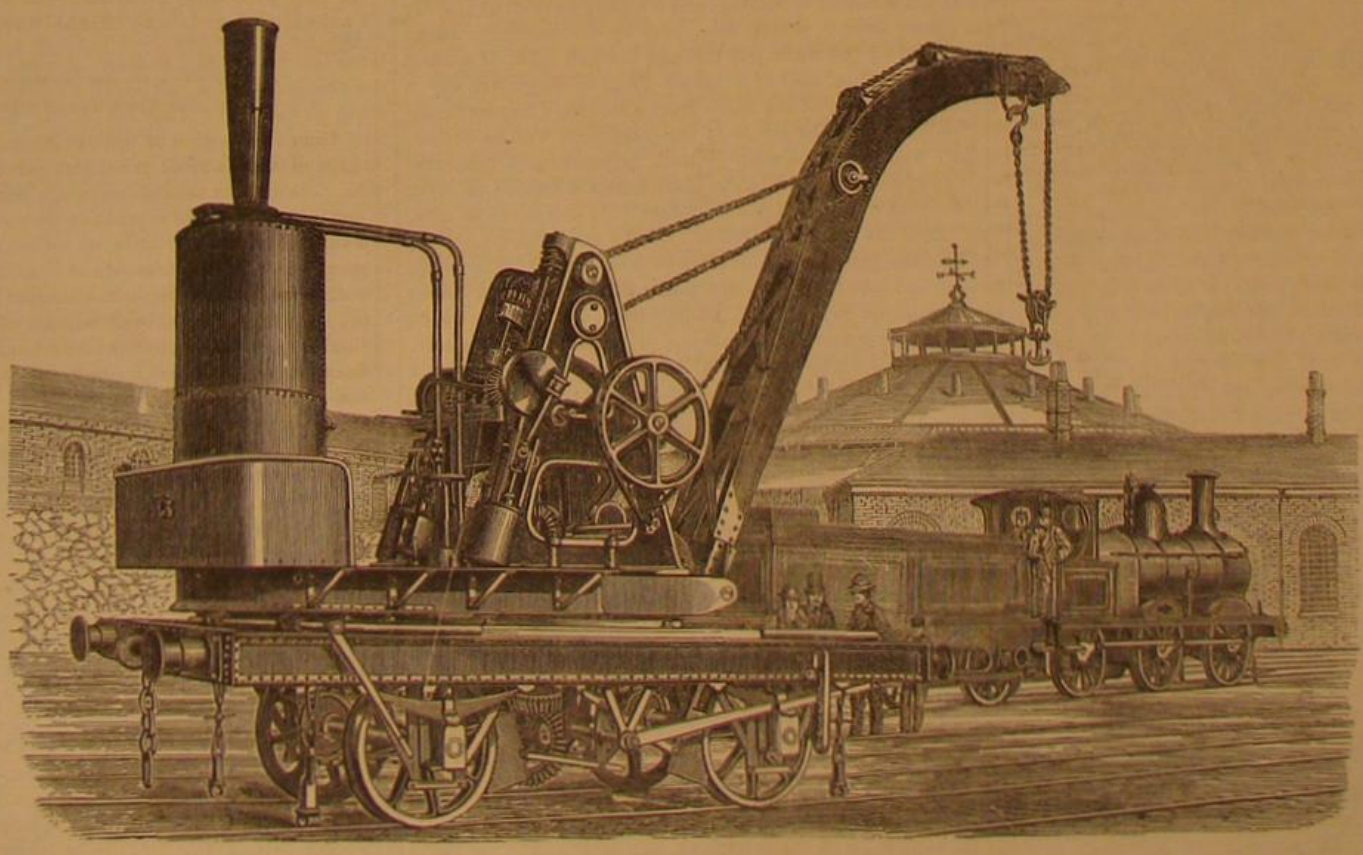
A NEW CENTRIFUGAL FILTER.

Chinese Fermented Drinks.

The ravages of the phylloxera among the vines of France have incited many attempts to discover a new kind of beverage to take the place of the juice of the grape. The Marquis de Villeneuve reports that in China a *pseudo* wine called *tsien-ia* is much used, which is concocted from a preparation of four plants, common in that country, and mixed together in certain proportions. The plants are dried and powdered, and made into a paste, which is sold in the form of balls or squares at the rate of about three pence a pound. One square or ball will make several pints of a fermented liquor, pleasant to the taste and much resembling wine, which is now sought after by Europeans and others living in China. A fictitious brandy is also prepared in the same way, and the manufacture is so simple that with a capital of $25 or $50 to purchase the apparatus, a man may make 25 gallons of "brandy" a day. The Marquis adds that the liquors possess no injurious matter.

PORTABLE CRANE FOR LOCOMOTIVE WORKS.

Our engraving shows an excellent adaptation of Messrs. Appleby's system of building cranes (heretofore described and illustrated in our pages) to the uses of locomotive shops and engine houses. The form is but little varied from that shown on page 95 of volume XXIX; but it has underneath the platform suitable gearing for propelling it automatically, and it can also be used for traction purposes. These cranes are now built of immense power and capacity with engines that are readily reversible, enabling the machines to be handled with facility; and they are coming into very general use, several of them having been employed in lifting and transporting heavy articles at the Vienna Exposition of 1873.



APPLEBY'S LOCOMOTIVE CRANE.

Messrs. Appleby (of London, England) have certainly carried this branch of mechanical construction to a high pitch of excellence, and their cranes are already at work in the Machinery Department of the Centennial Exposition at Philadelphia, being employed in getting some of the heavy material into position.

Dangerous Soap.

We have remarked of late the introduction into the market, under high sounding names, of various strong potash combinations intended for laundry and cleansing purposes. One of these preparations, which appears to contain more caustic potash than any other ingredient, lately caused the death of a child who accidentally ate a little of it; and we have found the same stuff strong enough to remove old hard paint from wood work when merely wetted by the same and allowed to rest thereon for perhaps an hour or two. We advise our readers to let such preparations severely alone; they are ruinous to clothes, and, except to cleanse kitchen floors or other grease-soaked places, should not be used. Even the ordinary low grade soaps are heavily charged with soda and impurities, which, the manufacturers say, they are obliged to add in order to hold their own with fraudulent dealers who adulterate still more heavily; and these soaps are also highly destructive to fabrics. It is much better economy to purchase a good quality, even a superior quality, of white soap for household purposes; for the extra cost of the soap will, in the end, be more than saved in the lessened wear of clothes, of oil cloths, and of paint. It is hardly necessary to add that strong alkali soaps should never be used on the skin, as their effect is corrosive and harmful. The object of using soap for the toilet is simply to overcome the natural oil which exudes from the body, and render it possible for the water to combine therewith; and a very little of the mildest soap is ample for this purpose.

Turmeric.

We are aware that the coloring matter of turmeric (the *curcuma longa* of the pharmacopœia) has been more than once recommended as a substance likely to be useful in photographic work; but we hardly think it has received proper consideration, or that it has been utilized to the extent which its varied qualities would seem to warrant.

Our attention was recently attracted to the subject in consequence of a desire to protect, by a yellowish varnish, the very thin foreground of a negative we wished to print. For this purpose we added a few drops of a tincture of turmeric to a little plain collodion, and poured it over the whole plate. When dry, portions covering the better-exposed parts of the plate were scraped off, and the negative exposed under paper in the ordinary way. On examining the process of printing, we were somewhat surprised to find that, although the yellow film was exceedingly feeble, it anon actinic qualities were so great that, when the unprotected parts of the negative were fully printed, the parts covered by it were altogether untouched, and that, even after an exposure of two hours to full sunshine, there was no trace of decomposition of the silver chloride. This circumstance naturally prompted us to make a series of experiments, the result of which leaves no doubt in our minds that a solution of the coloring matter of turmeric should find a place in every photographic laboratory.

A convenient solution may be readily prepared as follows: Four ounces of well dried turmeric (*radix curcumæ*), which may be obtained from any chemist, is to be well bruised, or reduced to coarse powder, and moistened with alcohol. After standing for an hour or two, the damp mass is packed into a percolator (a lamp chimney with a piece of muslin tied over the smaller end answering well) and some more alcohol poured over it. If the packing has been properly done, the spirit last added will displace that which had been absorbed by the turmeric, and cause it to flow through the muslin at the rate of two or three drops per second. When the operation is fairly started, sufficient spirit should be added to give a bulk of four ounces of percolate, which will be a very strong solution of curcumin, capable of giving a fine yellow color to collodion, varnish, or any alcoholic solution.

A drachm of this solution added to an ounce of plain collodion, and poured over a plate of glass, gives a yellow film of great beauty, which, although it hardly seems to stop out any material quantity of white light, is so non-actinic that, when used in the window of the dark room, plates of the most sensitive description may be manipulated with perfect freedom from fog. The cause of this is quite evident from a slight spectroscopic examination, which shows that the violet is altogether absorbed, the green and red alone being transmitted. We know that some emulsion makers prefer a red, or rather ruby, light in their dark rooms. This can very readily be got with the turmeric, it being only necessary to add to the collodion a few grains of boracic acid, which, when the film is dry, and especially if heated, destroys its power of transmitting the green, giving a pure red light.

It is well known that the color of turmeric, in common with many other vegetable coloring matters, is gradually decomposed by light; but our experiments would seem to show that when enveloped in the collodion film, or when mixed with ordinary photographic varnish, it is much more durable than when in contact with the starch and other *matériel* of the turmeric root; and, even should it be found unsuitable for permanent use, it will assuredly be valuable as a temporary expedient.

But an alcoholic solution of curcumin is of more use than merely to exclude the actinic ray from the dark room; it is one of the best organifiers for a washed emulsion pellicle that we have yet tried. We added it to the extent of ten drops to the ounce of emulsion just previous to pouring into the dish; and as the curcumin is very

sparingly soluble in water, it is not removed by the necessary washing, and gives to the redissolved pellicle a fine yellow color, which altogether prevents the necessity for backing of any kind.

We may add that we experienced some difficulty at first in removing the yellow appearance from the developed plates, but ultimately it yielded readily to a wash with methylated spirit. Our experiments have not been sufficiently extended to warrant any very strong statement as to the superiority of curcumin over other organifiers; but from what we have seen, we believe that it will be found in every way a most important addition to the *matériel* of the emulsion worker.—*British Journal of Photography.*

Correspondence.

Penguins.

To the Editor of the Scientific American:

I notice in your issue of January 29, an illustrated article on penguins, which calls to mind a little incident which occurred three years ago, in the South: A boat's crew and myself went fishing off Goff's Island, in the South Atlantic; on nearing the shore, we saw what appeared to be six or seven persons on a rock, and from their gestures they seemed to be hailing us. Supposing them to be the survivors of some ill-fated vessel, we rowed down to them and found they were penguins, who stood there, nodding their heads and flapping their fins, as if enjoying the trick they had played on us. We soon after went on shore at another part of the island, and there found the birds in large numbers, so thick in fact that they could be kicked over.

We also found great numbers of their eggs, which they lay in the sand, and we secured a large quantity of these and carried them aboard the ship. We also went on shore at Kerguelen's Island (the subject of your illustration) and there one of the sailors had his hands badly bitten, in trying to catch one alive. At the Crozetts, we again met the penguin family; and here several of the seamen brought them aboard, ate the flesh, and made pillows of the feathers. I made a cap of the skin of one, which lasted for a long time, the feathers making it waterproof. The birds are seen in great numbers at sea, and old sailors take warning of a gale by their quack.

But a more beatiful bird is found in the Southern Oceans. It is the albatross, the king of sea fowl. It seldom if ever goes on shore. I have seen hundreds of them, in schools, riding gracefully over the waves, and I succeeded in catching one by baiting a shark hook with a piece of pork. The bird measured 7 feet 8 inches between the tips of his wings. We made tobacco pouches of the skins of his feet, and pipe stems of the small bones of the legs and wings; and the skin was to be made into a muff, as, after pulling out the large feathers, a long heavy down is left, making it very desirable as a substitute for fur. The bill is long and crooked, similar to that of the eagle; and when hungry, the bird will devour food at an alarming rate.

The albatross can be found in immense numbers, and I have often wondered why it would not pay for capitalists to send out vessels to secure these birds for their feathers.

Pittsfield, Mass. W. E. DAY.

NEW PHOSPHIDES OF SILVER, AND A METHOD OF ESTIMATING SILVER QUANTITATIVELY BY MEANS OF PHOSPHORUS.

BY WILLIAM FALKE, PROFESSOR OF NATURAL AND PHYSICAL SCIENCES IN MANHATTAN COLLEGE.*

In the fall of 1873, the author's attention was attracted to the action of phosphorus upon the salts of silver, in particular the nitrate. If reference be made to most treatises on chemistry, it will be found therein stated that phosphorus is a powerful reducing or deoxidizing agent, and that by introducing a stick or clean piece of phosphorus into many metallic solutions, as, for example, copper sulphate, silver nitrate, or gold chloride, the metals are separated or reduced from their combinations, and are deposited upon the suspended phosphorus in the metallic state: at first such a fine film forming upon the phosphorus as to be transparent. Gold under these circumstances, appears beautifully green on viewing it by transmitted light, which color is characteristic of this metal, and by it it can be distinguished from spurious foils. Silver and copper are deposited upon the surface of the phosphorus in minute but brilliant crystals; and by very prolonged digestion, the whole, or nearly all, of the metal may be separated from the solution. In these reactions, the phosphorus, or part of it, removes the oxygen (or chlorine) from the metallic salts, precipitates the metal, and enters itself into solution.

In studying and experimenting upon the above detailed reactions, it occurred to me to dissolve the phosphorus in some liquid before adding to the metallic solution, whereby the phosphorus would be almost instantly diffused, and would, of course, offer an immensely increased surface for chemical action. The liquid in which phosphorus is most largely soluble is carbon disulphide, which is the solvent that has been almost exclusively employed in the following experiments:

On adding such a solution of phosphorus, which should not be too concentrated, to a solution of nitrate of silver in water, a dark and sometimes iridescent film is formed, which covers to some extent the sides of the glass vessels and also incases the globules of carbon disulphide at the bottom. A copious separation of the same black substance also precipitates, almost immediately on shaking.

The whole of the silver is thus removed in a short time from the solution, particularly on warming and stirring. Other metallic solutions, with different metals, were thus treated, most of which were completely thrown down in a short time, as copper, gold, platinum, etc.

Here it is important to observe that the precipitates and films thus obtained consisted not only of a part of the metals, but compounds had formed—combinations of phosphorus and metal.

After the above preliminary indications of an hitherto unobserved character, minute investigations were instituted in order to determine the nature of the compounds thus formed, and to see to what use, if any, they could be put. At present this report will confine itself entirely to the investigations on silver: the other results will appear in future communications. The following proportions were employed: Silver nitrate (fused), 5 grammes (77·16 grains); phosphorus, 1 gramme (15·41 grains); carbon disulphide, 10 cubic centimeters (0·61 cubic inch); water, 100 cubic centimeters (6·1 cubic inches). The fused nitrate of silver is dissolved in the water (more or less) and the phosphorus is then dissolved in the disulphide of carbon, which is then poured into the silver solution; the small vessel containing the phosphorus should be rinsed with a little carbon disulphide which should be added to the rest, as, if any phosphorus remains in the vessel, the volatile carbon disulphide would evaporate and leave some phosphorus in a finely divided state behind which may ignite or burn spontaneously when dry in the air. The mixture is then stirred in the cold, and allowed to stand for some hours until all the silver has been removed or separated, which can be determined by taking a drop out with a glass rod and touching it with a drop of hydrochloric acid or a chloride, until no longer a white curdy precipitate or opalescence of chloride of silver appears.

Immediately on mixing the above solutions, the silver begins to separate in films and in powder, which appears highly crystalline in part, and which is combined with phosphorus. When the reaction is complete, the liquid is poured off from the precipitate, and the latter washed two or three times with water by decantation, then with some strong alcohol to remove the water, and lastly with carbon disulphide to remove excess or free phosphorus, which is not in combination and must be removed.

The above is a brief description of the method employed whereby the black phosphide of silver was prepared and carefully purified from any free phosphorus. I was greatly surprised when the above compound suddenly took fire spontaneously while drying on the filter in the cold upon the funnel. A second portion was prepared with the utmost care, and washed at last with carbon disulphide until some drops of the filtrate could be evaporated from paper without becoming luminous in the dark, proving that all free phosphorus had been removed from the compound. The second time, I again had the opportunity to behold my fugitive black substance undergoing combustion, leaving metallic silver behind. The case was evident: the new phosphide was a pyrophorus, and burned spontaneously when dry in the air or in contact with oxygen.

In order to preserve some of the new phosphide in the dry state for examination, it was introduced into a tube or small flask while yet moist, and closely stopped with a rubber stopper through which two small glass tubes passed, one for the purpose of passing into the flask a dry current of carbonic acid gas and the other as the exit tube.

The flask with the moist phosphide is then placed over a water bath heated to boiling, and a steady current of the dry gas passed over it, which soon dries by the moisture being carried off by the warm gas through the exit tube. If a much higher heat than that of a water bath be employed, say a direct application of the flame from a Bunsen's burner (melting point of tin), the whole of the compound will be decomposed, and silver remain behind, presenting a beautiful spongy appearance, while the phosphorus is carried off with the current of hot gas, which is decidedly luminous as it escapes into the air and oxidizes. If the compound is dried without too great an application of heat, and is afterwards poured out into the air upon a plate, it takes fire, and leaves metallic silver with a little phosphoric acid behind, which latter can be removed by washing with some warm water. It was with the greatest difficulty that the molecular formula of this phosphide of silver was determined; it seems to be Ag P. Its molecular weight is 139. The affinity of silver for the nitrogen-phosphorus group is very feeble, as this compound, among others, plainly shows.

The action of nitric acid on the black phosphide led to a series of highly interesting observations, whereby several new and definite phosphides were obtained. On adding nitric acid (concentrated) in the cold to some of the moist black phosphide, which is generally mixed with some metallic silver, chemical action is set up and red fumes are evolved, during which some of the compound is dissolved, with whatever metallic silver may be mixed with it. A precipitate remains behind, having a brick red color, which at first was supposed to be amorphous phosphorus, but proved upon examination to be another phosphide, having the composition: $Ag_3 P_2$. Calculated: Silver, 69·90; phosphorus, 30·09; total, 99·99. Found: Silver, 69·44; phosphorus, 30·55; total, 99·99. This red compound is permanent in the air, and is much more stable than the first. It will be observed that, as the amount of silver increases, the stability of the silver phosphides becomes greater.

The red phosphide is soluble in concentrated boiling nitric acid, with perhaps the exception of a trace of a yellow compound which is undergoing investigation.

Other methods of operating were now employed. Instead of dissolving the nitrate of silver in water, it was acted upon in the dry way by a solution of phosphorus in carbon disulphide. Plenty of the solvent should be employed for the phosphorus; in this case, at least twenty times the weight of the phosphorus was employed.

In preparing the phosphides by adding a solution of phosphorus upon powdered dry silver nitrate, if not sufficient carbon disulphide is employed, a violent decomposition may take place. Operating thus upon a large quantity with an insufficient amount of the solvent, the writer was painfully injured by a powerful explosion, which produced a report like a blast.

A red compound is the result, that is, the particles of the dry powdered nitrate are covered by a red coating.

On treating the red precipitate with water, after pouring off the carbon disulphide, the nitrate of silver, which still remained undecomposed, is dissolved, and the reddish substance disappears, leaving a flocculent black precipitate, which was found to have the formula $Ag_3 P$. Calculated: Silver, 91·26; phosphorus, 8·73; total, 99·99. Found: Silver, 91·1; phosphorus, 8·8; total, 99·9. It is permanent in the air, unless highly heated.

It is curious to note the different results obtained by acting upon silver nitrate dissolved in water by means of the phosphorus solution, by changing the conditions: thus, by acting upon a concentrated silver solution in the cold without stirring, nearly pure silver separates in films which become quite thick, as, for example, in the following proportion: Silver nitrate, 4 grammes (61·7 grains); phosphorus, 0·9 gramme (13·8 grains); carbon disulphide, 10 cubic centimeters (0·61 cubic inch); water, 30 cubic centimeters (1·83 cubic inches).

By treating a very dilute solution of the nitrate, the silver completely separates into beautiful crystals, after the lapse of twenty-four hours. Silver nitrate, 1 gramme (15·43 grains); phosphorus, 0·2 gramme (3·08 grains); carbon disulphide, 5 cubic centimeters (0·305 cubic inch); water, 500 cubic centimeters (30·5 cubic inches). By this means very pretty crystals may be separated.

A New Cause of the Breakage of Railroad Rails.

Some interesting observations have recently been made on an Austrian railway line, which possibly may shed considerable light on the hitherto unexplained causes of the breakage of steel rails during cold weather. Cases have frequently occurred when such rails have been fractured, and yet the adjacent metal has presented no flaw to which the rupture could be traced.

The section of the Austrian road referred to is about eight miles in length, and is often blocked with snow. This obstacle is generally surmounted by strewing sand in front of the driving wheels of the locomotives and in putting on extra steam while running over the slippery section. The rails are of Bessemer and Martin steel, weighing about 82 lbs. to the yard. It was suggested that the sanding of the tracks caused them to heat, to be suddenly cooled again, however, by the low temperature of the air and by the falling snow. Besides the molecular construction of the metal being thus injured, there would be an extra amount of abrasion on the surface at the spots where stoppages occurred.

Examinations proved, says the *Ironmonger*, that these abraded portions varied in length from 2 to 9 English inches, $\frac{1}{12}$ to $\frac{1}{4}$ inch in depth, and extended over the whole breadth of the rail. A train, in passing over the depressions so caused, necessarily experiences a certain shock; and it is reasonable to suppose that the concussion thereby communicated to the rail will be most felt when the ground beneath is frozen hard, so that the natural elasticity of the rail has no room to play. In three instances, rails so worn snapped asunder suddenly at the abraded portion, although no flaw or defect in the metal could be detected. This led to the removal of all abraded rails from this section of the line, amounting to twenty-eight lengths of Martin steel rails, and ten lengths of Bessemer rails. No similar case of fracture is known to have occurred in the iron or puddled steel rails previously in use, although the amount of abrasion they underwent must have been at least as great. The inference is that the improved rails of Bessemer and other steels, their superior strength notwithstanding, are less capable of withstanding concussion than the older rails, and consequently whenever they are used increased vigilance is requisite to prevent accidents in the winter time.

Proposed Optical Barometer.

When a refracting prism is successively immersed in media of different refractive indices, the ultimate angular deviation of the ray will, as is well known, depend in each case on the relative indices of the glass and the medium surrounding it at the time of the experiment. And as the refractive index of atmospheric air varies with its density, the amount of deviation of the refracted ray will be a measure of the density of the air, that is, will give the means of ascertaining the reading of the barometer at the time.

If the ray of light were made to pass through a number of refracting and totally reflecting prisms, the deviation would be increased. If with these prisms a microscope were combined, the prisms might be used as a barometer. Or if the ray be received obliquely on a number of pieces of glass, having parallel faces and slightly separated from each other, although there would be no angular deviation, there would be horizontal displacement which would admit of being measured by a micrometer. How far such an application would be of practical value is certainly doubtful, as the effect of changes of temperature on the prism itself might interfere with the very limited range of the instrument. Or again, it is possible that easterly, westerly, or other currents—or perhaps differences in the hygrometric state of the atmosphe

* A part of this article formed the subject of a paper read before the New York Academy of Sciences (late Lyceum of Natural History), December 13, 1875.

—may affect the index of refraction otherwise than by the mere changes of density which they produce. But if such be the case, the refracting prism will be useful in determining the existence and amount of such variations in the refrangibility of the atmosphere.—*Thomas Stevenson, in Nature.*

The Case was Postponed.

A tattered memorandum book was recently found on the steps of a very humble dwelling out West. Some of the entries are as follows:

"My father had a slight misunderstanding with a neighbor about a division fence which he had inherited from my grandfather. After several disputes he consulted a lawyer, who had a good many children, but little practice. This was fatal. A suit was commenced.

"Several years ago my lawyer said I must get ready for the trial. I did so, and went to court at every term. But it was postponed on every pretence which human ingenuity could invent.

"1871. March term—Counsel for defendant moved a continuance, because he was engaged in the Court of Common Pleas. Court granted the motion, but intimated, with great dignity, that such an excuse would never avail him again.

"September term—Counsel trying a case in an adjoining county. Judge hesitated, but yielded.

"December term—Defendant ill. Proved by the certificate of a respectable physician.

"1872. March term—Counsel had made an engagement to meet a client from New York, who could not conveniently leave his business again. Continued, the Judge suggesting that New York clients might find counsel nearer home.

"1873. September term—Carried the title deeds to my lawyer. Surveyor examined the premises, said the defendant had encroached on me. But another surveyor (partner and pupil of the first one) said that my deed spoke of a hackmatack stump in the line of the fence, a foot in diameter; whereas, the only tree anywhere near the fence was a pepperidge tree, not more than seven inches and a half across; case postponed to employ other surveyors.

"December term—Counsel agreed that Court might visit the premises in dispute. Judge refused to go, but said the jury might do so, provided that nobody went with them to explain and confuse. Next morning a heavy snow fell, and boundaries were covered. Case continued.

"1874. September term—Motion to postpone on the ground that the defendant's attorney wished to be absent, hunting for a few days. Motion prevailed. I remonstrated, but my counsel said the lawyers were very accommodating gentlemen, and the courtesies of the bar required it.

"1875. March term—One of the jurors taken sick. Motion to go on with the trial with eleven jurors. Defendant's counsel objected with great strength of voice, and demanded a full jury trial, pure and simple. I think he called it the 'palladium of our liberties.' Case postponed.

"September term—Received a bill for retainers, term fees, clerks' fees, and expenses. One item was for the amount of a retainer which my lawyer had declined from the defendant. Offered him the farm, provided I gained the case. He said this would not be deemed honorable practice, but he would take it, and give me credit as far as it went.

"Took the cars for the West, coming mostly on freight trains and after nightfall.

"Mem.—Don't forget inscription for tombstone: Here lies one who died of a lawsuit bequeathed by his father."

The above, from the Hartford *Courant*, we find copied into the *Shoe and Leather Reporter*, to which the facltious editor of the latter journal adds his experience as follows:

"Lest any reader should question the genuineness of the foregoing leaf from the experience of one unfortunate victim of litigation, we feel bound to say, as a fact within our knowledge, that in all but its *denouement* it is a faithful and accurate narrative of what most people must undergo who are unlucky enough to become involved in a lawsuit. We speak feelingly on the subject, for we have been for two years knocking at the door of the Supreme Court of the State of New York, praying for judgment on a claim so obviously valid that we are utterly at a loss to conceive any tenable ground upon which it can be defended. The debtor is anxious for delay, and the excuses by which he staves off a trial have been a great deal more numerous and far less cogent than many of those which are cited above. The other day we received notice from our counsel that the trial was positively to be 'reached.' We smiled incredulously, but nev ertheless performed our customary journey to the courtroom, with a cartload of books and a cloud of witnesses. To our great surprise the case *was* actually 'called,' a stage of progress far ahead of any that it had previously attained, and for a moment we were cajoled into the belief that the end was approaching, of one of the chief miseries of our existence. Vain delusion! The defendant's lawyer had a case to try in another court, and ours 'went over,' the judge and counsel on both sides acquiescing with as much readiness as if they considered it a matter of course. Not the slightest consideration was given to the circumstance that a dozen witnesses or more were waiting, as they had waited many a time before. Our own advocate smiled blandly while the adverse party mentioned that he was otherwise engaged, said never a word, but took up his hat and papers and left the room, very much with the air of a man who felt that he had been practising the recognized 'courtesy' which the gentlemen of the bar are so fond of displaying towards each other, when they have clients who are able to foot the bills.

"However, we were told to keep coming until these little hindrances were got out of the way, and we did. Sure enough, after several days of expectancy, it happened that there was no other case ready, and ours really *did* begin. The jury was impaneled, and our attorney rose to commence his opening. He had not got a sentence before his alert opponent interposed some objection. Then ensued a sort of conference between the two lawyers and the judge, and t turned out, as near as we could get at it, that our counsel hadn't put in the right sort of complaint—that it was not in such form as would admit of his getting his evidence in, and that everything must be done over again. And so here we are, with nothing to show for our two years of anxiety but keen realization of the eccentricity of law and the shadow of an impending bill of costs of sufficient magnitude to convince us that our system of judicature is the dearest of all human institutions.

"It may be said that our adviser was at fault. That may be. We are not well enough versed in the tortuosities of the profession to deny or affirm it. But he is eminent in his vocation, and quite as capable, we have no doubt, of protecting the interests of a client as the average of lawyers. We see by the frequency with which suits are determined, first one way and then another, until they practically come to naught in the final tribunal, through the discovery of some technical error that had been overlooked for years by astute and watchful practitioners, what an intricate, ambiguous, and inextricable paradox the law is, and how questions that seem perfectly simple in the light of common sense become bewildering mysteries when thrown into the judicial crucible.

"But after all, our grievance is slight compared with several others by which our friends and neighbors have suffered incalculable annoyance and loss. If we were to enter into a history of the wrongs we know to have been endured through the mischances of judicial procedure, we should awaken in the minds of our readers something of the aversion with which the very name of a lawsuit inspires us."

[Many, to our knowledge have suffered, by the law's delay, similarly to our friend Bailey, and the mysterious action of counsel in conducting the cases also has been incomprehensible to the clients. But it is seldom that we have read, from the pen of the litigant, so felicitous an account of his trials as the above.—EDS.]

Screws in Casings.

Mr. Griffiths, whose experiments with H.M.S. Bruiser we have heretofore mentioned, has been making some further trials with models at the swimming bath of the Greenwich Hospital Schools. The results which he has obtained from these latter trials are somewhat remarkable. Taking two models, representing the type of the long narrow and the short broad ship, both of the same displacement, and being respectively 5 feet long by 7¼ inches beam and 3 feet 1½ inches long by 14 inches beam, Mr. Griffiths showed, by towing them at the ends of a cross beam, that the resistance of the water on the long one was to that on the short one as 3 to 5. On putting a pair of twin screws in the ordinary position at the stern of the long ship, and driving them for sixty seconds by means of a piece of clockwork machinery, the model was propelled through the space of 55 feet. The short vessel, however, with the screws in the same position was only propelled, with the same machinery, through the space of 28 feet in sixty seconds; but when the screws were placed inside tunnel casings with lip orifices, the model was propelled through a space of 62 feet, being, as will be seen, greater than that traversed by the long model when propelled in the ordinary manner. It was also found that, even when the screws were placed in the ordinary position in the short model, but the tunnels left open in front of them, a better speed was obtained than when the tunnels were closed, though not so good as when the screws were actually in the casings. The *Engineer* states that these results were considered of so much value by a gentleman representing the Imperial Russian Government, who was present at the trials, that, at his suggestion, Mr. Griffiths has undertaken to have a model of a circular ironclad made, and to conduct some trials therewith as to the difference of speed to be obtained by his system over that now used in the Popoffka, the circular ironclad.

Construction of Lightning Protectors.

"Whether the point of a lightning conductor is made of platinum or of copper, or whether it is sharp-pointed, as suggested by Franklin, or presents an angle of 30° in accordance with the latest notions, however great may be the care taken in welding the metals, it is certain that in this respect the mode of construction is defective as regards conductivity, and it is to be feared that the conductivity is diminished by the action of the weather. But it appears further to be demonstrated that it is at the joint that a lightning protector is most often destroyed; it is there the discharge takes place.

"At first, Franklin proposed that the conductor should be made of one metal only. It is owing to the rapid oxidization of iron that the successive commissions have proposed to modify the nature of the extremity of the conductor. We think that it is possible to return to the original idea, since it is known how to cover iron with a metal (nickel) which forms on its surface a film perfectly protecting it from oxidization, and possessing the necessary conductivity.

"We have experimented with the conductivity of nickel spread over a rod of iron. The nickelized surface indicated a rather higher conductivity than the mass of iron; it resisted better the electric discharges given off by a powerful battery. This same rod, after being immersed in water for 10 days, did not indicate any alteration, and the electric conductivity remained the same.

"We think, then, that, in the future construction of lightning protectors, it would be expedient to do away with the copper or platinum tips, the termination being made of a single piece of nickelized iron, in the same way as the conducting rod is made.

"The lightning protector would thus become a safeguard against electric discharges, and, owing to the preservation of its point, would always possess the same protective effect.

"Again, the conductivity would remain constant, and the necessity of supervision be done away with. This last condition is of great importance, as illustrated by General Morrin. According to him, it is desirable that you should be able to verify automatically the condition of the lightning protector as regards conductivity. In fact, every one knows that, if the conductivity is defective, the lightning protector becomes a source of danger."—*E. Saint-Edmé.*

The Practical Uses of Light.

A few days since, at the London Institution, Dr. Crookes read a paper on the radiation of light, in which he spoke of some practical applications that might be made of his discoveries. His scientific work is already well known, but these applications were for the first time laid before the public. He suggests that the torsion balance, which he has throughout used for testing the amount of action caused by the approach of light to it, should be employed as a test for the purity of our gas supply. First he would test the quality of the standard candles used, which it is known really vary very much when that variation is regarded from the standpoint of scientific accuracy. Then with the torsion balance, he would test the comparison between the gas and the standard candle, the slightest motion of the balance being capable of being recorded by the index scale on which the reflecting mirror shines. The other suggestion was the application of the rotating apparatus to meteorological purposes. He has arranged the windmill rotating wires with pith balls, so that they carry round a small magnet suspended beneath them. Their rate of rotation depends on the amount of light that falls on them.

Near the magnet attached to them is suspended another magnet, which oscillates as the attached magnet presents alternately its north and south poles. This oscillation is arranged to make and break an electric circuit, which, by a wire that may be of any length, is connected with a recording Morse machine worked by clockwork. Each revolution of the rotating pith balls is thus recorded by a punch of the Morse on a strip of continuous paper, and so a self-recording account of the amount of light falling at any place may be kept.

In our present meteorogical records, Dr. Crookes observes, we notice heat, rain, and pressure of atmosphere; but light, the most important influence, both as regards health and agriculture, is neglected, because not till now have means of measuring it been known.

Ventilation of Ships.

The Malabar, British troopship, which recently left Portsmouth for Bombay with the 21st brigade Royal Artillery, is fitted by Messrs. Mosses & Mitchell, of London, with a couple of automatic ventilators. This new system of ventilation is reported to have answered admirably on board the Osborne royal yacht. An air receiver, 6 feet high and 22 inches in diameter, is placed on each side of the ship and connected with pipes 8 inches in diameter. These connecting pipes are filled with water, and the principle of the contrivance is simply this: When the vessel rolls at sea, the water rushes to starboard and forms a vacuum in the port receiver, into which the foul air of the ship is instantly sucked. On the return roll the water rushes to port, drives out the air, and leaves a vacuum in the same manner in the starboard receiver; and such is the extreme force with which the foul air of the ship is expelled, that it is to be used on board the Malabar for the purpose of sounding a fog horn which shall be heard a mile off.

A Well Made Steamer.

The Great Britain steamer was one of the first made iron vessels, and among the earliest to ply regularly between New York and Liverpool. She has lately arrived at the latter port from Melbourne, Australia, thus completing her thirty-sixth trip round the world. She was designed by Brunel, and built at Bristol, and in July, 1845, made her maiden voyage from Liverpool to New York in fourteen days. Her dimensions are: Length (extreme) 330 feet, breadth 57 feet, depth 32 feet, with engines by Penn, of 500 nominal horse power.

The weight of iron used in her hull alone is 1,040 tuns, which is about equal to an average thickness of 2¼ inch. Since 1852, independent of her employment in the Crimea during 1854 and 1855, she has sailed over 1,000,000 nautical miles, her last voyage out from Gravesend to Melbourne only occupying fifty-four days, and when recently surveyed she was pronounced to be one of the strongest vessels in the mercantile marine.

A New Fish.

Mr. J. M. Hutchings, of Yosemite, is reported to have discovered in the head waters of Kern River, 10,500 feet above the sea, a new and beautiful fish, which he names the golden trout. It color was like that of the gold fish, but richer, and dotted with black spots a quarter of an inch in diameter, and with a black band along its sides.

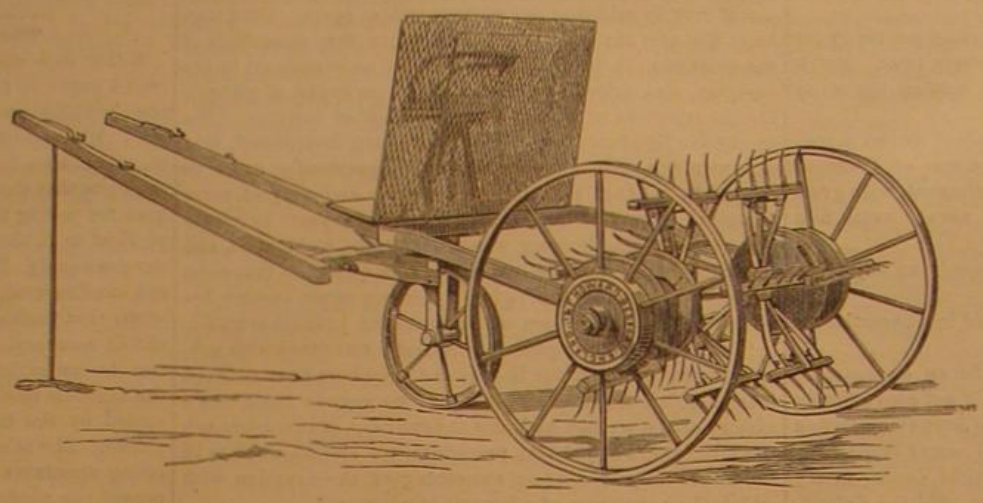
A FRUITFUL source of malaria is found in the earth adjoining ponds which are dammed for manufacturing or other purposes. The soil in the vicinity, through the water being raised above its previous level, becomes soaked, and hence damp and very dangerous to health.

IMPROVED HAY TEDDER.

Our engraving shows a new hay tedder, invented and manufactured by Messrs. J. and F. Howard, of Bedford, England, a firm widely known for the excellence of their agricultural machinery, both as to design and manufacture.

The rotating forks are operated by the traction wheels, being made very light and easily operated; and the driver is protected from the shower of hay by a screen of wirework placed upright behind him The machine is easily drawn by one horse.

The simplicity of such devices ensures their moderate cost, and their consequent extended use in superseding manual labor. In changeable climates, the rapid drying of the hay is a matter of great importance, and the slow process of turning it by hand is vexatious as well as expensive to the farmer. These disadvantages are got rid of by the use of several machines, the one which we represent being among the latest and best for the purpose.



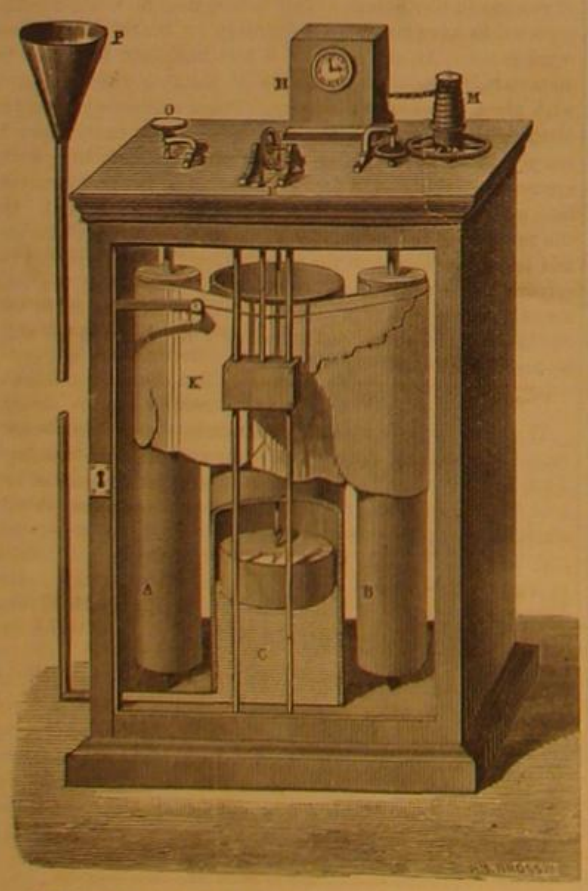
J. AND F. HOWARD'S HAY TEDDER.

Life-Preserving Pigeons.

Some very interesting and successful experiments have recently been conducted in France, with a view to determining whether lines could be sent ashore from a stranded ship by the aid of pigeons. It is in one of Mr. Charles Reade's novels that a means of escape is offered to a prisoner confined in a lofty dungeon. through some one shooting into his window an arrow to which a fine thread is found to be attached. The captive pulls the thread in and finds connected to it a string; the string gives place to a good sized cord, and the last to a rope capable of bearing his weight, and down which he descends. The pigeon from the wrecked vessel takes the place of the arrow, and, when liberated and naturally flying to the land, is able to convey thereto a thread 400 feet in length and 0·002 of an inch in diameter. People on the beach, by pulling on the thread, obtain a cord, and so eventually a strong rope completes the communication between ship and shore.

A NEW REGISTERING PLUVIOMETER.

The pluviometer is an instrument used to measure the quantity of rain which falls over a given surface, the knowledge of which fact is very useful in meteorological operations. The ordinary instrument, however, is defective in two points: First, it gives no record of the varying intensities or temporary stoppages of the rainfall; nor, second, does it afford any indication of the length of time during which such differences or stoppages in the intensity of the fall occurred.



M. Hervé Magnon has invented a new apparatus which satisfies the above want, and an engraving of the device is here presented, extracted from *La Nature*. A cylinder, C, receives the rain water led from the receiver, P. In the cylinder is a copper float, F, which, by means of a very fine cord passing over the pulley, N, is connected to the weight, K, which is a little the heavier. The weight, K, slides on two guides of tightly stretched pianoforte wire, and carries a pencil, the point of which comes in contact with the exterior of the cylinder, C. Inside the weight, K, which is hollow, is a small electric interrupter, which, whenever a current is transmitted to it from a regulator, strikes against the pencil and produces indicated points on a curve, which serves to control the clock movement by which are actuated the two copper cylinders, A and B. Over these last a belt of paper is passed, as shown; and the mechanism in H, which, as stated, moves them, is provided with a regulating fusee, M, so as to compensate for the difference caused in the diameter of the cylinder, B, by the rolling thereon of several thicknesses of paper. I is a fixed pencil which traces a horizontal base line on the paper. The latter, after first being rolled about the cylinder, A, is carried over cylinder, C, and attached to cylinder, B. In the middle cylinder sufficient water is then introduced to completely buoy up the float, F. If rain falls, the float, by the addition of water beneath it, is lifted; and the weight, K, following the movement, the pencil thereon traces a curve on the paper, which gives in millimeters the corresponding depth of rain. If, on the contrary, no rain falls, the line left by the weight pencil is straight and parallel to that made by the fixed pencil.

The Use of Plaster in Architectural Decorations.

In the earliest written records we hear of mortar being used as a plaster, while examinations of ancient Asiatic remains attest the fact. The Romans, we know, largely used plaster incrustations on their brickwork. The Coliseum shows plastered surfaces, and the early gothic structures were largely faced with stucco. It is a mistake to imagine that the middle age builders never used such a material. In many of the earlier churches and monasteries we find rubble walling; and a coarse rubble used in the vaulting, which was covered with a rough plaster, and probably decorated. Painted decorations have been discovered on the walls, and no doubt the vaulted surfaces were sometimes also relieved by color. The existence of plaster on the vaulted surfaces is proved in many instances by the ribs of the groining projecting before the face of the rough rubble filling-in, which formed a good key to the plastering. Netley Abbey and many other monastic buildings of the twelfth and thirteenth centuries may be cited.

"The subject of internal incrustation," says Mr. Pullan, "leads us to speak of the use of colored mortar for this purpose. . . . Painting cement and stucco has not been found advantageous, though the custom largely prevails. Painting the surface of calcareous cement does not improve it; the paint retards the induration by cutting off the air; and a sufficient time to allow of perfect evaporation of moisture is required. The same authority asserts that, if paint or oil be applied on stucco, it ought not to be used in less than a year after the incrustation is made. This observation is confirmed by plasterers and painters.

"But the employment of different ingredients with mortar shows far better results, that may be turned to account in decorative plastering. Metallic substances like antimony, white lead, arsenic, martial pyrites, are injurious; they give colors which are not permanent, and calcareous cements exposed to the weather are found to be best without metallic matter. Among the more durable ingredients for imparting color, without injuring the cement, may be mentioned colored sands, and coarse powder of durable colored bodies. Thus Thames sand produces a gray tint like Portland cement. Yellow and other beautiful colored sands are obtainable in the Isle of Wight, Croydon, etc.; or colored glasses or stones, in place of sand or partially, may be employed to give deeper tints. These should be beaten to a coarse powder, the fine portions being washed away as injurious to the cement. Colored mica and marble may also be used in external plaster work instead of paint. Bone ash produces by admixture a pleasing gray, which may be contrasted with brighter stuccoes of sand. Substances insoluble in water have been found best for the purpose of tinting cements, while sulphurated and metallic powders impair them for external use. Colored calces of iron produce a deep tint, and may be used in internal incrustation. Any colored, hard, gritty body may be incorporated with mortar for incrusting purposes. We have made great advances lately in this direction. The sgraffito treatment of plaster is one that admirably shows what artistic effects may be produced by simple means in fit colors and relief: though it seems to us, more may be done in tinting our plastered surfaces in light tones, and in rendering paint and paper less necessary for finished decorations."—*The Church Builder.*

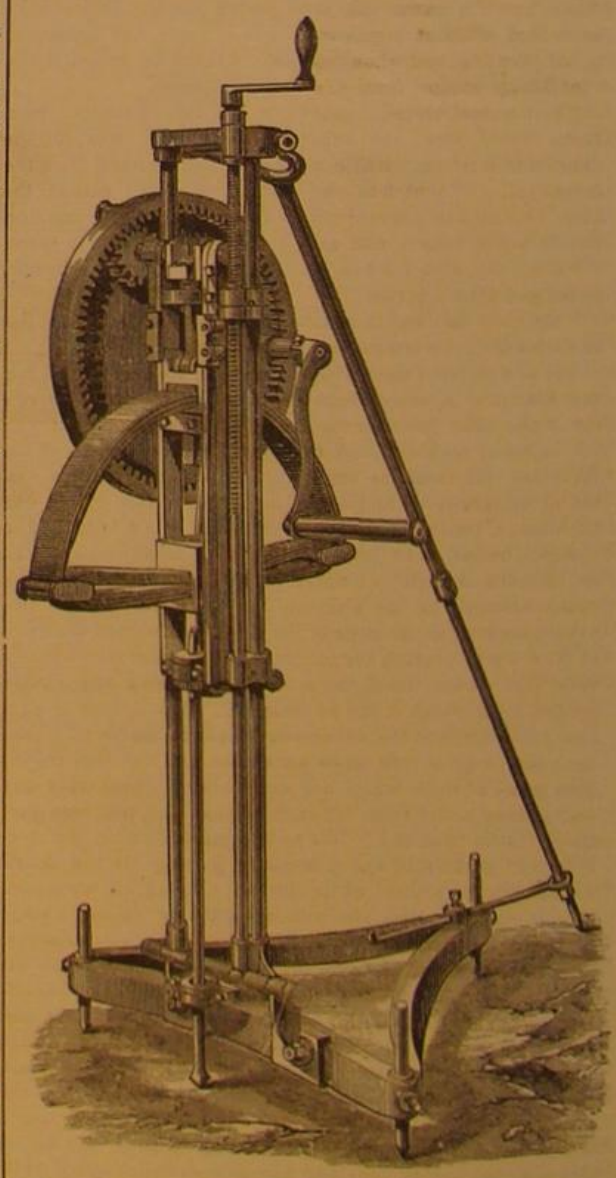
SPIDER web silk is 6·8 times finer than that of the ordinary silkworm.

Grease Butter in the English Courts.

The English butter men have revolted against the grease butter, and the English *Grocer* publishes a vehement editorial, demanding a law to the effect that people who make grease butter shall inform the public of the fact by marks on the packages. Somehow John Bull fails to comprehend the butter question as clearly as astute American dealers have done. Here is a report of a case where a London grocer is summoned for selling as butter a pound of something which the complainant avers does not contain a particle of the genuine article. The trial comes off, learned professors swear to flatly different statements, and the magistrate paradoxically and complacently observes that he is "perfectly satisfied with the analysts on both sides," whatever that may mean. The composition of the grease stuff is adjudged to be "consistent with genuine butter; "whereupon the *Grocer* rises in its wrath and insists that the butter, which a jury of its countrymen solemnly pronounces to be butter, is not butter, but a "curious mixture of fats." There is an exasperating obscurity about the whole business. As near as we can understand it, somebody has been feeding the British Lion on grease butter, which that noble beast has eaten innocently, and relished; but now, having discovered a fraud, he roars to have the noxious substance pointed out to him, in order that he may not commit the error of eating it again. "Where ignorance is bliss, 'tis folly to be wise" doubtless will hereafter be the British grease butter man's motto. Similar stuff is now being sold in France.

ROCK-DRILLING BY HAND POWER.

We select from *Engineering* an engraving of a rock drill operated by hand, intended for use where neither steam nor pneumatic power is available. It has recently been patented by Messrs. H. B. Barlow, Jr., & Co., of Manchester, England. The machine consists of a light stand, supporting guides which can be adjusted to various inclinations, the particular machine shown being adapted for drilling holes vertically or at angles down to 45°. The boring tool is not connected to the hammer, but rests on the rock, being merely guided by the collars through which it passes and which insure its being kept parallel with the hole which is being formed. One of the guide collars has an intermittent rotary motion given to it by a ratchet, thus causing the tool to be partially rotated after each blow.

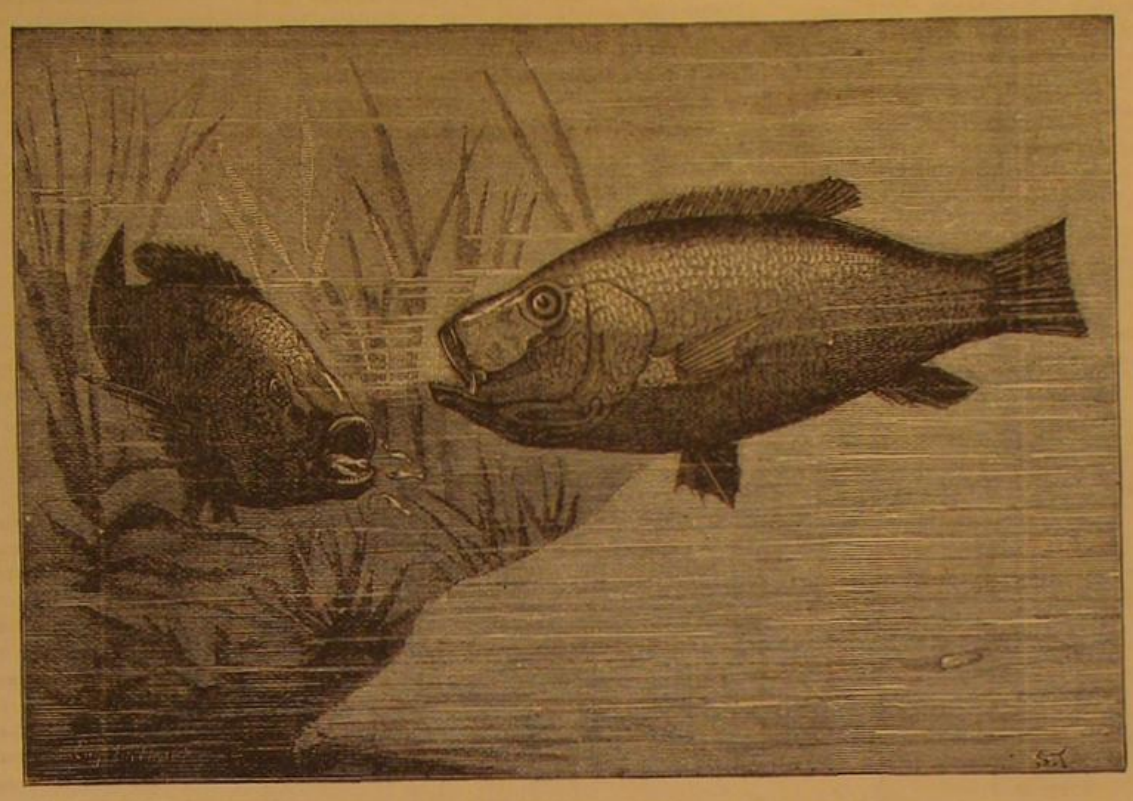


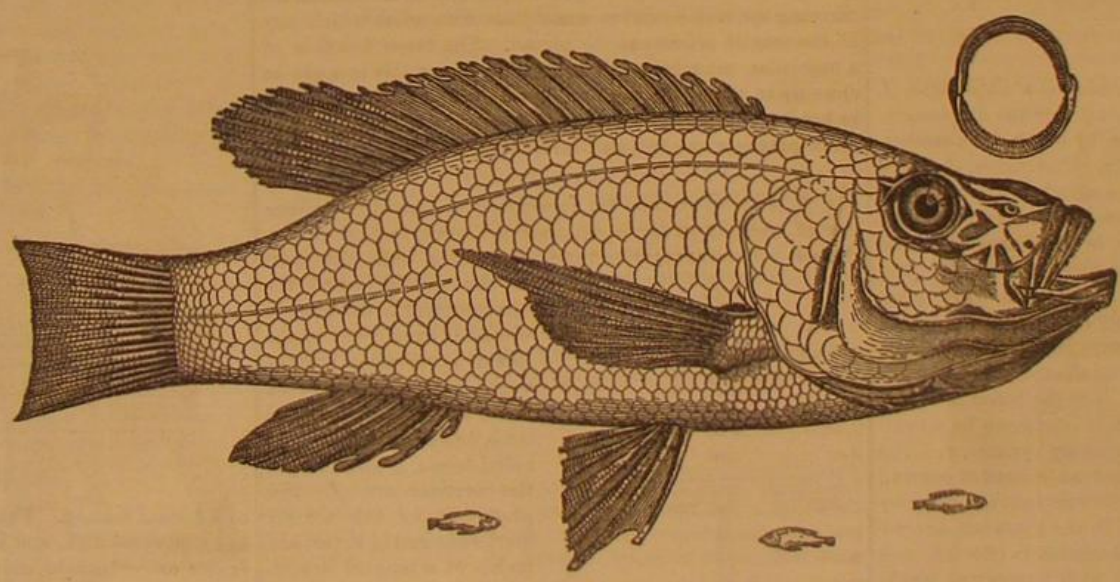
The tool is struck rapidly by a steel-faced hammer worked by a crank through the medium of a spring. The throw of the crank is 1¼ inches; but when in full work the hammer, under the action of the spring, moves about double the stroke due to this throw, a speed of 40 revolutions per minute of the handle causing 212 blows per minute of about 5 inches fall to be struck by the hammer. The machine was awarded a prize at the recent exhibition at Manchester.

THE CHROMIS PATERFAMILIAS.

Up to the present time naturalists have recognized but very few fishes which incubate their eggs in the mouth or in the gills. Agassiz, during his voyage up the Amazon river, discovered one species. Latterly the macropode, a Chinese fish of very singular characteristics, has been remarked to have the same peculiarity. Both the macropode and the species noted by Agassiz belong to the great group of *labyrinthobranchia*; and it was the opinion of the abovenamed naturalist that to that order alone belonged all fishes which, through the possession of a bronchial sac, are enabled therein to incubate their eggs in so curious and abnormal a manner.

The recent discovery, however, of the *chromis*, having the same peculiarity, shows that Agassiz was in error; for this creature has gills disposed in simple layers, and is wholly destitute of any special apparatus for retaining either eggs or fry, and yet it carries upwards of 200 young fish in its gills and mouth. This remarkable incubation is done by the male. When the female has deposited her eggs in a sandy cavity or among the weeds, he approaches and by an inspiration draws them into his mouth. A peculiar movement then follows, the mechanism of which is as yet unknown, but the result is to force the eggs between the leaves of the gills. The gentle pressure on the eggs, afforded by the gill layers, serves to keep them in place, and there, in the midst of the respiratory organs, they undergo their changes. The young grow rapidly, and soon struggle to escape from their narrow prison. Eventually they find an exit through the opening into the mouth of the parent, and there they crowd together as thickly as the seeds of a pomegranate, distending the jaws of the old fish until the mouth is unable to close. Sometimes the young, although in a perfect state, remain in the gills, all, however, with their heads directed toward the mouth of their progenitor. How they pack themselves together, how the parent manages to feed without swallowing his offspring, and when the latter finally escape from the mouth, are matters still unknown.





THE CHROMIS PATERFAMILIAS.

The chromis, an excellent representation of which is given in the annexed engraving, taken from *La Nature*, is seven inches in length and one inch and seven tenths in hight. The teeth are very fine and acute, and disposed in several series, and are of a yellow tinge. The scales are cycloidal, more broad than high. The color on the back is an olive green, shot with blue. The belly is brilliant silver, marked with green and blue. The fish is found in Lake Tiberias, in Palestine, near Ain-tin, the site of ancient Capernaum. In that locality there are several hot springs which unite to form a moderate-sized stream which enters the lake. The chromis is principally met with in the hot waters.

Medicated Ice.

The possibility of using antiseptics in medicine was recently pointed out by Mr. Edward Martin, in a letter to the *Lancet*, from which the following is taken:

"Every practitioner has at times to face the difficulties of the scarlatinal throat in young children. It may sadly want topical medication; but how is he to apply it? Young children cannot gargle, and to attempt the brush or spray often fills them with terror. In many cases neither sternness nor coaxing avails. Yet these little ones in almost every case will greedily suck bits of ice. This has long been my chief resource where I could not persuade the child to submit to the sulphurous acid spray. Lately I have been trying an ice formed of a frozen solution of the acid (or some other antiseptic). Though, of course, not so tasteless as pure ice, the flavor is so much lessened by the low temperature, and probably also through the parched tongue very little appreciating any flavor whatever, that I find scarcely any complaint on that score from the little sufferers; they generally take to it very readily. The process of making it is very simple. A large test tube immersed in a mixture of pounded ice and salt is the only apparatus required, and in this the solution is easily frozen. When quite solid, a momentary dip of the tube in hot water enables one to turn out the cylinder of ice as the cook turns out her mold of jelly. I have tried the three following formulæ, all of which answer, though I think I prefer the first:

1. Sulphurous acid, ½ drachm; water, 7½ drachms: mix and freeze.
2. Chlorate of potass, 1 scruple; water, 1 oz.: dissolve and freeze.
3. Solution of chlorinated soda, ½ drachm; water, 1 oz.: mix and freeze.

"However, the form is of secondary importance, as each practitioner can construct his own. Boracic acid, salicylic acid, or any other harmless antiseptic with not too much taste, would, doubtless, be as useful as those indicated."

Making Maple Sugar.

"A great many farmers," says a sugar making correspondent of "*The Christian at Work*, residing in Ohio, "might make a few hundred pounds of superb maple sugar, and a barrel of superb maple sirup, just as well as not. They have the trees, an abundance of cheap help, and wood that would cost nothing except the labor of preparing it for the fire. The only difficulty in the way is a disinclination to engage in such a job. Let us make our own sugar this year," says the writer, and then follow his directions for doing it.

"My process of reducing the sap is this: I keep the larger pan supplied with fresh sap, by means of a spout with a coarse cloth strainer over the end, from the reservoir, so adjusted as to admit a supply equal to the evaporation from the pan. From time to time I transfer sap from the larger to the smaller boiler, passing it through a fine woolen strainer. After accumulating a desired quantity in the small pan, and reducing it to a thin sirup, it is clarified by putting into a quantity which will make three or four gallons of molasses the white of an egg beaten up with about a gill of sweet skimmed milk. The sirup should not be hot enough to cook the egg. The egg and milk will entangle any sediment or foreign matter in the sirup, so that when brought to the boiling point everything will rise, when it is skimmed off, leaving the sirup clean. I then continue to boil it as rapidly as possible, till it is reduced to the desired consistence. I reduce my molasses to what I suppose to be about 38° B. My process of making sugar is to reduce the molasses to a degree which I should think to be about 48° or 50°, and pour it into a cask with one head out, with a spile at the bottom, to which other lots are added from time to time, as they are made. In a short time the mass will begin to granulate; and after having stood some days the molasses will drain out, leaving a white and beautiful sugar."

Borrowed Plumes.

An indignant naturalist writes to the London *Times* denouncing the ladies' fashion of ornamenting their dress with spoils from the feathered kingdom. A chance catalogue, or portion of a catalogue, of a sale of birds' feathers was the provoking cause of his communication. He says:

"The second page of this document (the first being occupied by the title) relates to 2,077 bundles of herons' or egrets' feathers (they go by other names 'in the trade',) the weight of which I find to be given as 702 ounces. How many feathers may go to a bundle I cannot say; but weighing some twenty exceptionally stout feathers (not herons') which happened to be on hand, I find them to balance one fourth of an ounce exactly. I think, therefore, that these 2,077 bundles cannot well contain fewer than 56,160 feathers; and allowing twenty of them to each bird (which I believe to be a fair allowance), we have evidence of the death of 2,808 herons or egrets. The next page relates to 2,948 similar bundles, weighing 1,168 ounces, showing, on the same estimate, 4,672 birds. To this follow other lots, which, in like manner, I compute to represent 2,320 birds, or in all 9,700 herons or egrets. All these lots are said to have arrived from India, and nearly all to have been warehoused last autumn. The spoils of how many more birds were included in the catalogue itself, to which this is a first supplement, or of how many in the second supplement, I, of course, cannot say; but, even if there were none, I venture to affirm that no country could long supply nearly 10,000 herons or egrets, killed in a single breeding season, without the stock becoming utterly rooted out. Yet I am told that there is one or more of those sales almost weekly."

The circumstance that birds' feathers are the most beautiful and consequently more valuable at breeding time makes their speedy extermination all the more certain.

"But this sale included also the skins of other birds—mostly, to all appearance, from South America or its islands. Of these there are enumerated 15,574 humming birds, 740 of which are specified as being of one kind, the ruby humming bird. I will not occupy your space by giving details of the rest; sufficient to say that parrots, kingfishers, trogons, tanagers, and various other brightly colored birds are there by the thousand. It may be that the Government of India might take steps, by establishing a close time, to save the herons and egrets from utter extirpation; and the same might be done in our colonies of Trinidad and Demerara, whence I have reason to think that many of the other victims are procured. But the most effectual remedy would be for every rightminded man or woman to discountenance the wearing of feathers on the person or their use in the decoration of furniture."

Mr. Buckland on Crabs.

Mr. Frank Buckland suggests a new way of killing crabs, which we commend to the notice of Mr. Bergh and other protectors of the brute creation. Usually the unfortunate crustaceans are placed in a pot of cold water, which is allowed to heat gradually over a fire, so that the crabs suffer the pangs of a lingering death, the reason for which is that, if at once thrown into hot water, they cast their claws. The proposed mode of painless killing is merely to run an awl or needle through the heart, which is situated in the center of the body, just below the mouth. Crabs, as a general rule, are popularly supposed not to be the most digestible of foods; but Mr. Buckland thinks otherwise. He says that, together with oysters and lobsters, they "should form the diet of all persons engaged in business or literary pursuits where much wear and tear of the nerve power takes place from day to day." No substance conveys phosphorus so readily into the human system, he adds, or assimilates so readily therewith, as the flesh of crustacea.

Effects of Lightning.

The examination by Professor Calladon, of Geneva, of a case of a pyramidal poplar struck by lightning, enabled him to verify some of his previous conclusions, and to add some new observations. The flash which struck this tree, situated 12 yards from the shore of the Lake of Geneva, left perfectly intact the upper portion. At seven eighths of its

hight commences the trace left by the lightning, in the form of a wound (*plate*), 1 to 1¼ inches in width and from 2 to 2½ inches in depth. This wound descends as far as the ground, turning round the trunk in the form of a screw, and describing four fifths of the complete circumference of the tree. Fragments of wood of various sizes were projected to distances as far as 50 yards. Some are pierced by jagged holes, indicating a violent eruption of the electric fluid from the interior to the exterior, the track of the fluid having probably been in the layer which separates the alburnum from the old wood or duramen. The places where the emission of the fluid occurred are sometimes indicated by spots of a red color, similar to the effect which might be produced on wood by the application of a hot iron. They correspond to a slight depression of the surface of the wood. The wound of the tree is turned from the shore of the lake, lightning striking more readily plants which grow near watercourses, visible or underground.

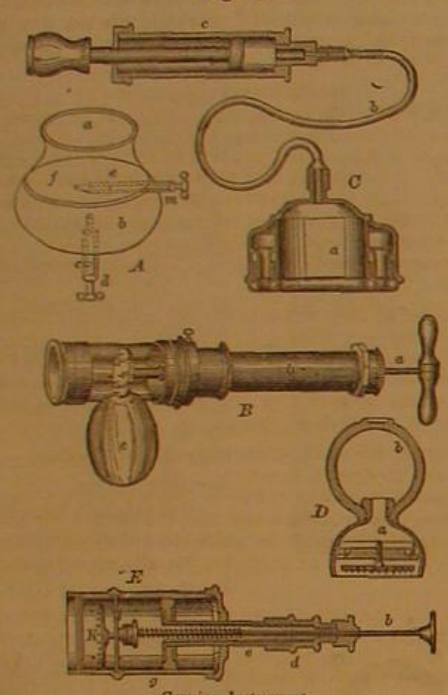
MEDICAL AND PHILOSOPHICAL INSTRUMENTS.

Our extract, this week, from Knight's "Mechanical Dictionary,"* includes descriptions and illustrations of a number of improved surgical and philosophical instruments. One of the oldest

CUPPING DEVICES

known is that described by Hero, of Alexandria, and represented at A, Fig. 1. It consists of a glass vessel, having an

Fig. 1.



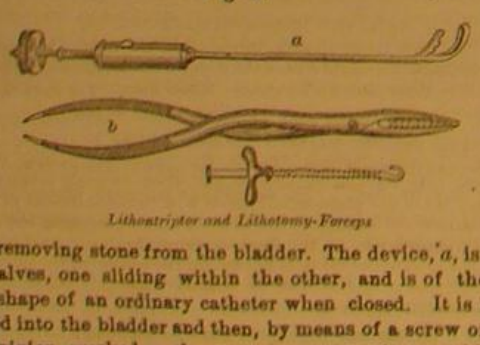
Cupping-Instruments.

inner chamber divided from the former by a diaphragm, *f*. *m* is a valve which governs the opening, *e*, in the diaphragm. The valve, *d*, controls the aperture, *c*, by which the chamber, *b*, is connected with the external air. The valve, *d*, being opened and the valve, *m*, closed, the mouth is applied to the opening, *c*, and a powerful inspiration is taken, rarefying the air in chamber, *b*. The opening, *a*, is then applied to the skin of the patient, and the cupping operation follows. Another apparatus of modern date is shown at B. The glass cylinder has a lip attached suitably for application to the skin. A central rod, *a*, has a disk with lancets which act as scarifiers, and the air is exhausted from the cylinder by means of a piston in the tube, *b*, attached. *l* is the blood receiver. In the instrument, C, the receiver, *a*, is connected by a flexible pipe, *b*, with the nozzle of an ordinary syringe, *c*. The sides of the concentric chamber afford an extended bearing for the cup, and prevent its being driven into the body by the pressure of the atmosphere. In D, the glass has an elastic bulb, *b*, by which the partial exhaustion is effected, and has also an adjustable disk provided with puncturing points to lance the skin. The scarifier, in E, is placed exactly within the hollow piston rod, *e*, which works in a stuffing box on the cylinder, *g*. In using, the air is exhausted from *g* by the motion of the piston, *e*, operated by the handle, *d*. To puncture, the needle bar, *b*, receives a quick downward thrust, forcing the needles on X, into the protuberant flesh within the cup. The spring returns the needle bar and disk into position. The

LITHONTRIPTOR AND LITHOTOMY FORCEPS,

Fig. 2, are instruments for crushing into small fragments

Fig. 2.



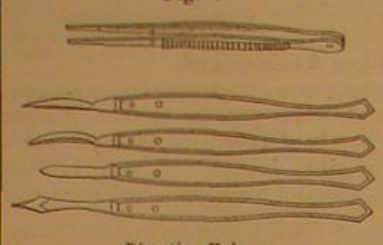
Lithontriptor and Lithotomy-Forceps

and removing stone from the bladder. The device, *a*, is made in halves, one sliding within the other, and is of the size and shape of an ordinary catheter when closed. It is introduced into the bladder and then, by means of a screw or rack and pinion, worked on the outer extremity, the movable part is made to slide back, thus forming two jaws by which the stone is grasped. By turning the screw or handle, the blade is propelled onward by short jerks, thus breaking the stone into such small fragments that it may easily be voided. The lithotomy forceps, shown at *b*, is used for extracting stone from the bladder through the opening previously made by lithotomy. Its blades are concave and corrugated, and, through their crossed shanks, may be fully opened when inserted, without expanding the wound. Various forms of

DISSECTING KNIVES

are shown in Fig. 3. The forceps, also in the figure, is designed to extend or tighten the flesh at the point of division and to aid in removing divided parts. The shapes of the knives need no special description. The dissection of the human *body for* purposes of Science was first ordered by Ptolemy Philadelphus, in the college of Alexandria, Egypt, who even authorized the vivisection of criminals condemned to death. Fig. 4 represents

Fig. 3.

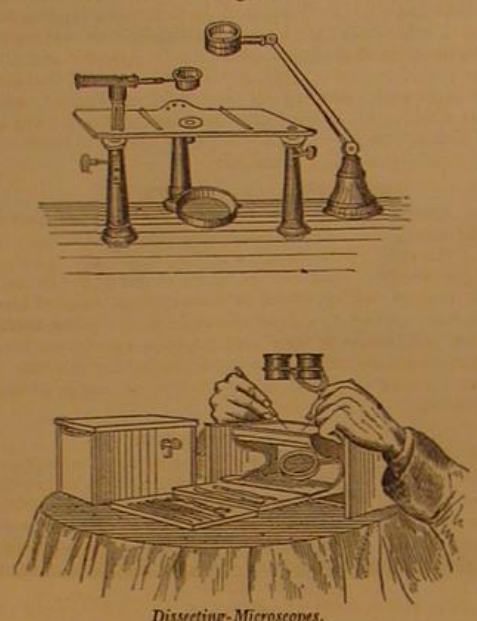


Dissecting-Knives.

DISSECTING MICROSCOPES.

The stage of the upper figure has rack adjustment for focus,

Fig. 4.



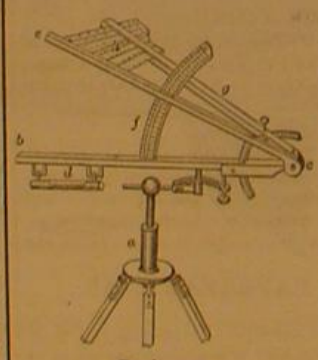
Dissecting-Microscopes.

spring clips to hold object slide, diaphragm, movable arm for carrying the lenses, and separate jointed stand on which any of the sets of lenses can be placed. The lower figure is of a binocular microscope of moderate power. It is made to close up in a box, the top and front of which contain loops to hold the knives, scissors, etc. Beneath the glass is a gutta percha stage and an illuminating mirror.

THE DENDROMETER,

Fig. 5, is an instrument for measuring the hight and diameter of trees, in order to estimate the cubic feet of timber therein. The surveyor elevates the limb, *e*, until that part of the tree to which the measurement is designed to extend is exactly cut by the line of observation, and the angle subtended between that and the horizontal limb, *b* (which is set by the spirit level), is shown upon the vertical arc, *f*. The gradations on this arc are marks answering to feet and inches of a tangent line extending from the horizontal point upward, taken at a given distance from the tree. The horizontal angles, which are to determine the diameter of the trunk, are ascertained by the limb, *g*, which slides on an arc, *h*, which is marked similarly to *f*. The length of the trunk and its diameter at several parts being thus ascertained, recourse is then had to tables, etc., for finding the corresponding solid contents. The

Fig 5.



Dendrometer.

GEOMETRIC SQUARE,

Fig. 6, is an instrument for measuring distances and hights. It is made 12 or 18 inches square, and the quadrant is graduated in each direction. The two sides opposite to the axial point of the alidade are graduated to 100 equal parts, with major divisions of 10 of said parts. The 100 point finishes at the angle obliquely opposite the center from which the arc is struck. One side represents the horizon, and the alidade with two sights is equal in length to the diagonal of the square. The alidade has divisions equal to those on the sides of the square. In measuring vertical hights, the distance is measured from the station in the base, and by moving the alidade the angle subtended by the object is observed. The

Fig. 6.

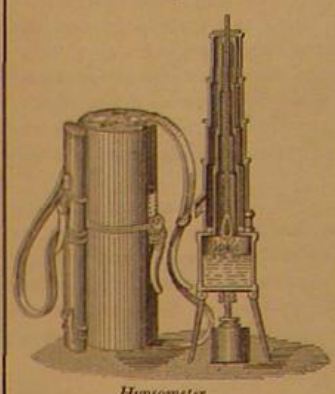


Geometric Square.

HYPSOMETER,

Fig. 7, is used for measuring hights by observing differences in barometric pressure at different altitudes. This is usually done by noting the boiling points of water. The temperature is shown by a mercurial thermometer with a very large bulb and stem, which has a length of 1 inch for every degree of the scale. This is read by a vernier to 1,000ths. It is found that a difference of barometric pressure of 0·589 inches is equivalent to 1° in the boiling point or 530 feet of ascent at moderate elevations.

Fig. 7.

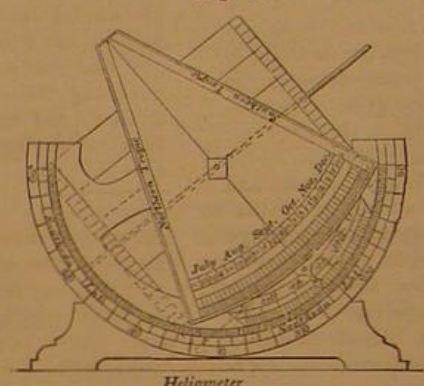


Hypsometer.

THE HELIOMETER,

Fig. 8, serves to ascertain the solar time in all latitudes, and

Fig. 8.



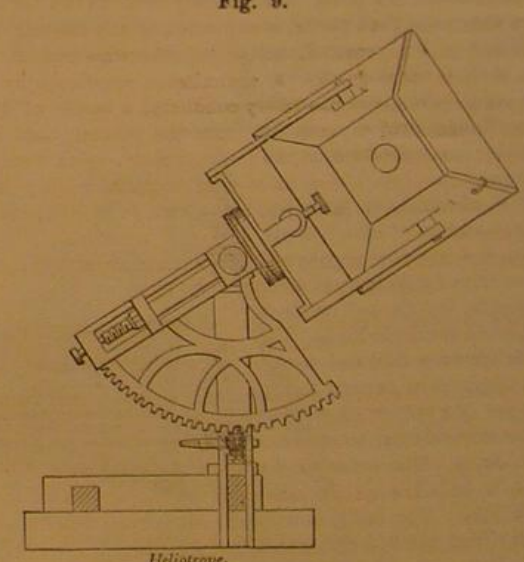
Heliometer

for ascertaining the latitude when the apparatus is set at noon according to the date. It also is used for finding the date and length of day, sunrise and sunset (other conditions being established), the difference of time between two places, the position of the earth's axis in relation to the level at the point of observation, etc. It does not admit of a brief description.

THE HELIOTROPE,

Fig. 9, is a geodetical instrument used to reflect a ray of light

Fig. 9.



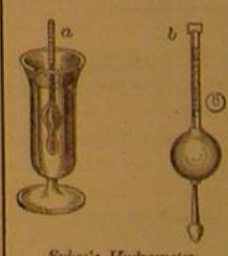
Heliotrope.

to a distant station. That used in the British triangulation has a silvered disk, and has been seen at 100 miles distance, from Cumberland to Ireland. The

HYDROMETER,

Fig. 16, is employed for determining the relative densities of liquids as compared with distilled water. It consists essentially of a float weighted at the bottom so as to keep upright, and having an elongated stem, which in Sykes' instrument, here shown, is graduated into 11 equal parts, which are again subdivided into 22. Eight different weights, numbered respectively 10, 20, etc., to 80 are used in connection with it. The proper weight to be employed depends on the strength of the spirit, etc., to be tested. It is placed on the lower projecting stem, sinking the instrument to a depth corresponding to some one of the gradations on the upper stem. This is noted, and also the temperature of the liquid; and the corresponding strength per cent of spirit is then found from tables constructed for the purpose.

Fig. 10.



Sykes's Hydrometer.

PEAT.—At Clay, N. Y., near Syracuse, the Dodge process for drying and condensing peat into fuel is now in successful operation. $1 a tun is alleged to be the labor cost of production. The specimens we have seen are excellent.

THE French Academy of Sciences has awarded a prize of $4,000 to M. Paul Bert for his original researches on the effect of barometric pressure on the phenomena of animal life.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

Parisian Toy-Making--Utilizing Waste.

Any one who has ever walked through one of the great toy-importing houses in this city at holiday time, and perhaps wondered at the taste and ingenuity displayed by the French workmen in devising many of the most beautiful playthings, would hardly imagine that waste and refuse materials, very odd ones too sometimes, are largely used in the Parisian toy industry. Elegantly dressed dolls, tricked out in all the refinements of the latest fashion, and which fetch incredible prices on this side of the Atlantic, are frequently costumed from the cast-off stage clothes of actresses in the theatres, purchased for a mere song, or from the useless garments remaining in theatrical wardrobes after a play has had a long run. The coverings of old purses and pocket books, fished out of the gutters by sharp-eyed ragpickers, furnish the material for the doll boot maker. Old sardine boxes and cans yield their plate to the manufacturer of barrels for toy guns. The little wooden or metal wheels which support movable toys are obtained from the refuse of any industry in which articles having circular openings are made. French cruet stands, usually of wood and having holes for bottles, provide thousands of such disks, removed in making the apertures. All the solder and pewter that can be extracted from old roofing and water spouts, or workshop scraps is pressed into service for the manufacture of dolls' knives and forks, tea sets, etc. ; and even the ancient lead coffins dug out of the old cemeteries at Nuremberg, the French toy maker utilizes in the manufacture of lead soldiers. No other nation equals the French in converting the ordinary refuse of the street and workshop into useful and ornamental products. It is this characteristic for saving which makes the French nation so prosperous.

Cooking by Cold.

It is a curious fact, not generally known, that the action of intense cold on organic substances is similar to that of a high degree of heat, and that, when subjected to a very low temperature, meat can be brought to a condition similar to its state when cooked by actual warmth. Quite recently a Hungarian chemist, Dr. von Sawiczewsky, who, it appears, has investigated all the various ways suggested for preserving meat (by chemicals, cooking by heat and hermetically sealing, etc.), and has found points of objection to all, has attempted the preparation of the material by subjecting it in a perfectly fresh state to a temperature of 33° below zero, Fah., and sealing it afterwards in tins. The results obtained have been highly satisfactory; the meat on being removed from the cans appears, in point of smell and color, as fresh as if just taken from the butcher's stall. Although partially cooked, and thus requiring less fuel to complete its preparation for the table, it is entirely without the taste of meat which has been partially subjected to any heating process, and may be roasted, boiled, or otherwise treated, the same as if it were fresh. A commission appointed by the German governments has lately conducted a series of careful and successful experiments upon the process; and as a final test two corvettes of the German navy, being about to circumnavigate the globe, have been supplied with a large stock. An extensive factory is being erected in Hungary for its manufacture.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

PATENT CORSET LOOM.—HUGO CARSTAEDT *vs.* THE UNITED STATES CORSET COMPANY.

The defendant's mechanism does not infringe the first or third claims of the patent. The defendant's take-up is materially unlike the corresponding parts of the plaintiff's machine, and their needle bar is not in combination with the sectional rollers or wheels, which are described in the plaintiff's patent.

The take-up, which is mentioned in plaintiff's second claim, does not mean every kind of take-up, or the take-up in every kind of loom, but refers only to take-ups which are designed for or adapted to the weaving of irregular fabrics.

The plaintiff's needle bar is placed in such relation to the cloth and to the take-up, and by means of such position it is enable to accomplish a result which had previously been unattained in corset weaving.

SHIPMAN, J.:

The patent which is alleged to have been infringed by the defendant was granted to the complainant on March 30, 1869, for an improvement in take-up mechanism for looms for weaving irregular fabrics, and was reissued on November 19, 1872. The patented machine was designed expressly for the weaving of corsets. In weaving articles of irregular size, it is necessary to give greater fullness to one side or portion of the woven articles than is given to another portion. The cloth, notwithstanding this irregularity, is woven in one piece, so that sometimes the weaving proceeds regularly across the whole width of the fabric, and sometimes irregularly across an increasing part of the width.

The defendant's mechanism is also a take-up mechanism which is adapted to irregular fabrics, but is not sectional in its character. A sectional take-up is one which takes up the cloth only on some parts of the fabric, while the rest remains unmoved; that is, the rolls which are used to take up the cloth are divided in sections, and can be used independently of each other. The defendant's take-up consists of an endless sheet or sheets of rubber, pressing the fabric against a roller.

It is strongly contended by the defendant that the complainant's needle bar is antedated by the needle bar which is described in the French patent, dated October 2, 1846, to Messrs. Bender, Bandier, and Madame Gobert. The devices mentioned in the patent, and exhibited in the drawings, are somewhat complicated; but the needle bar, which in one part of the specification is styled a rotary bar, seems to have been either a rotary bar or a fixed bar attached to a movable traction box, or traction slide, and not in any proper sense of the word a stationary bar; it did not, therefore, anticipate the bar of the complainant's patent.

As the patent of William P. Brown, and his knowledge and use of the plaintiff's invention, were not set up or referred to in the answer, the testimony in regard to the Brown take-up was not considered.

Let there be a decree for an injunction against the use of the needle bar, and for an account with costs.

[*J. Van Santvoord*, for complainant.
Geo. Gifford, for defendants.]

United States Circuit Court---Southern District of New York.

THE GOODYEAR DENTAL VULCANITE COMPANY AND OTHERS *vs.* EBEN M. FLAGG.

The courts have determined that the construction to be given plaintiff's patent was India rubber, "and the compounds commonly employed therewith reduced to a soft plastic state, capable of vulcanization, and subsequently vulcanized."

In the process described by defendant, he does not use India rubber, or any substance capable of vulcanization. The substance used by him is rendered plastic, and not hardened by heat.

BLATCHFORD, J.

I do not find that any decision has been made in regard to the plaintiff's patent, which gives to it such a construction as necessarily includes the process and substance used by the defendant.

In the Gardner case the defendant did not compound India rubber with sulphur, but he compounded India rubber with iodine, and he employed heat to harden the rubber (Goodyear Dental Vulcanite Company *vs.* Gardner, 4 Fisher's Patent Cases, 224, 231.)

In the Smith case the view of the court was that the material to be used under the plaintiff's patent in carrying out the invention patented was to be India rubber, "and the compounds commonly employed therewith reduced to a soft plastic condition, capable of vulcanization and subsequently vulcanized." Goodyear Dental Vulcanite Company *vs.* Smith, 5 *Official Gazette* of Patent Office, 585.)

It appears from the description of the process used by the defendant in this suit that he does not use India rubber or any substance capable of vulcanization; that the substances he uses is one which is rendered plastic by heat, and is not hardened by heat; that heat is used in the process to soften the substance, and render it plastic, and not to harden it, and that the substance, after being molded, is hardened by being cooled. It is not sufficiently clear that this process is embraced in the claim of the plaintiff's patent to warrant the granting of an injunction until one is awarded as the result of a decree for the plaintiffs on final hearing.

(*E. N. Dickerson* and *B. F. Lee* for the plaintiffs.
W. D. Shipman, C. A. Seward, and *S. Luther Hamilton* for the defendant.)

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STONE-DRESSING AND SAWING MACHINE.

Silas Steinbeck, Chicago, Ill.—This invention consists of rotary sawing and surfacing cutters, having recesses or notches of peculiar form, to admit the sand between them and the stone; and it also consists of improvements in means for feeding the sand to the cutters, which consist of a slowly rotating screw, which throws the sand over the edge of the trough on to conductors down which it flows to the stone at the cutters.

IMPROVED SPRING MOTOR.

Edwin Lambkin, Sebewaing, Mich.—This is an improved spring power for running street cars, railroad hand cars, road vehicles, and driving machinery. The invention consists in the peculiar construction of a spring drum, and in means for applying a brake and operating a shifting mechanism, the whole of novel and ingenious construction, but hardly possible to explain clearly without the aid of drawings.

IMPROVED CROSSCUT SAW HANDLE.

Samuel Boone, La Gro, Ind.—We have here an improved mode of attaching saw handles to the saw. There is a ferrule, with a perforated rubber block in the closed end thereof, a saw-binding clamp-piece, which is securely attached to the handle by a binding block, with saw-fastening clamps, and a shank with threaded end that extends into a perforation of the handle to be screwed thereon. A rubber cushion and washer at the bottom of the ferrule produces the secure attachment of handle to ferrule and block. The saw is recessed both at the back and side edge, to apply the handle longitudinally or at right angles to the saw.

IMPROVED BACKLASH SPRING.

Thomas Alsop, Elkhart City, Ill.—This inventor proposes a new back lash spring for mill spindles, shaftings, etc., which bears equally on the pinion at both sides of the shaft, and takes up the backlash uniformly throughout the whole length of the spring. The invention consists, mainly, of one or more springs, coupled together and applied at one end by a fixed sleeve or clutch to the shaft, and at the other end to a loose disk that engages, by stops or pins, the pinion that transmits the power to intermeshing gearing. The springs are rendered durable, as no friction or tensile strains are exerted thereon.

IMPROVED SAW GUMMER.

Jason W. Mixter, Templeton, Mass.—This inventor now improves on the saw gummer for which letters patent have been granted to him under date of June 23, 1874, so that the carriage, which is formed with a quadrantal slot at each end, is allowed to swing freely upon screws which pass through said slots and enter the main frame, admitting thereby the changing of the line of cut from the horizontal to the perpendicular without moving the cutter from its place, and without necessitating the readjustment of the machine.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BEE HIVE.

William L. Hamilton, Glasgow, Ky.—This bee hive is provided with the latticed frames, working in and out of the upper chamber on slides, and held detachably together by wires, to be opened readily for taking out the honey.

IMPROVED HAY RAKER AND LOADER.

George Lambert, Hill Grove, O.—This is a new machine for gathering hay and loading it upon a wagon in a compact form. The hay is elevated by an endless apron having cross bars and swinging arms with spikes to collect the hay. Guides raise the arms from a horizontal to a vertical position as the apron lifts the hay, thus compressing the same.

IMPROVED PLOW HANDLE.

William A. Couch, Hannibal, Mo.—This is an open work metal handle, easily attached to the upright of the plow stock by a single bolt. The novelty lies in the construction, which is such as to ensure strength as well as lightness.

IMPROVED GANG PLOW.

Enoch C. Eaton, Pinckneyville, Ill.—This invention includes several new and ingenious devices by which the plows can be readily adjusted to work deeper or shallower in the ground, which will hold the plows from lateral play when at work. Suitable new arrangements also enable the plows to be easily raised from the ground.

IMPROVED GUANO DISTRIBUTER.

Richard A. Barrett, Newsome Depot, Va.—This relates mainly to combining with the distributing cylinder an axle having long journals, frame bearings, flanges, and nuts. When nuts are screwed up, the distributing cylinder is compelled to turn with the axle; but when the nuts are loosened, the weight of the distributer will hold the axle still while the wheels revolve upon its journals.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED REFRIGERATOR CAR.

Arnold W. Zimmerman, Denison, Tex., assignor to Samuel Pillsbury, New York city.—This inventor has devised a new refrigerator car for preserving fresh meats, vegetables, and other perishable articles while transporting them over great distances. There is an ice receptacle at the top of the car, provided with flat top and curved and inclined bottom. Above the ice receptacle an air space is formed, that communicates, by side spaces, with the main part of the car, for conveying the warm air and vapors to the ventilators above the air space. The condensed moisture is collected by a longitudinal inclined trough below the lowest part of the ice receptacle, to be conveyed to the outside. The ice water of the receptacle is drawn off by end pipes and stop cocks.

IMPROVED SHAWL STRAP.

Frederick Turner, Frankford, Phila., Pa.—This consists in a combination of straps with a handle, which terminates at each end in a spring hook for connecting the straps, so that they can be connected and disconnected readily. It also consists in the combination of a cross bar, having a hook, with the handle and strap.

IMPROVED SPRINKLER.

John C. Melcher, Black Jack Spring, Tex.—This is a short drum, with the inlet for receiving the water on one side and the orifices for discharging the water on the opposite side. The device has the effect of causing the water to emerge in solid jets, capable of reaching over a wide range of area.

IMPROVED CENTER BOARD.

William Austin, Apalachicola, Fla.—These center boards do not differ from the usual single center boards, except they are each placed obliquely to, instead of parallel with, the keel of the vessel or boat. By virtue of the angle at which the center boards are placed the vessel is set to windward, and made to run much closer to the wind than vessels having the ordinary center board.

IMPROVED SPARK ARRESTER.

Royal P. Faries, Wichita, Kas.—This consists of a wire netting section in the smoke stack for the escape of the smoke. The cinders are allowed to pass above into a trap formed by a close cover over the pipe and a contraction of the top of the latter, from which they are conducted back into the smoke arch through pipes passing down the side of the smoke pipe through the saddle.

IMPROVED SCHOLAR'S COMPANION.

William A. Harwood, Brooklyn, N. Y.—The object of this invention is to provide for use of school children a pocket companion or case for pencils, pens, etc., which shall possess a shape best adapted to enable it to withstand the rough treatment to which it will ordinarily be subjected in actual use, and to prevent rapid wear of the pocket in which the case is carried. The box is formed of a single sheet of tin, bent to form rounded sides, the bottom being nearly flat. The ends are formed of separate pieces of conical forms, and are fastened on said body so as to inclose its ends. The cover is a mere strip of tin with parallel edges, and is fitted to slide forward and backward in grooves.

IMPROVED MUZZLE.

August Miller, Salina, Kas.—This is an improved muzzle for calves, by which they can be effectively prevented from sucking the cows when in the same inclosure with them, without being hindered from grazing or getting other food. A full top muzzle frame with a swinging front plate has hinged and spurred side plates, the whole being attached to the head by suitable fastening straps. The swinging side plates have inward projecting catches, that bear on the top frame, and prevent the front and side boards from swinging away from the mouth.

IMPROVED LIFTING JACK.

Samuel E. Mosher, Chillicothe, Ohio.—This is an improved lifting jack, which may be made entirely of cast iron, and adjusted to any suitable hight to support the weight to be lifted in a safe and reliable manner. A hollow standard guides a tubular and toothed lifting bar, into which the toothed and lever acted block enters that raises the lifting bar to support the same on differential toothed spring pawls at any hight. The actuating lever is made of two sections, fulcrumed to oscillating pieces of the main standard and pivoted to the lifting block.

IMPLEMENT FOR FORMING BARBS ON WIRE FENCES.

James H. Hill and William H. Jayne, Boone, Iowa.—This is an improved implement for forming barbs upon the wires of a wire fence easily and quickly, and in such a way that the barbs will retain their places securely. By suitable construction the barbs are firmly twisted around each other and around the fence wire.

IMPROVED HAIR RESTORATIVE COMPOSITION.

Mrs. Anness R. Kinyon, Downer's Grove, Ill.—This improved restorer consists of extract of wild grape vine, with which is combined salt and castor oil, to cleanse and heal and prepare the scalp for the restoring properties of the grape vine. The alcohol is combined in sufficient quantity to cut the oil and keep the preparation sweet.

EXTENSIBLE FRAME FOR WINDOW SCREENS, ETC.

John R. Simpson and George W. Simpson, New York city.—This improved frame, though designed especially for a fireboard frame, may be used for a window screen frame. It is so constructed that it may be readily expanded and contracted, to adjust it to fireplaces and windows of various sizes.

IMPROVED BOILER TUBE STOPPER.

Peter Walker, Jersey City, N. J.—This consists of a spring packing ring and a clamp for expanding it for each end of the boiler tube. The clamps are formed of a collar on each end of the tube. Other collars on a rod pass through the tube, and are fixed so as to clamp and expand the packing rings tightly into the tubes of the boiler. The rod and tube of the stopper are of suitable length to fasten the packing rings into the tube at the ends. A stopper of this kind can be put in a locomotive or marine boiler, by the aid of suitable tools, without stopping the fire.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING WAGON.

Jacob Kramer, New York city.—This is a dumping wagon having the seat mounted upon the front truck, and the body hinged at or about the middle thereof to the rear axle, whereby the rear axle bears the greater part of the load, and the body turns clear of the seat.

IMPROVED WHIFFLETREE.

Remus D. Hale, Transitville, Ind.—This consists of a dovetail-shaped projection on the under side of the whiffletree sliding into a corresponding grove in the top of a stud pivoted in the evener, and fastening by a snap spring, so as to be easily and quickly connected and disconnected.

NEW HOUSEHOLD ARTICLES.

IMPROVED COFFEE POT.

Louis C. Lomer, New York city.—In this coffee machine a liquid-holding vessel (provided with an internal arrangement of strainers and a discharge pipe leading from the bottom thereof) is supported in or upon a detachable stand or pedestal. The improvement relates particularly to the construction of the stand, which has semi-circular hinged covers, which are left open while the alcohol is burning, and closed to extinguish the flame.

IMPROVED DOOR AND GATE SPRING.

Levi Gallaher, Businessburg, Ohio.—This spring is so arranged as to throw back the gate whenever the latter is opened only sufficiently to allow passage through. When the gate is pushed open more widely, devices prevent the action of the spring.

IMPROVED IRONING TABLE.

John L. Young, Foxburg, Pa.—To this improved ironing board the shirts may be readily applied, and then securely retained in stretched state for ironing. There is a dovetailed recess at one end, to which the collar band is attached by a fastening key, and also a dovetailed stretching block, to which the lower part of the bosom is keyed. The block is guided in the recess at the opposite end of the board by a projecting bottom edge, and locked to the ratchet teeth of the recess.

IMPROVED BOILER WASHING MACHINE.

William B. Rodecker and Frank C. Pifer, Eureka, Ill.—This invention relates to the arrangement of parts, whereby the clothes are turned in the cylinder and prevented from becoming packed too closely against the sides thereof; also, whereby the cylinder is held in the middle of the boiler.

Business and Personal.

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Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

R. J. W. can prepare gun cotton by following the formula on p. 282, vol. 31. Cone pulleys can be proportioned by the rules given on p. 180, vol. 26.—F. K. will find a recipe for cement for grindstones on p. 251, vol. 31.—W. C. will find a description of the manufacture of bicarbonate of soda on p. 125, *Science Record* for 1875.—W. N. can proportion his safety valves by the formulæ given on p. 363, vol. 29.—W. & Co. can produce a fine black finish on German silver by using the method described on p. 288, vol. 31.—W. J. W. will find directions for gilding with leaf gold on p. 347, vol. 31.—J. F. Y. will find a description of salicylic acid on p. 96, vol. 33.—C. F. M. will find directions for refining cotton seed oil on p. 11, vol. 32.—J. E. J. will find directions for calculating the horse power of an engine on p. 33, vol. 33. This also answers J. McD. A cement for fastening leather on pulleys is described on p. 42, vol. 26.—T. H. S. can blue iron by the process described on p. 123, vol. 31.—B. S. S. will find directions for melting small quantities of brass on p. 54, vol. 31.—F. P. will find a good recipe for black ink on p. 92, vol. 33.—W. H. Jr. will find a recipe for marine or waterproof glue on p. 42, vol. 32.—J. M. C. will find directions for gilding on marble on p. 59, vol. 30.—R. A. E. will find some excellent directions for painting carriages on p. 308, vol. 33.—W. A. McG. will find a recipe for yeast on p. 183, vol. 33, and one for baking powder on p. 123, vol. 31.—B. W. S. will find directions for laying out a wind wheel on p. 241, vol. 32.—H. B. will find a recipe for aquarium cement on p. 80, vol. 31.—O. C. L. will find directions for producing the Etruscan finish on gold on p. 363, vol. 33.—P. W. will find an answer to his query as to sizes of boilers on p. 43, vol. 34.—A. B. will find a description of Pharaoh's serpents on p. 315, vol. 32.—R. T. W. will find a recipe for indelible ink for stamping on p. 129, vol. 28. This also answers A. F.—W. P. will find directions for painting outdoor work on p. 402, vol. 31.—W. L. S. will find full directions for burning coal dust economically on p. 107, vol. 32.—I. O. Y. will read the SCIENTIFIC AMERICAN regularly, he will not waste his time over the perpetual motion nonsense.—N. R. H. will find a recipe for a dipping acid on p. 139, vol. 31.—H. R. will find directions for making a tar concrete sidewalk on p. 50, vol. 32.—C. R. will find directions for enameling the insides of iron vessels on p. 362, vol. 32.—E. D. J. will find a description of a depilatory on p. 362, vol. 32.—W. K. will find a recipe for scarlet ink on p. 200, vol. 30.—C. W. can fireproof shingles by the method described on p. 280, vol. 28.—F. R. can tan skins with the fur on by the process described on p. 233, vol. 26.—C. J. can preserve wood from decay by the process detailed on p. 319, vol. 31.—W. D. will find directions for making plaster of Paris on p. 399, vol. 29.

(1) D. L. says: 1. I wish to construct a magic lantern for parlor use. I have a pair of 3½ inch condensers, and I want to know if the object glasses of a large opera or field glass will do for the magnifying lens. They are two inches in diameter, and achromatic. A. Yes. 2. I have also a compound microscope. I should like to throw objects from it upon a screen. Can I attach it to my lantern? A. By using the lowest power objective you have, without the eyepiece, and placing it and the object in the most concentrated portion of the light, you may be able to get a small projection if your light is good. See p. 101, vol. 34.

(2) S. A. asks: 1. Can you give me a recipe for a lead glazing that will stand a white heat for hours? A. The lead glazings are all characterized by their easy fusibility. You will have to look in some other direction for so refractory a glazing as you describe. 2. Has there ever been any instrument for testing the heat used in burning stoneware? A. Yes, various forms of pyrometer have been employed for this purpose. See p. 130, vol. 24.

(3) G. S. T. says: In walling wells with timber, I find that the wood renders the water unwholesome. Is there any remedy for it? A. Yes, char the wood on its surface.

(4) C. T. C. asks: 1. Is it true that benzine will dissolve india rubber? A. Benzine dissolves caoutchouc but sparingly in the cold. Bisulphide of carbon is the proper solvent, but it also dissolves readily in hot naphtha. 2. Can india rubber be colored? A. Yes, by means of the aniline dyes. 3. Will the benzine, when the solution is exposed to the air, evaporate and leave the rubber? A. If an object be covered with either of these solutions as a varnish, on exposure to the action of the air the solvent will evaporate, leaving behind the rubber as a thin pellicle.

(5) G. P. W. asks: What proportion of fish glue shall I mix with common glue in making belt cement? A. Use 2 ozs. isinglass to every 4 ozs. of glue.

(6) M. H. K. asks: We solder rings with various kinds of precious stones in them, with hard solder, by placing them on a block of metal while blowing on them. I claim that the success of the operation is due to the mass and the conductivity of the block of metal, and that therefore the best conductor of heat of equal size is the surest. A friend contends that it is the mass alone, and that the poorer the conductor of heat, the better. Please state which is right. A. The mass and its conductivity should both be taken into consideration.

Which will preserve ice the longer, of two vessels of equal size, etc., one which is kept free from the water that results, or one which the water fills up, mingling with the ice? A. The former.

(7) J. McC. asks: What will prevent aniline red ink from fading? A. This cannot be remedied. Use some other coloring matter.

(8) G. E. E. says: I send you a specimen of graphite. It is at present impure. Is there any process for purifying it? A. No. 2. Does a large deposit of it indicate the neighborhood of coal, lead, or emery? A. No. 3. Considering the enormous consumption of plumbago, and the working out of many graphite deposits, is an immense mine of it likely to become of any value? A. Yes.

(9) R. R. asks: 1. What will prevent the colors running when carpets are washed? A. Carpets whose colors are not properly mordanted or fast cannot be washed without injury.

How can I make a liquid ink eraser? A. Oxalic or hydrochloric (dilute) acids, and sometimes cyanide of potassium, are employed for this purpose.

(10) S. C. D. asks: 1. What apparatus is necessary for measuring the indices of refraction and dispersion of a specimen of optical glass, for calculation of curvature for grinding correct lenses? A. It requires a circle graduated into degrees and minutes, upon which is mounted a telescope similar to the theodolite, with cross wires in the eyepiece. A small table is attached to the objective end, so as to move with it: a narrow vertical slit illuminated by sunlight is placed 10 or 15 feet distant from the instrument. The telescope is then turned on the slit, and the position read off. Then a prism (made of the glass you wish to try), whose angles are known, is placed upon the table in front of the objective, and the telescope turned so that the solar spectrum is seen at the position of smallest deflection: and then the position is again read. From this the index of refraction is determined. The dispersion is found by observing the fixed lines of the spectrum. 2. Should the edges of the disks be finished before or after grinding the lens? A. After. 3. How is the roughing out for lenses of short radius (concave) done, before applying the tool? A. The convex sides may be shaped by grinding off the edges on a flat tool until it nearly fits the templates. The concave side is ground on convex tools. Opticians who have different tools use those of longer curves first.

(11) M. R. C. S asks: 1. How can I cover small twigs, leaves, and gauzy textile materials with crystals resembling frost or ice? A. Hot concentrated solutions of gum arabic, white sugar, alum, and chloride of ammonium (sal ammoniac) are employed to produce these effects. 2. How can I produce the appearance of icicles? A. Icicles may be imitated by means of pure gelatin (isinglass).

(12) F. W. B. says: I have made some attempts to manufacture sal soda from soda ash, by putting into boiling water all the soda ash it will take up or dissolve, carefully skimming off all the scum that rises, then taking it off to cool; but before it begins to crystallize, I carefully turn it off and leave the sediment. This I repeat three times, and get a clean and clear crystal, but there seems to be quite a waste in the dark sediment left. Is this the best way to make sal soda? A. Crush the crude soda ash into small pieces and calcine in a reverberatory furnace along with a quantity of fine sawdust. Digest the refined ash for some time with clean, hot water (not boiling), draw off the clear liquid into rather shallow troughs, and, by means of a proper ladle, remove the crystal from time to time. The residue is treated to recover the sulphur.

(13) McC. Bros. ask: What substance, when mixed with cane tops and corn tops (out of which and mold a compost has been made) will rot or decompose the said tops, and thus give us a valuable manure? A. Disintegrate the vegetable fibers of the cane tops as completely as practicable, and treat with a suitable quantity of good lime. Sulphate of lime will not answer.

(14) M. L. W. asks: 1. What is the chemical composition of the mineral witherite, and what are its uses in the arts? A. Witherite is a carbonate of baryta. In 100 parts it contains: carbonic acid 22·3, baryta 77·7. It is used in chemical works, in the manufacture of plate glass, and in France in the manufacture of beet sugar. It is also employed in the production of the rarer salts of barium. 2. Are any deposits of it found in this country? A. It is not of common occurrence in the United States, but is found in considerable quantity near Lexington, Ky., with barite.

(15) J. A. H. says: The carrying boards under flour reels are flat, and consequently, in cold weather, with hot air inside and cold air outside, moisture forms on the boards and clogs them with flour. Can you give me a recipe for a varnish that will retain its gloss under these disadvantages? A. Varnishing them would not rid you of the annoyance. It will be necessary for you to jacket them with some non-conducting substance, so as to equalize as far as possible the immediate interior and exterior temperature of the boards, and thus prevent the precipitation of the moisture from the warmer air within.

(16) J. W. T. asks: What are the relative velocities of three planets whose orbits are to each other as 15, 19, and 12, in times which are to each other as 7, 3, and 5? A. If we understand the question aright, the answer will be

15	19	12 multiplied by
7	3	5 respectively.
—	—	—
105	57	60

(17) F. G. H. asks: Will malleable iron rust when in water, or when exposed in a damp place? A. Yes.

I would like to know of a good process for tinning malleable and gray iron castings. A. Pickle your iron castings in oil of vitriol, then immerse them in muriate of zinc (made by putting in muriatic acid as much zinc as it will dissolve), and then dip them in a mixture of 3 parts tin and 1 part lead.

(18) G. W. S. asks: A friend contends that a locomotive exerts a greater power when the crank is on the bottom center than when it is on the top. I say there is no difference. Which is right? A. You are.

(19) M. H. says: I wish to build an oven for heating wagon tires. Can you give me an idea how to make it? A. Build a circular trough with a fireplace on one side and the chimney over the top of it. The roof may be about 12 inches from the top of the trough, and should be of bars of iron, supporting bricks. In heating the tire, keep it covered all over with wood or charcoal, and revolve it in the fire as usual.

(20) C. W. L. C. asks: 1. At what speed shall I run a smooth disk to saw cold iron and steel? A. About 25,000 feet per minute. 2. What shall I use for belting to drive it? A. Leather.

(21) W. E. D. says: I have been using a steel mill for milling brass screws. It was made of round bar steel ½ inch in diameter, with a $\frac{3}{16}$ hole drilled in lengthwise to the depth of 1¼ inches. While using the mill, it became heated by friction, and I cooled it by pouring water on it. While turning up a screw, the mill exploded with a sharp report: at the same time a puff of steam came out from the hole; it blew out a piece nearly ½ inch long and about ⅛ the size of the mill. Wha was the cause? A. Some of the water used in cooling remained in the hole, and the heat vaporized it; the pin fitted the hole too tight to allow the steam to escape, and hence the explosion.

(22) N. S. B. Jr. asks: 1. What kind of wood will make the best sled runners? A. Lance wood. 2. How shall I bend them? A. Boil them in water. 3. I have a pair of red ash poles 1 x 1¼ inches, which I wish to make into runners by bending them up the 1¼ inches way. Can I do so safely by boiling them in water for 4 or 5 hours? A. Yes.

(23) C. says: We are building a steamboat for hunting and fishing purposes, to carry a party of 10 or 12. She is to be 50 feet long, 10 feet wide, with 24 inch gunwales, with a flat bottom, and she must not draw over 8 to 10 inches water. Could a propeller be used in so little water, or should side wheels be used? A. Side wheels would be preferable for this case. Make them as large as convenient, if they have fixed floats. 2. What size of portable engine with horizontal boiler is necessary, and what size of side wheels, to attain 5 or 7 miles per hour up stream? A. If a portable engine is used, it will be necessary to introduce gearing, so as to get the proper speed for wheel shaft, in which case an engine rated at 15 or 18 horse power will probably answer, if sufficient boiler be given her.

(24) W. L. McG. asks: What has become of the report of the commission appointed by Congress for ascertaining the causes of explosions of boilers? A. The commission that made the experiments last season has decided, we believe, to keep them private until the whole series is complete.

(25) S. D. P. Jr. says: In operating a steam boiler, the firemen keep a bed of coal about 10 inches deep. They claim to save coal over the plan of working a lighter bed, for the reason that it does not require stirring up so often, and there is, in consequence, less waste of coal through the grate. I will add that the draft is not very strong. The boiler is 4½ x 12 feet, with 71 three inch flues, in brickwork setting. A. It is difficult to give a general rule, as much depends upon the draft, the kind of fuel, etc. But if you have any doubts in regard to the correctness of your firemen's views, you can settle the matter conclusively in a very short time, by experimenting with fires of different thickness.

(26) J. L. G. asks: Would it be practicable to set a boiler 500 yards from the engine, packing the pipes in sawdust? A. It can be set at this distance, if careful provision is made for draining the pipes.

(27) A. C. asks: Will 16 sticks, each 1 foot in diameter and 8 feet long, make a cord? In other words, what is the legal rule for measuring round timber? A. If you are buying the logs as timber, the general rule among lumbermen is to compute the cubic contents according to what the logs will square. In the case of cord wood, there is so much difference of opinion among measurers, and such variety in the decisions of the courts, that it is not possible to tell you what the legal rule is.

(28) R. D. says: I can take apart, put together, and run one form of engine, but have had no experience with any other. If I applied for a license to run such a one as I understand, would I be examined on engines generally (of which I know but little) or for the one I want to run? A. The examination is generally intended to test the candidate's knowledge of the particular boiler and engine of which he desires to take charge.

(29) A. S. says: I am informed that to measure the capacity of a vessel I should weigh the water it will hold, and that for every 8 lbs. of water it will hold a gallon of liquid. Is this so? A. This rule will give a rough approximation. At ordinary temperatures, the weight of a United States gallon of water is about 8·32 lbs.

(30) C. R. says: A 10 inch pipe is laid on an incline 300 feet long, and then a 20 inch pipe on the same incline. If we put a plug or a fire hydrant on each pipe, give them the same opening, and put the same sized nozzle on each, which nozzle will throw the farther? A. The hydrant on the 20 inch pipe should throw a little the farther under the circumstances, because the head required for velocity and friction would not be as great as in the case of the 10 inch pipe.

(31) J. L. W. asks: How can I prevent the twisting of belts? A. By using a good quality of belting, setting the pulley true, and lacing the belt even and straight.

(32) G. W. G. says: 1. I am about building a steam yacht 38 feet long and of 7 feet beam. Are there any objections to using iron for the hull? A. We see no objection to using iron. 2. Of what thickness should the iron be? A. About ⅛ of an inch thick, or less. 3. Would galvanized iron be the best? A. Galvanized iron will be best on many accounts. 4. Would it be advisable to use side wheels? A. If the boat is to be generally run in smooth water, side wheels will answer well.

(33) J. B. F. asks: What shall I use on the point of a small drill to prevent it from clogging and heating, in boring copper, silver, and gold? A. Lard oil.

(34) R. B. says: I sent you last June the dimensions of a tow boat I was building. At her first trial trip we started out with 65 lbs. of steam, and made the run of 2 miles in 11 minutes, the propeller making 109 revolutions per minute, and the steam being cut off at $\frac{3}{16}$ of the stroke. She has a been running and towing ever since, and has proved herself to be one of the best boats in Baltimore. She has towed a three-masted schooner, laden with 750 tuns of coal, 20 miles in 3½ hours, and made the run back in 2 hours. She has a 16 x 16 inch square cylinder. Her dimensions are as follows: Length 60 feet over all, width 14 feet, depth of hold amidships 7 feet. She draws 7 feet 4 inches water aft and 4 feet forward. Her propeller is 6 feet in diameter. She cost about $9,000, complete. A. You seem to have a very satisfactory and powerful boat. We are much obliged for your letter.

(35) F. M. L. L. says: What kind of power is best for operating coal-mining machines? A. Compressed air or steam.

(36) F. W. B. says: Wishing to build a dam and to put up a mill, and having on hand a 24 inch turbine wheel, I desire to learn if, by suitable gearing, I can use the wheel for the small amount of work to be done, say not over 5 hours grinding per day, or from 20 to 30 bushels? The head of water is from 20 to 25 feet. A. As you have a wheel that can exert more power than is needed, you will scarcely experience much trouble in reducing the effect somewhat.

(37) E. B. asks: What is the best method of straightening stencil plates, after cutting the letters, so that they will lay flat on the work? A. Place each plate on a large block of wood, then straighten it with a small block of wood and a light hammer.

(38) S. K. J. says: In your issue of January 1, you speak of the conductor in Mr. Edison's experiments not requiring insulation, and say that it may be wound round large bodies of metal. Will these bodies of metal, round which it is wound, yield the spark? That is to say, will the "etheric" fluid leave its conductor and pass to the mass of metal, and can the spark be obtained from the mass? So also in the case where it has trailed along the ground, or in the water: can the spark be obtained from the ground or the water? Its practical application depends on this very important point. A. It is now generally believed that the "new force" referred to is electricity, consequently it should be subject to electrical laws. Provided insulation is good, we would, therefore, expect to obtain sparks by induction from the bodies about which the wire is wound.

(39) W. K. asks: What is the best remedy for leaks round the flues and seams of a steam boiler? A. Caulk the leaks.

(40) J. H. L. asks: 1. How are the electro-magnets in the Gramme magneto electric machine wound, to make the poles come in their centers? A. The armature coils are wound separately, the inside end of one coil being connected to the outside end of the one next following. Wires also lead from the junctions to strips of metal attached to a cylinder of some insulating substance. The latter is placed on the armature axis. The coils, for what are called the "field magnets," are all wound one way, but the connections are so arranged that north and south poles come on opposite sides of the armature. If coils with like ends pointing in one direction are put on a magnet, similar poles will be produced at opposite ends of the latter when the inside ends of the coils are connected together and the outside ends joined to a battery. 2. Why could not the frame and magnets be cast in one piece, making the magnets of cast iron? There would be no work on this part but to bore out the journals and cover parts intended for the electro-magnets with copper, thus saving considerable cost. A. They are now made that way.

(41) R. B. asks: Which is the correct way to connect a throttle valve on an engine, that is, which end of the valve should take the steam first? A. The steam should enter on the underneath side of the valve, so that it can be packed whether the steam is on or off.

(42) J. N. P. says: In an article in your issue of January 29, the writer claims that the breakage of band saws is due to the saw being obliged to turn a wheel or pulley, which causes friction, straining of the saw, etc. Could not that be very easily remedied by turning the pulleys by a mechanical movement, independent of the saw? A. The device mentioned is already in use. Another and a beautiful device supplies the supplementary outer rim on the upper or loose pulley. The friction of the supplementary rim is sufficient to turn the loose or upper wheel. But when the lower or driving wheel is stopped suddenly, the upper or loose wheel turns inside of the supplementary rim, which effectually prevents the sudden jerk on a thin narrow blade, which causes most of the breakage. Another device is to belt from the shaft of the driver to that of the upper or loose wheel shaft, so that, when the lower shaft is suddenly stopped, the belt stops the upper one also.—J. E. E., of Pa.

(43) L. R. asks: What is the best substance as a non-conductor of heat, which can be packed in a cavity in iron? A. A mixture of ⅔ plaster of Paris and ⅓ alum is a good one.

(44) O. H. Y. asks: What is the fastest speed at which it is safe to run circular saws? A. Nine thousand feet per minute, that is, nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: Run a saw 12 inches in diameter, 3 feet around the rim, at 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, at 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, at 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, at 750 revolutions; 5 feet in diameter, or 15 feet around the rim, at 600 revolutions. Of course it is understood that the rim of the saw will run a little faster than this reckoning, on account of the circumference being more than three times as large as the diameter. Shingle and some other saws, riveted to a cast iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed.

(45) E. D. E. asks; 1. What is the smallest shaft, 14 inches in length, that I can put in a steam engine, the crank being 2 inches long and the pressure on the end 600 lbs.? A. Use a 1½ inch shaft. 2. What is the best iron for the purpose? A. Low Moor iron or Uister iron.

(46) G. B. C. asks: Can you give me a good recipe for lathe cement, for holding small articles? A. Use beeswax 1 oz., resin ½ oz., pitch ½ oz.; melt, and stir in fine brickdust.

(47) D. L. R. asks: After a current of electricity has passed through an electro-magnetic engine and done its work, what becomes of it? Does it not pass on in its circuit? If it does, why will it not run another engine of same capacity? A. The energy is absorbed in performing the work.

(48) G. S. D. asks: 1. Will a magnet, placed near a piece of iron or steel, impart its magnetism to the iron and steel to that extent that an equilibrium between the two bodies will take place, and so that neither will have any power to attract the other? A. No. If the iron or steel is free from magnetism, there will be attraction; if not, there will be attraction or repulsion: attraction when unlike poles are opposed, repulsion in the opposite case. 2. Will an artificial magnet always retain its magnetism in full force, without any loss from any cause? A. No, unless special precautions are taken with regard to it. 3. Is an artificial magnet as strong as a natural one? A. Artificial magnets can be made with power greatly exceeding that of natural magnets.

(49) T. P. says: Joshua Rose writes the most interesting articles in your journal. This makes it a pity that he should say that, to divide the circumference of a circle into 60 equal parts, "we have only to divide the radius of our circle into 10 equal parts to get the required distance." A. In "Practical Mechanism," No. XLI, the division of the radius of a circle was given as an aid to setting the compasses approximately; it was not intended to imply that by such a rule the compasses could be set correctly to the exact distance. We are obliged to T. P. and other correspondents for calling our attention to the matter.

(50) W. S. says, in reply to J. B. R., who asked for a solution to clean articles after brazing: I have succeeded by dipping, while hot, into a dilution of sulphuric acid in water.

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

G. H. S.—It consists mainly of sesquioxide of iron and silex.—R. B. J.—It is argentiferous galena.—S. P. W.—Write to Professor C. D. Cope, Corresponding Secretary of the Academy of Natural Sciences, Philadelphia. The petrefied wood is not rare enough to be of much value.

S. asks: What amount of flour of both grades is contained in a bushel of good wheat, and how much bran and other refuse?—H. V. says: We get from a cow milk of which the cream is of a light red color, as if there were blood in it. Can any one tell me the cause and the remedy?—G. W. C. asks: How can I repair a rubber comb?—S. asks: Is there any veterinary college in America?—H. G. H. asks: How can I make the flexible composition of which toy beads are made, which looks somewhat like vulcanized rubber?

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 Ocean. By C. O.
On Spontaneous Generation. By S. R.
On Cleaning Chimneys. By W. P. E.
On a New Motor. By A. F. G.
On the Mississippi Jetties. By E. G. F.
On the Life of Matter. By J. R.
On a Pneumatic Tube and Carrier. By A. B. H.

Also inquiries and answers from the following: B. M. Jr.—C. P. S.—J. E.—W. S. M.—J. L.—Z. & S.—W. C.—C. D.—W. M.—A. B. C.—R. K.—F. C. W.—N. Y.—B. D. W.—N. J.—F. C.—J. T. B.—R. C. N.—W. D.—J. McB. S.—E. T. D.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes galvanometers, and what do they cost? Who makes an economical rotary engine, and what is its cost? Who makes ice-making machinery? Who sells the best amateur printing press? Who sells barber's chairs? Who sells agricultural machinery? Who makes machines for tearing up tarred rope? Who sells the Gramme magneto-electric machine?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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Spoke-tenoning machine, J. G. Peace 173,053
Square and bevel, carpenter's, E. Simonin 172,938
Square, tinner's, D. H. Metcalf 172,821

Stairs, Stewart and Conwell	172,830
Stave-cutting machine, Burns and Wass	172,962
Stench trap, L. Brandels	172,865
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Stool seat, R. W. Myers	173,044
Stove and furnace, J. F. Quimby	173,097
Stove, base-burning, E. Smith (r)	6,890
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Stove grate, G. R. Moore	172,822
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Stove pipe joint, D. R. Brownlow	172,844
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Sugar carrier, movable, A. Mitchell	173,088
Surveying instrument, Schneider and Kraft	173,068
Suspender and other loops, J. W. Bradley	172,959
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Tablet, writing, J. H. Hodder	173,006
Tag and seal, combined, E. A. Locke	172,927
Teaching penmanship, copy for, A. A. Connolly	172,971
Telegraph coupler, G. F. Green	172,994
Tent, F. A. Leavitt	172,882
Thill coupling, W. O. Hanby	173,001
Tinner's fire pot, J. H. Whitling	173,096
Tire upsetter, C. H. Reynolds	173,060
Tobacco, etc., stripping, D. H. Hull	173,009
Tobacco pipe, H. B. Stephenson	173,079
Tongs for coal, etc., L. J. Baldwin	172,906
Trap, fly, D. S. Kidder	173,021
Treadle, Barnjum and Dial	172,953
Treadle, H. Reese	173,059
Valve, pressure, F. A. Cramer	172,917
Valve, rotary, J. F. Sweet	173,084
Vehicle, bracket band for, J. G. Lefler	173,026
Vehicles, side bar for, E. J. Sprong	172,939
Vessels, ballasting, J. A. Bidwell	172,907
Wagon tongue, F. Larson	173,025
Wash bench, J. B. Fellows	172,983
Washing machine, Camp and Osterhout	172,964
Watch case spring, I. N. Hopkins	172,827
Watch, stem-winding, A. Philippe	173,053
Watch cannon pinion, Hunter and Moseley	173,011
Watchman's time detector, A. Meyer	173,036
Water closet valve, J. E. Boyle	172,843
Water pressure regulator, E. Hays	172,877
Wax leaves, tool for veining, M. J. McColl	172,819
Well, ventilating driven, J. Suggett	173,103
Wheel or pulley, E. Brown	172,910
Windmill, W. F. Mann	172,885
Windmill, E. S. Smith	173,075
Window washer, A. J. Mosher	173,043
Window weather strip, J. S. McIntire	173,034
Wrench, J. J. Grant	172,854

DESIGNS PATENTED.

8,936.—FAN.—S. M. Dudley, Detroit, Mich.
8,937.—LOCKET.—G. W. Gill, Philadelphia, Pa.
8,938.—BADGE.—J. F. Naulty, Philadelphia, Pa.
8,939 to 8,941.—TOBACCO PIPES.—L. Nax, Phila., Pa.
8,942.—GLASS DISHES.—J. Proeger, Pittsburgh, Pa.
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8,944.—BREASTPINS, ETC.—C. T. Sloan, New York city.
8,945.—TYPE.—D. W. Bruce, New York city.
8,946.—CARD RECEIVER.—G. E. Hatch, East Cambridge, Mass.
8,947.—FURNACE BRICK.—G. H. Nott, Hyde Park, Mass.
8,948.—SADDLE CLIP.—M. Seward, New Haven, Conn.
8,949.—ARM CHAIRS.—M. Sulzbacher, New York city.
8,950.—ADVERTISING CARD.—J. P. Thomas, N. Y. city.
8,951.—TEA SET.—W. C. Beattie, Taunton, Mass.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, January 28 to February 5, 1873.

5,632.—H. Varner, Montreal, P. Q. Fruit gatherer. Jan. 31, 1876.
5,633.—E. Bartlett, Renfrew, Ont. Machine for digging and picking potatoes. Jan. 31, 1876.
5,634.—B. and C. Hickox, Brantford, Ont. Breast iron. Jan. 31, 1876.
5,635.—P. Williams, Detroit, Mich., U. S. Wagon body and hay rack. Jan. 31, 1876.
5,636.—F. Bramer, Little Falls, N. Y., U. S. Wheel harrow. Jan. 31, 1876.
5,637.—F. S. Malloch, Brockville, Ont. Rounding and straightening metallic rods, etc. Feb. 2, 1876.
5,638.—L. and J. Gaffney, Osgoode, Ont., *et al.* Combination and burglar-proof lock. Feb. 2, 1876.
5,639.—A. J. Millikin, Smith's Falls, Ont. Shirt bosom. Feb. 5, 1876.
5,640.—C. E. Carpenter, Syracuse, N. Y., U. S. Side plaiter. Feb. 5, 1876.
5,641.—G. H. Little, Peabody, Mass., U. S. Injector and ejector. Feb. 5, 1876.
5,642.—C. A. Shaw, Boston, Mass., U. S. Nail-cutting machine. Feb. 5, 1876.
6,643.—J. L. Whiting, Boston, Mass., U. S. Making brush handles. Feb. 5, 1876.
5,644.—W. Pearson, Philadelphia, Pa., U. S. Hosiery-sewing machine, etc. Feb. 5, 1876.
5,645.—W. Vassie, Hamilton, Ont. Lamp holder for sewing machines. Feb. 5, 1876.
5,646.—P. K. Dederick, Albany, N. Y., U. S. Wire baling tie. Feb. 5, 1876.
5,647.—W. T. Nichols, Maywood, Ill., U. S. Road scraper. Feb. 5, 1876.
5,648.—E. D. Wright *et al.*, Springfield, Vt., U. S. Lamp chimney. Feb. 5, 1876.
5,649.—F. G. Farnham, Hawley, Pa., U. S. Glove fastener. Feb. 5, 1876.
5,650.—C. Corby, London, Ont. Nut lock. Feb. 5, 1876.
5,651.—W. T. Doremus, New York city, U. S. Chair base. Feb. 5, 1876.
5,652.—C. E. Patric, Springfield, Ohio, U. S. Grain drill and seeding machine. Feb. 5, 1876.
5,653.—E. Curtiss, Findley, Ohio, U. S. Cider mill. Feb. 5, 1876.
5,654.—H. Préfontaine, Montreal, P. Q. Hand blower. Feb. 5, 1876.
5,655.—E. Fisher, Kincardine, Ont. Machine for cutting boiler plate. Feb. 5, 1876.
5,656.—S. Warrick, Montreal, P. Q. Steam engine. Feb. 5, 1876

5,657.—A. J. Griffin, Lowell, Mass., U. S. Hydro-carbon burner and gas generator. Feb. 5, 1876.
5,658.—N. Seibert, San Francisco, Cal., U. S. Lubricator. Feb. 5, 1876.
5,659.—J. J. Hathinger, Hyde Park, Mass., U. S. Carpet sweeper. Feb. 5, 1876.
5,660.—J. L. Whiting, Boston, Mass., U. S. Making brushes. Feb. 5, 1876.
5,661.—H. Disston, Philadelphia, Pa., U. S. Hand saw and handle. Feb. 5, 1876.

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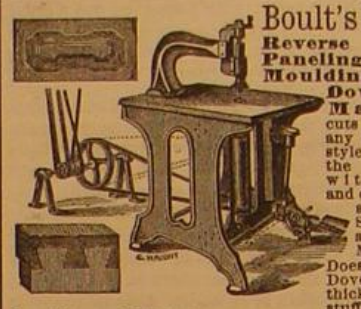
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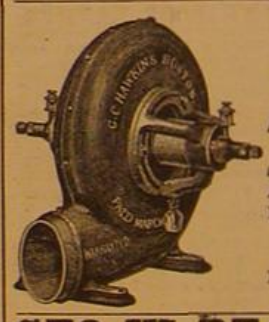
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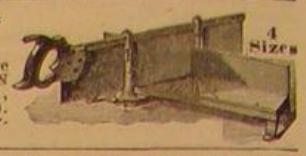
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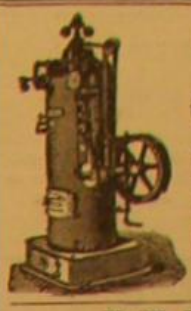
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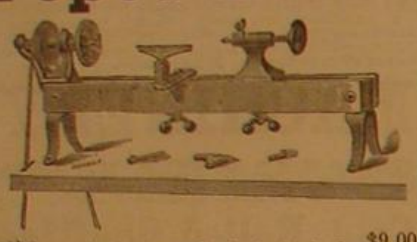
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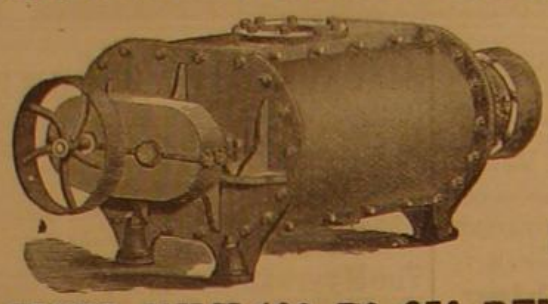
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Vol. XXXIV.—No. 11. [NEW SERIES.] NEW YORK, MARCH 11, 1876. [$3.20 per Annum. [POSTAGE PREPAID.

A NEW SOURCE OF POWER.—ABSORBENT STRATA.

M. G. Hanrian, of Meaux, France, has discovered a source of power in wells and absorbent rock strata, which is certainly both curious and original, and possibly capable of a wide utilization. He proposes to drive machinery or raise water through the absorption of water by the lower strata of the soil, the avidity with which the absorbent rock absorbs the water creating, in the descent of the latter, the power, which is transmitted by mechanism to the surface. This will be better understood by reference to Fig. 1 of the annexed engravings, which we select from the *Bulletin du Société d'Encouragement pour L'Industrie Nationale.* A well, D, is first dug until the water-bearing stratum is pierced. This well is suitably curbed, and then another and smaller excavation, E, is carried downward in the impermeable rock, B, until the absorbent stratum, C, is nearly reached. The bottom of this bore is covered with concrete, F; and a small tube, surmounted by a hood to prevent its being choked by impurities, is continued still further down and into the absorbent rock, C. Inside E is a sheet iron tube, H, entering a wide receptacle at its upper end (at the bottom of which sediment is deposited) and extending down into the water in the lower well. I is a valve governed by the hand wheel from above, which serves to admit water from the main well, D, into the tube, H. Said tube has within it one part of an endless bucket chain, J, which passes over and acts as a bolt on the pulley, N. Another tube, K, is placed in the well, D, and this also contains a bucket chain, M, which passes over the pulley, O. The valve, I, being opened, the water in D, of which there is a continual supply from the springs in the aquiferous stratum, descends the tube H, and enters the well, E; thence it escapes by the tube, S, through which it is forcibly drawn by the absorbent action of the rock at C. In its descent through I, the water, acting on the buckets of the chain, J, thus rotates the pulley, N. This pulley being on the same shaft as pulley, D, the latter also is rotated, and the bucket chain in pipe, K, therefore lifts the water from D, into the receptacle, M, whence it is led away for distribution by the conduit, P. The absorption which takes place through the layer, C, is said to be so complete that, when the valve, I, is closed, the bottom of the well, E (pipe, S, having perforated sides), becomes perfectly dry.

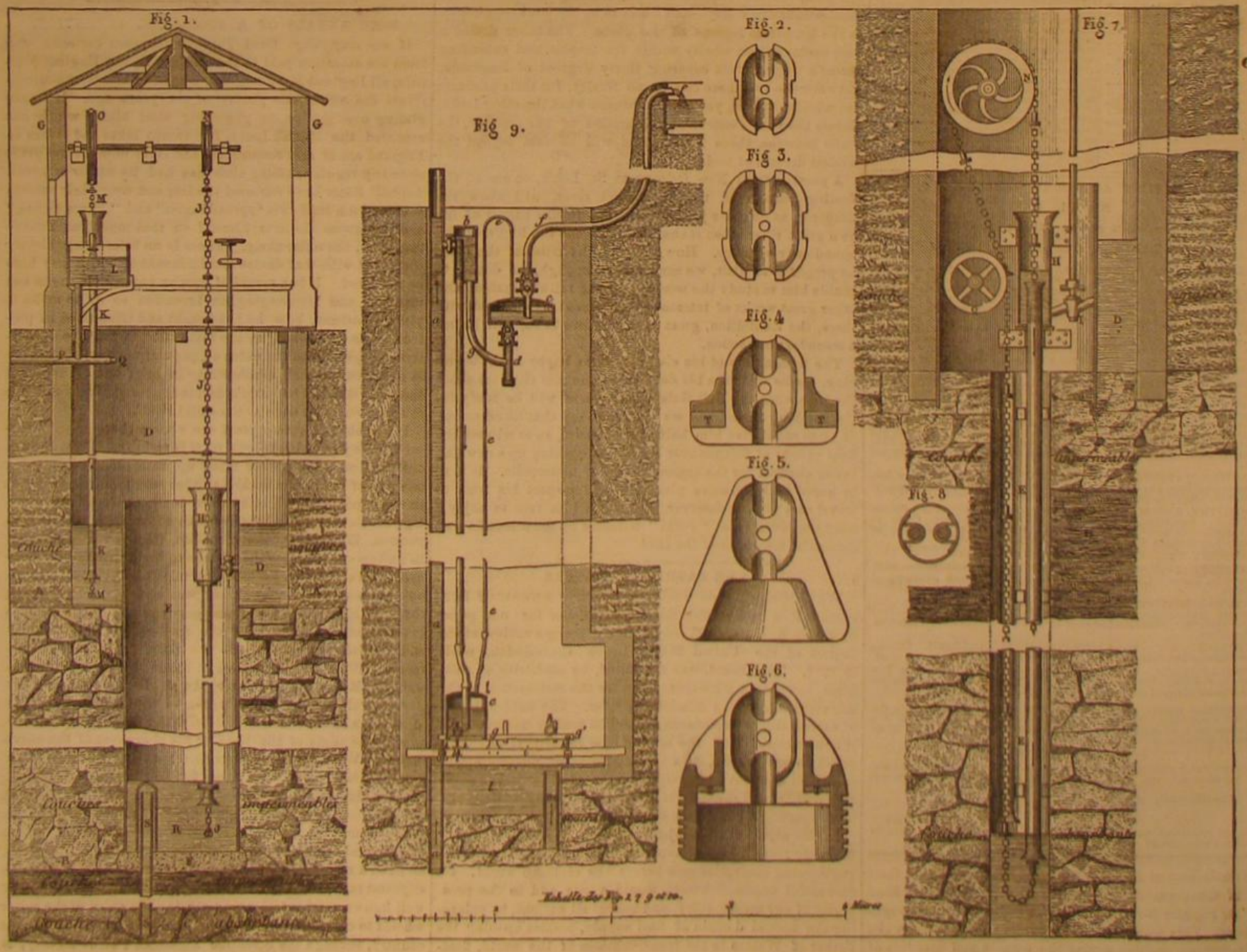
In Figs. 2, 3, 4, 5, and 6 are shown various forms of chain buckets. Fig. 5 is best adapted for thick liquids, Fig. 6 for tubes of large diameter, where the weight to be lifted is heavy. Fig. 7 represents a different arrangement of mechanism designed for the application of the power to machinery. A is the water-bearing stratum, B the impermeable strata beneath, and C the absorbent rock. The well, D, is dug as before, and inside is placed a kind of coffer dam, in the center of the area enclosed by which is sunk a small well, E. The valve, I, admits water from D, into the pipe, H, and the water as before carries down the bucket chain; the ascending part of the chain is guided through another tube, passing over the tightener, O; and finally the power is transmitted to the pulley, N, to the shaft of which the driving pulley of the machine is attached. Fig. 8 is a section of the well, E.

In Fig. 9 an entirely different arrangement of machinery is shown, the device known as Hero's fountain being utilized instead of the bucket chains. This is perhaps best applicable when the absorbent rock lies above the water-bearing stratum, as in the case of an artesian well. From the latter rises the tube, *a*, the water rising in which has access to the reservoir, *b*. A portion of the water descends into the lower receptacle, *c*, by the tube shown, compresses the air in said receptacle, and thus through the small pipe, *e*, causes a similar compression in the reservoir, *c*. But into the latter a portion of the water in *b* has likewise entered, through the conduits, *g* and *d*, and ball valves prevent its return. Consequently the water, in *c*, is compelled to ascend the tube *f*, and thus is raised the required hight, to a receiving reservoir above. As soon as the water which enters *c* is no longer equilibriated by the weight, *h*, on the lever, *g*, which holds shut the movable bottom, said bottom falls open, and the weight, *h*, rolls to the left along the lever, holding the bottom in this position until all the water has escaped. Then the weight counterbalances, the bottom closes, and the operation above described is repeated. The water is at once absorbed by the surrounding rock; and this water, sinking in said rock, tends to displace the water in the layers beneath, and thus forces the same up the tube, *a*, keeping that conduit constantly filled.

It is stated that at Bailly-Romainvilliers, near Couilly, in France, the arrangement first described, and shown in Fig. 1, is in operation, and lifts from 600 to 1,000 quarts of water per hour a distance of 22·4 feet, absorbing for this work from 2,500 to 4,000 quarts at a depth of 185·6 feet. The apparatus shown in Fig. 1 has raised 1,000 quarts per hour 12.8 feet, the sounding tube passing to a depth of 233 feet. These were little more than experimental trials, and therefore can hardly be taken as estimating the possible capabilities of the plan.

The advantage of course lies in a constant power, available wherever a water stratum and an absorbent stratum can be found. The principal obstacle lies in the choking of the pores of the absorbent rock by impurities, but this the inventor proposes to check by filtering the water, and by occasionally administering doses of hydrochloric or sulphuric acid, which will destroy organisms, etc., and expose a clear rock surface.

THE following shows the degree of heat at which gold of varying degrees of fineness melts: 23 carat gold, 2,012° Fah.: 22 carat, 2,009°: 20 carat, 2,002°: 18 carat, 1,995°: 15 carat, 1,992°: 13 carat, 1,990°: 12 carat, 1,987°: 10 carat, 1,982°: 9 carat, 1,979°: 8 carat, 1,973°: 7 carat, 1,960°: composition, 1,587°



RANRIAN'S METHOD OF RAISING WATER

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NEW YORK, SATURDAY, MARCH 11, 1876.

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THE publishers of *Forest and Stream* have opened, at their office, 17 Chatham street, in this city, a "Kennel Stud Book," or register for recording the pedigree of thoroughbred dogs. This work will undoubtedly in time occupy the same important position among the owners and breeders of pointers, setters, and spaniels that the "Herd Book" now does among the admirers of fine cattle.

THE COMING EMPEROR.

When the sovereign of a great country visits a sovereign people, not imperially, to conquer or conciliate, but as a private gentleman, to study their works and ways for the benefit of his own subjects, it is obvious that a new order of royal entertainments is called for. The greeting which a barbaric empire like India accords to its future ruler may fitly be characterized by barbaric shows, parades, illuminations, and festive entertainments; but from a free people, to an enlightened sovereign like the Emperor of Brazil, such things would be out of place, and utterly distasteful.

He comes for information, not to be bored with windy speeches or pretentious dinners. Our local cooks and officeholders have few charms for him, compared with the achievements of our explorers and pioneers, our engineers and inventors, our scientific and industrial leaders. We shall, therefore, entertain him most royally by furthering to the utmost the real objects of his visit, showing him, in the most unobtrusive and sensible way, our physical and industrial resources, our works of internal improvement, the means by which a great wilderness has been conquered for man. The great region which he is doing so much to improve is still very largely similar in condition to what the Great West was a few years ago—a land of fertile plains untilled, broad rivers barren of commerce, mountains of precious metals undisturbed. He has railways to build, internal navigation to develop, immigration to foster, and a wild country to subdue and make tributary to the needs of men. His expressed desire is to study on the spot the means and methods by which this country has been so rapidly and enormously developed, withal so largely brought under the dominion of science and civilization. And we may be sure that he will not thank us for any attentions which may draw him away from the grand purpose of his visit.

We may be equally sure that he will be royally grateful for any proper assistance that may be given to the prosecution of his studies. There is talk of his entering the country by way of the Mississippi. That course would be singularly happy, since it would lead him straight to an engineering enterprise in which he cannot but take the highest interest: and at the same time his visit would give *éclat* to the completion of a work which may do very much to increase the social and commercial relations of the two countries. It is morally certain that, by May, the Mississippi will be open to navigation by vessels of the highest class, and nothing could be more appropriate than for the ruler of the Amazons to be the first to demonstrate the freedom of the Mississippi to the commerce of the world. It requires no prophet to foresee that the largest river of the world and the longest are plainly destined to furnish each the principal market for the productions of the other. The one extends, from north to south almost across the temperate zone, draining the heart of the most productive valley—and likely to be the most populous—in the temperate regions of the globe. The other drains a vast basin, almost wholly within the tropics, and extending across a tropical belt covering thirty degrees of longitude. Between the two there can be no rivalry, for their products are wholly diverse, yet each produces what the other lacks. Before the next Centennial celebration of our country, the trade between these two regions will be vast beyond the wildest dreams of to-day.

A passage from New Orleans to St. Louis, on one of the floating palaces of the Mississippi river, will show the Emperor, as no other journey can, the future aspect of his own great river when it shall have become the highway of a boundless commerce. How many of the cities of the West he proposes to visit, we cannot say: enough, no doubt, to enable him to study the working of our railway system, and other great works of internal improvement. Compared with these, the Exhibition, great as it promises to be, will be but a secondary attraction.

The termination of his visit may be as happy as the beginning, for he will take his departure from this city just about the time when the Hell Gate improvement will be ready for the finishing stroke, and we venture to say that no ceremony of state could give him half the pleasure, as to witness the final victory of Science over Nature, in opening up a new and better channel for the commerce of our metropolis. It is to be hoped that obtrusive placemen will respect his wish to travel as a private observer, and leave him free to enjoy a most unconventional "royal" welcome by the scientific and industrial magnates of the land.

THE FATHER OF WATERS.

We publish, in this week's SCIENTIFIC AMERICAN SUPPLEMENT, a remarkable document written for our paper by James B. Eads, C. E., of St. Louis, being a review of the Report of the United States Levee Commission, made in 1875. This board was appointed, by authority of Congress, to report a permanent plan for the reclamation of the alluvial lands of the Mississippi river. The subject is one of extraordinary importance, as will be readily understood if it is considered that the area of the lands that might be saved to agriculture, by a proper system of reclamation, is estimated at about 70,000 square miles, of unsurpassed natural fertility, and capable, if peopled as thickly as Belgium, of supporting a population of over 300,000,000.

In this aspect of the subject, the work of reclamation may be justly regarded as perhaps the most useful and important engineering enterprise now before the civilized world. Its successful accomplishment would vastly add to the prosperity of our own country, and benefit all nations, by enlarging the special domain of food supply, besides opening the Father of Waters to the free commerce of the world, floating the largest vessels for an inland distance of fifteen hundred miles.

By reference to the review, it will be seen that Engineer Eads and the Levee Commission have arrived at diametrically opposite conclusions, not only as to the best method of executing the work, but as to the results that might be expected from the adoption of their respective plans. The subject is a grand one, but the principles involved are simple, and their relative correctness would seem to be capable of determination without serious difficulty. The most curious thing is that practical engineers should disagree about the matter.

The Levee Commission aver that the volume of the Mississippi is too great; hence the overflow, to prevent which they recommend a reduction of the river volume by means of side channels. These are expected to conduct large portions of the water to the Gulf, and thereby reduce, as they allege, the flood discharge to the limits of the levees. They further advise the raising of the hight of the artificial banks or levees, the cost of which they estimate at forty-six millions of dollars ($46,000,000). This expense, although large when exhibited in figures, is as nothing compared with the gain to be derived from a successful reclamation.

The chief questions to be settled are: Is this plan practicable? Will a reduction of the river's volume diminish the flood discharge? What has been the experience on the Mississippi and on other rivers having analogous bottoms? Is it not a fact that, below the points where side channels have been formed and water drawn off, the river bottom has become filled up, and the flood level raised? Is it not true, in respect to other rivers, that their flood levels have been lowered by increasing rather than by diminishing the river volume, by stopping up old side channels rather than opening new? Is it not plain that, in an alluvial bottom like the Mississippi, the quickest and best way to lower the flood level is to deepen the bed of the river?

Will not the river deepen its own bed if its volume is increased?

The weight of evidence, derived from past experience on the subject, clearly gives an affirmative answer to the latter question, and this, substantially, is the position taken by Engineer Eads. He declares that the recommendations of the Levee Commission are founded in error. He avers that the proper way to lower the flood line of the Mississippi is to do the very opposite of that recommended by the Commission. He advises that the side channels be closed, so as to increase the volume of the water; and that, excepting repairs, the levees be not raised, because the increased flow will deepen the river bed, rendering the artificial building-up of the levees unnecessary. He adduces an array of practical evidence, in support of his position, that seems unanswerable.

We shall recur to the subject hereafter.

SOME ANNALS OF A SUCCESSFUL INVENTION.

If we may judge from *Punch's* frequent cartoons, and from the attention paid to the subject in the English journals, all England is undergoing a skating mania, which outrivals the velocipede *furore* of six years ago. It is not gliding over the ice on glistening steel blades which has captured the British fancy, for frozen lakes and rivers in England are of rare occurrence, and it is now several years since any regular skating club has had its winter carnival. Asphalt floors have replaced the ice; and over their smooth surface John Bull cuts "spread eagles" and "figure eights," and otherwise disports himself on that ingenious Yankee invention, the roller skate. There is an interesting history connected with that device and its inventor, which may here be reviewed. It is a record of how an enterprising man has managed, and is managing, an invention so as to make it yield a fortune, how he has fought and triumphed in protecting his right; and, at the same time, it conveys suggestive thoughts as to the value of popular devices, not merely at home but abroad, emphasizing in brief our oft-repeated assertion that the inventor's field is not restricted to any one country, but is as wide as the world itself.

It was about eighteen years ago when a then-termed "parlor" skate *furore* broke out in this vicinity. Halls in various parts of the city were fitted up with smooth floors, and one part of the public flocked thither and hired the skates at so much per hour, while another portion paid for the privilege of viewing the others learn how to manage the new invention. Education in that direction, though vastly amusing to lookers-on, was just the reverse to the learners; for however good skaters on ice the latter might be, they soon found out that managing roller skates was a very different affair, that gliding straight ahead was easy enough, but to attempt to guide oneself by turning the foot was to invite sudden and painful precipitation to the floor. Perhaps for this reason public interest in the first forms of parlor skate soon waned. Meanwhile, however, Mr. J. L. Plimpton, of this city, perceiving the difficulty, set to work to remedy it by devising a skate which would keep the floor without reference to the angle of the body or the sharpness of the curve turned. With remarkable perseverance he labored on for several years, expending some $25,000 in fruitless efforts. Finally, however, he produced a device which a learned English judge has recently pronounced "almost as ingenious as the wonderful adaptation of bones to be found in a horse's pastern and fetlock." In the center of the sole of the skate, he fixed a spherical spring of india rubber, yielding to the slightest inclination of the foot, a mere change of motion by well known mechanical means causing the axles of the roller wheels to converge. This invention was patented in this country, through the Scientific American Patent Agency, in January, 1863, and subsequently in England, in 1866.

His device perfected, Mr. Plimpton began its introduction

in certainly an ingenious and novel way. He first fitted up a hall adapted to his purposes in this city, and for a long time practised himself, and taught invited friends to use his skates. Afterwards he took with him a few of his best drilled pupils to other cities. In lieu of hiring a room and trusting by general advertising to draw a promiscuous throng, he would, after preparing his establishment in any town, issue neatly printed cards of invitation to the most influential people in the place. These would usually accept from curiosity, and, finding a genial, pleasant gentleman ready to tell them something new without apparently aiming at their pockets, would become interested, try the skates, and in a very short time "set a fashion" which would speedily be followed by the remaining townsfolk. No long period would elapse before the skating rink would be doing a thriving business, and enterprising investors would speedily seek a share in so profitable a concern. Then Mr. Plimpton would dispose of the lease of his hall and fixtures, with the right to use the invention within certain counties and States. His next step would be to locate in another town, and repeat the operation of introducing the invention; and thus he continued until he had sold rights for ten States to one firm, besides territory in all parts of the Union. Since 1867 he has realized $50,000 for State rights alone, and this sum is nothing beside the profits of the lucky purchasers, who generally followed the inventor's novel plan of introduction, as already described. One man bought the right in the State of California for $4,000, and resold it for $36,000; and the purchaser of the right for San Francisco, it is stated, made $45,000 in one year at the rink in that city. It would take far too much space to recapitulate all the instances of this kind, therefore we may turn to the inventor's efforts toward the introduction of his skate in England. Mr. Plimpton had already an agent in Great Britain, whose success had been very great; so the inventor concluded to join him. The presence and tact of Mr. Plimpton resulted in measures which kindled the present *furore* abroad. Rinks have been established all over England and France. In a single rink in London $500,000 is said to be invested, and in Brighton $40,000 has been refused for the establishment by its owner. Paris has a magnificent rink in full operation. The skates are manufactured in Brooklyn, where a new and large factory is shortly to be erected for this special purpose. We are informed that $60,000 worth of the skates have been made during the past six months, and that the average weekly shipment to Liverpool is now 2,000 pairs.

It could hardly be supposed that so successful an invention would lack infringers, and the latest attempt in England has resulted in a patent suit, considered so important in a legal aspect by the press of that country that whole columns of the London journals are given to *verbatim* reports of its proceedings. One Malcolmson, it appears, substituted a steel spring for the movable rubber spring in the Plimpton skate, and started rinks on his own account. He, out of a dozen infringers, was selected as the typical offender. Celebrated counsel were engaged on both sides, and Sir George Jessel, Master of the Rolls, himself a scientist and a mathematician of great ability, presided at the trial. The questions to be settled were: First, was or was not the Malcolmson skate a colorable imitation of Plimpton's device? And if it was, was Plimpton's skate "new within the realm," so as to come under the protection afforded by the patent laws to all novel inventions? His Lordship disposed of the first point by deciding that Malcolmson's device was "a simple mechanical alteration, which is, if anything, a little worse than the plaintiff's, as it cannot be adjusted," and rendered a decision at once in favor of Plimpton on that issue.

On the second question came the tug of war, and (as is usual in most patent litigations in this country) the SCIENTIFIC AMERICAN came into prominence, forming part of the defendant's evidence. When Mr. Plimpton obtained his first patent in 1863, we, in accordance with our usual custom, printed a brief abstract of the claim, and prefaced it by an editorial note describing the gist of the invention. A copy of the SCIENTIFIC AMERICAN was sent to the British Patent Office, where it was open to public inspection. At the same time the proprietors of *Jewett's Illustrations*, in which was a drawing of Plimpton's skate, together with other patent drawings used in our Commissioner of Patents' annual report, found its way to the same place. But this book, it appears, was lost; at all events, it was not discovered until during the progress of the trial. But the book containing the patent drawing and the paragraph from the SCIENTIFIC AMERICAN, which was published in connection with the claims, comprised the evidence of the defendant in his efforts to prove that the invention of the plaintiff had been introduced by publication into England before the patent of Plimpton was applied for. The courts declared against the defendant's evidence as insufficient, decided in the plaintiff's favor on all the issues, and granted an injunction restraining the defendant from using the plaintiff's invention, or any part thereof, and from selling or letting for hire any roller or runner skates not made by the plaintiff or his licensees, or differing only colorably therefrom by the substitution of mere mechanical equivalents, ordering him at the same time to deliver up or destroy those in his possession, and to pay the costs of the suit. To afford the defendant an opportunity of presenting an appeal, the judgment would, however, be suspended for six weeks; and in the meantime, though restrained from making or selling skates in infringement of the plaintiff's patent, the defendant would be at liberty to continue his rink at Brighton, keeping an account of the proceeds.

Apart from the importance of this trial to the parties in direct interest, it has a bearing of significance in relation to the rights of American inventors in England. At the present time, printed copies of all American patents, which include both the drawings and full descriptions of the inventions, are forwarded, directly after each week's issue, to the British Patent Office. From the proceedings in this trial, and the ruling of his Lordship, there can be but little doubt but that the introduction of these copies into England constitutes a publication, and therefore, in the eye of the law, an introduction of the invention, which would prevent a patent subsequently taken there from being sustained in the British courts.

But, on the other hand, this very apparent disadvantage is met and counteracted by that admirable provision of our patent law which accords to every inventor six months delay between the allowance of his patent and the payment of the second government fee. Not until that payment is made does the patent issued; and hence, during the above interval, the inventor, at once knowing that his right is secure and at his disposal at any time during the half year on his paying $20, and besides that it is kept secret from all the world, has abundant opportunity to proceed with his applications for foreign protection. Should he neglect to avail himself of that opportunity, then the unfortunate result noted in the preceding paragraph might well occur, but he can then blame only himself. There is not so great and beneficial a safeguard in the patent law of any other country; it is a standing monument to the wisdom and good sense of those who framed it.

There is one more suggestive point to be noted by way of conclusion to this already over-long article, and that is that this successful invention is one out of fifty of similar nature. Moreover it is an unimportant device, one which offers no such large benefit to humanity as does a sewing machine or an electric telegraph; it is little else than a plaything, and yet look at the money that is being made out of it! If a little thing like this, properly managed, yields a fortune what should be the proportionate returns from a great or highly useful invention—one not out of fifty, but standing alone in its value, novelty, and utility?

CYLINDER CONDENSATION.

We have recently received from the author, Mr. George Basil Dixwell, a pamphlet bearing the above title, and containing much that is of interest to engineers. Mr. Dixwell, if we may judge from his treatment of the subject, is not an engineer, but he states that he has been aided by the advice of an eminent expert; and all his experiments seem to have been carefully conducted. We could wish that he had followed the example of Mr. Isherwood, which he commends so highly, and given full details of the apparatus employed and the results obtained, in his many experiments. But it will doubtless be more interesting to our readers, if, instead of criticising, we proceed at once to give a summary of Mr Dixwell's views.

Most persons who have devoted any attention to the question of the expansion of steam are aware of the very great economy that might be realized by high grades of expansion in perfect engines, and know also that this economy is far from being attained in practice. Mr. Dixwell devotes a considerable portion of his pamphlet to discussions of the reasons for this difference, which is chiefly illustrated by the results obtained from experiments with the United States steamer Michigan: results which have been, as he states, confirmed by fifty other examples. The reasons for the enormous condensation shown by these experiments are detailed under the following heads:

External radiations, which he considers very slight in general, and which may be almost entirely prevented by covering the cylinder properly.

Conversion of heat into work. Under this head, Mr. Dixwell has given some remarks which are well worthy of attention. He discusses the point as to whether the whole work is to be considered in estimating the condensation from this cause, or only the work performed during expansion, and decides, as a corollary to some experiments which he details, that the latter measurement is the correct one. We think he could have drawn a more logical proof from Régnault's experiments on the properties of saturated steam, or from the fundamental principles of thermo-dynamics; but he is entitled to great credit for giving prominence to a truth that is too often disregarded by experienced engineers.

Internal radiation, or alternate cooling and heating of the cylinder, and re-evaporation of the steam condensed for work, is another of the causes of condensation, and Mr. Dixwell shows that the maximum amount due to this can readily be calculated. Mr. Dixwell, in common with a great many others who have examined the subject, is disposed to look with little favor upon Mr. Isherwood's theory of condensation from "expansion *per se*," and gives some pertinent reasons for accepting an opposite conclusion. Having disposed of these generally received causes of cylinder condensation, which he finds far from sufficient to account for the whole loss, the author gives his theory of the manner in which the principal loss occurs, and which he calls 'cumulative action." Suppose, for the sake of illustration, that the cylinder is so much cooled, from the causes enumerated above, that 4 ozs. of the entering steam are condensed, up to the point of cut-off, and that, during the remainder of the stroke and during exhaust, 3 ozs. are re-evaporated: the cylinder will thus be cooled to such an extent that during the next stroke 7 ozs. will be condensed, and some of it re-evaporated. At each successive stroke, the amount of condensation will be increased, until the amount of heat received by the metallic surfaces from the entering steam, up to point of cut-off, is just equal to the amount of heat lost from condensation due to causes previously enumerated, increased by the amount of heat required for re-evaporation. Hence this action, which multiplies the effect of primary condensation, may properly be called "cumulative."

In his interesting review of the causes of cylinder condensation, we think that Mr. Dixwell is somewhat in error when he assumes that the results obtained from the Michigan experiments are generally applicable; and we think that he overlooks some important elements, notably the effects of the relation between diameter, length of stroke, and piston speed. As far as he has gone, however, his views are very reasonable. Having discovered all the causes of cylinder condensation, as he imagines, Mr. Dixwell next discusses the means of preventing it, showing the effect of steam jackets, compounding, and the use of superheated steam. He has devised a pyrometer which can be placed in a cylinder, and will give the temperature at various parts of the stroke, by means of suitable connection with a dial on the outside. We regret that the author did not devote more space to a description of this instrument, but he merely states that it is a thin strip of copper, rolled up into the form of a hollow cylinder, and pierced with many holes. By the aid of this instrument, he discovered that, when using highly superheated steam, it parted with all or the greater portion of its extra heat as soon as admitted into the cylinder, and that the temperature in the cylinder remained nearly constant throughout the stroke. This is a genuine discovery, so far as we know; and were this the only fact stated in the pamphlet, it would be enough to make it an important addition to engineering literature. The general supposition is, as our readers well know, that superheated steam does not immediately have its temperature reduced, when admitted to the cylinder, and that there is in consequence some danger of overheating the working parts of the engines. Mr. Dixwell explains the sudden cooling by reference to experiments, in which it was shown that a highly polished metallic surface, when covered with a thin film of a powerfully radiating gas, like steam, is itself converted into a very energetic radiator; and he makes a calculation to determine the thickness of metal that was alternately heated and cooled in one of his experiments. On this theory, it is evident that the proper degree of superheating is dependent upon the conditions under which an engine is running; and this Mr. Dixwell finds to be the case in practice. He is thus led to recommend two plans, for the purpose of preventing condensation and increasing the efficiency of an engine: one, superheating the steam just enough to enable the internal surfaces to repel the spray formed by condensed steam, or, secondly, superheating the steam to a degree that is found safe for any given cut-off. He takes the limit of safe temperature in the cylinder at about 400° Fah. The experiments do not appear to have been carried far enough to determine the proper degree of superheat for each point of cut-off; and the author suggests that it can be conveniently ascertained, in any given case, by the use of his pyrometer.

It has been impossible, in this brief notice, to do more than call attention to the most prominent points discussed in this interesting pamphlet, which treats in a rational manner of one of the most important matters connected with the design and management of steam machinery.

PATENT RIGHTS VS. STATE RIGHTS.

We have heretofore had occasion to call attention to the unconstitutionality of the various attempts, by State legislation, to interfere with the rights of inventors and patentees in the disposition of their patents. In some States, laws have been passed which practically authorize the citizens of such States to cheat the inventor out of his fees if he sells on credit. Such laws provide that a note given in purchase of a patent must state on its face that it is given for the patent, the number, date, and other particulars whereof must be designated on the note, otherwise such note shall be void and the holder debarred from receiving payment. All such laws are, under the constitution of the United States, void. A note given for a patent right will be binding if drawn in the usual manner, all State laws to the contrary notwithstanding.

So in the case of that class of State laws that require the taking out of licenses in order to sell patents, or that require, under penalties, the filing of copies of patents with county or State officials as a condition precedent to selling patent rights within the boundary of any State—all such laws are unconstitutional and void. We have heretofore published the decisions of the United States courts declaring their nullity.

Another decision against the applicability of State laws to patent rights has lately been made by the United States Circuit Court, in Massachusetts. We publish the decision in this issue. This was a recent action to recover damages for an infringement which took place as far back as 1863, up to 1867. The defence was that under the the State laws of Massachusetts—statute of limitations—the plaintiff could not recover, he not having brought the action within six years from the time of the alleged injury. This defence was not allowed. The court ruled as follows:

"Should the legislature of a State pass an act in express terms limiting the time for bringing an action in the federal courts for infringement of patent rights, there can be no reasonable doubt that such a statute would be unconstitutional and void. The policy of the Government to provide a uniform system of rights and remedies throughout the United States upon the whole subject matter of patents for new and useful inventions and discoveries, by placing it under the control of Congress and the federal courts, would be frustrated if such State legislation could directly or indirectly limit, restrict, or take away the remedy."

Fine gold will melt at 2,016° Fah.; pure copper at 1,994°; fine silver at 1,873° and pure spelter at 773°.

THE ST. CHARLES RAILROAD BRIDGE, MO.

We herewith publish an engraving of the St. Charles bridge, over the Missouri river, built by a company formed for the purpose and leased to the North Missouri Railroad Company at a rental of $100,000 a year. The bridge cost $1,800,000, or nearly double the original estimate, the difficulties in constructing the foundations being greater than were anticipated.

It is the longest iron bridge in the United States, consisting of three through spans on the Fink plan, four Fink suspension spans, and the iron viaduct approaches, making a total length of iron bridge of 6,535 feet. The seven river spans vary in length from 305 feet to 331 feet. There were eight river foundations—most of them presenting new and extraordinary difficulties in construction—varying from 54 to 76 feet in depth, the caissons for which had to be carried down through alternate strata of quicksand, large boulders, and tangled masses of drift logs. Add to these subaqueous difficulties the facts that at the bridge site the Missouri river rises and falls 40 feet; that its flood speed is nine and one half miles per hour; and drift islands drawing 20 feet of water, and which are more than 300 feet in diameter, are not unfrequently carried past in the heavier freshets, and an adequate idea may be formed of the character of the work.

During the progress of the work, owing to an unusual freshet, the general direction of the current was suddenly changed. Four thousand feet above the site of the bridge a diversion of the current carried away 1,400 feet of the south bank, and, curving outward and returning in the form of an S, brought its abrading force directly upon the south abutment. In this emergency, when the entire demolition of the abutment was threatened, the engineer constructed a groyne, which so diverted the current as to reclaim a large tract from the river bed and confine the channel. The south abutment is now surrounded by dry land. This groyne projects 700 feet from the south shore, and extends above the shore some 400 feet. Out from the south shore a spile wall was driven, from which coarse rip-rap was thrown in, and an embankment made upon it, producing an eddy immediately below. In this eddy, material could be deposited without danger of wash, and so the work was carried forward in an irregular line, guided by the slack water which preceded the bank in its progress down stream. This was continued until a space 700 by 400 feet, more or less, was inclosed by the wall meeting the shore below the bridge line. After being properly packed and protected from wash, this immense cofferdam, for such it now was, was pumped out, leaving the former uncertain bed of the river comparatively dry land, upon which the pier could be erected without interference from the principal enemy, the river current.

It was afterward built to such a hight and so strengthened that its outer walls now form the south bank of the river at that point, thus effectually and permanently forcing the current to keep toward the north shore and to be confined within fixed limits. Although the cross section of the river is necessarily narrowed, it does not affect the velocity of the current.

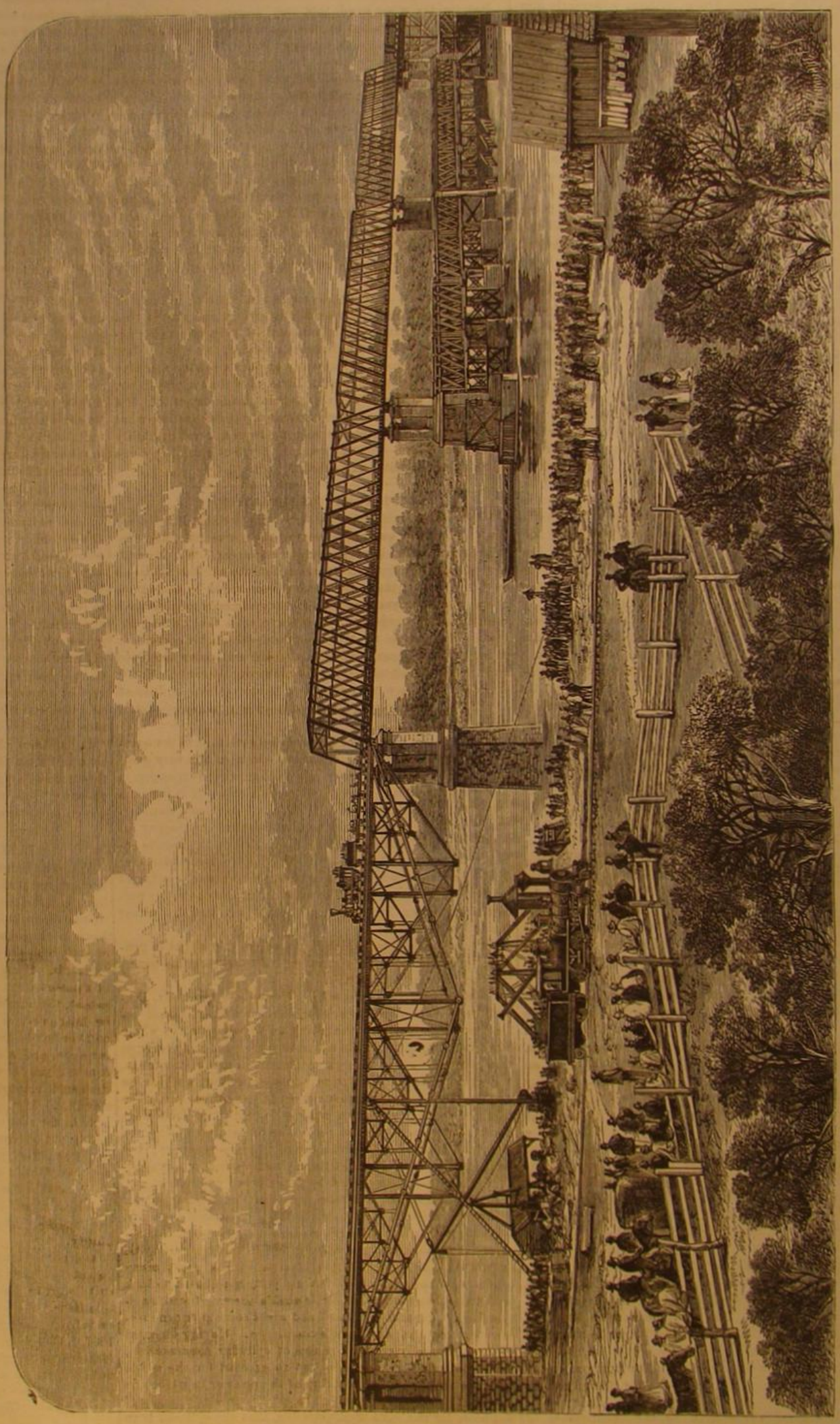
The bed of boulders found immediately below the shifting bottom, although more permanent in position, by their bulky and unyielding nature, made the passage of the foundations through them very difficult. To drive a pile through them required an average of 3,000 blows of a 3,000 lbs. hammer, and, in some cases, over 5,000 blows were required to sink the pile to the bed rock. Sycamore piles alone were found capable of standing the continued batter of the pile hammer. The pile basis was used only when the pile was entirely protected from scour.

The superstructure is of the Fink and trellis or double form, the latter modified by the omission of the usual counter ties. The counter strains are taken by compression ties, extending a few panels on each side of the center, and consisting of two parallel plates stiffened by short diagonal braces of wrought iron riveted to the side plates and at the centers. The wrought iron strut columns are secured to the chord by wrought iron suspension joints, so that they are equally available for tensile strains at points where such strains occur, thus dispensing with the center tie rod usually found in this form of truss. The substitution of the peculiar ties at the center, for counter ties, constitutes the essential difference between this truss and the one used at Kansas City.

The details show many important features of novelty. A leading idea of the engineer has been to construct the bridge of as few pieces as possible. For instance, the upper chord is composed of a single cast iron tube. The structure is fastened throughout by pin joints. The cross ties are placed directly upon rolled iron girders placed between the chords proper, thus throwing all the bending strains upon parts not subject to either tension or compression, dispensing with the ordinary stringers, and avoiding the bulky depth of flooring beams usually seen. The Fink deck spans are proportioned to carry 2,250 lbs. per foot, the chord is 2 feet in diameter, and the main post is 21 inches. The truss itself is a double triangular girder, with inclined end posts and no connection between the systems The counter brace action is secured by stiffening the middle ties and giving the braces a tensile connection. The floor beams are composed of 12 inch channel iron, sandwiched with and forming part of the lower chord, the cross ties being laid directly on these, without the interposition of a stringer. These girders are proportioned in the same manner as in the Fink trusses, but to a working load of 2,400 lbs. per foot. The weight of each Fink span is 680,000 lbs., of each trellis span 788,000 lbs

Probably the most dangerous work of all was the erection of these spans. As no false work could possibly stand at this point in the river, temporary piers were constructed, resting on piles and surrounded by cribs 18 feet wide and 50 feet long, filled with stone. There were three of these piers in each span, and on these were placed, bodily, by means of powerful twin derrick boats, Howe truss spans, 80 feet each. On these spans was placed the false work proper, the top of which was 121 feet from the water.

The bridge was designed and constructed by Mr. C. Shaler Smith. Captain James B. Eads, the engineer of the St Louis bridge and of the Mississippi delta improvement, one of the directors of the bridge company.



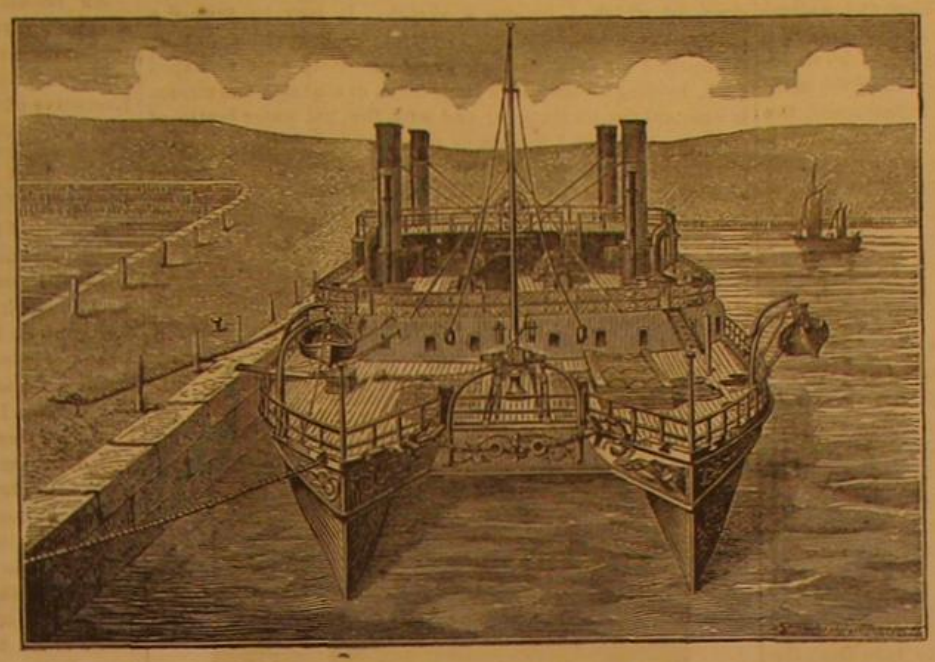
THE ST. CHARLES RAILROAD BRIDGE, MO.

A VERY good impression of any article of metal having a flat ornamented surface may be taken by wetting some note paper with the tongue and smoking it over a gas flame. The article is then pressed upon the smoked part, when, if the operation be carefully conducted, a clear impression will appear. This can be made permanent by drawing the paper through milk and afterwards drying it.

THE TWIN CHANNEL STEAMER CASTALIA.

Unlike the Bessemer, which vessel is now admitted to be a failure, the Castalia, as the twin-hulled steamer plying across the English Channel is named, has turned out a success. Both ships were built with the idea of reducing rolling or pitching motion, and consequent sea sickness among the passengers, to a minimum. The Bessemer, it will be remembered, was fitted with a swinging saloon which, it was imagined, would remain at rest despite the oscillations of the ship. The Castalia has no such appliance, but her inventor has relied on her long and widely separated hulls never being submitted to the action of one and the same wave. While this last might not be possible on the Atlantic, where the long ground swells will affect even the largest of vessels, it is apparently quite true of the English Channel, where the sea is short and chopping. The Castalia therefore has been found to be remarkably exempt from the uneasy motions of ordinary vessels, while she is as readily controlled and directed as the latter.

The length of each hull is 234 feet, beam of each 16·4 feet, depth of hold 12·6 feet, and they are separated a distance of 25·2 feet. The bridge which unites the two vessels is of elliptical tubular section, and is extremely strong, as it necessarily must be in order to bear the opposing wrenching strains of the double hull. On the bridge are located the cabins and saloons, a hurricane deck above serving as a promenade. The ship is flat-bottomed, and draws but 5·7 feet of water, so that she can easily enter any port in the vicinity of her station without regard to the condition of the tide. Her motive power consists in two paddlewheels arranged in the space between the hulls, each wheel having its own engine. An excellent representation of the vessel is given in the annexed engraving.



THE TWIN CHANNEL STEAMER CASTALIA.

IMPROVED METHOD OF COVERING STEAM BOILERS, ETC.

Inventions and appliances for economizing steam and fuel are continually being patented and brought into general use, and in times of depression like the present claim the attention of manufacturers and steam users in a more than ordinary degree. By no means the least economizer of fuel and steam is a good durable covering for boilers and steam pipes, such as is illustrated in the annexed engravings. The invention, shown in section in Figs. 1 and 2, consists, first, in leaving an air space or dead air chamber between a wire covering and the surface covered; second, in the keying of some plastic material on the wire cloth; and third, in giving a double check to radiation by the confined air and the non-conducting composition. There are numerous other advantages which might be mentioned, but the abovenamed are the most prominent. The air space is made by taking heavy wire cloth, to which is fastened, every four or five inches, a stud one inch or more in length. The wire cloth is then fitted over the surface to be covered, the studs keeping it the necessary distance off. The plastic material is next applied in two or more coats. The first coat partly penetrates the meshes of the wire cloth and keys itself, obtaining a strong, durable hold. The second coat makes a smooth, even finish, which may be painted, grained, or varnished, as may be desired.

Fig. 1.

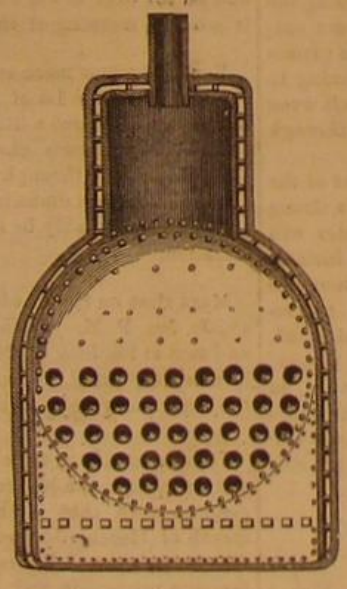
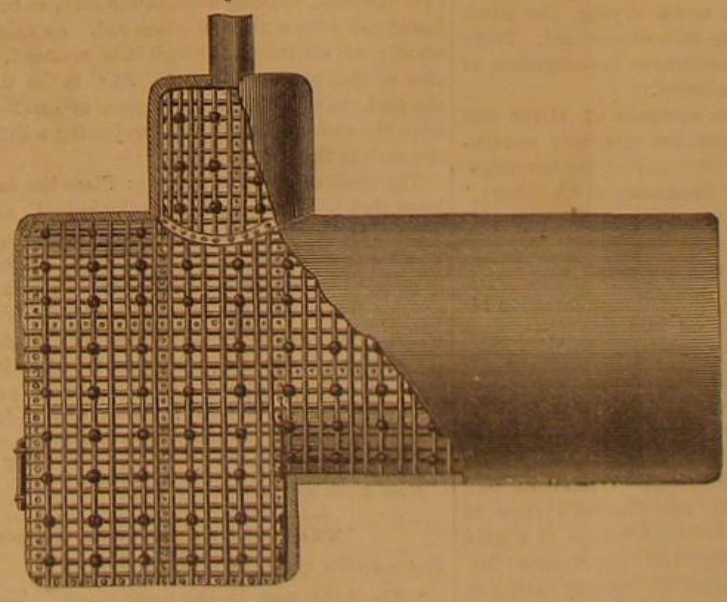


Fig. 2.



ASHCROFT'S BOILER COVERING.

There are many objections to applying a covering direct to the surface of the boiler, for it has been found, especially in marine boilers, that, when so covered, the inside as well as the outside of the boiler rapidly scales. The air space method, we are informed, is not open to these objections. On the contrary it keeps the iron clean and bright, besides preventing the radiation of heat and condensation of steam. Fig. 3 shows the application of of the invention to steam pipes. We learn that it is used extensively in the United States navy, the boilers of several of the largest steamers being thus covered. The Pacific Mail Steamship Company have also had the boilers in the last new steamers—City of Sydney, City of San Francisco, and City of New York—protected with the air space covering. It has besides, we are informed, been extensively applied to large manufacturing works in all parts of the country.

This method of covering was patented in June, 1866, to John Ashcroft, but has not been prominently brought before the public till within the past year, when the patent was purchased by the Chalmers Spence Company, of New York, who now apply it in connection with their non-combustible plastic covering. Their works in New York city are located at the foot of 9th street, East River, next to the Morgan Iron Works; and they may be applied to, at that address, for further information.

The Solar Eclipse of March 25, 1876.

It is quite possible that this eclipse, which is given as an annular one in the *Ephemerides*, may be total for an instant on the North Pacific Ocean in longitude 140° 16′ west of Greenwich, and latitude 35° 39′ north, or near this position it may prove one of those rare phenomena characterized in our text books as total without continuance. The central line traverses the southern and largest island of the Sandwich group, where the eclipse will be annular for a few seconds. At a point in longitude 155° 56′ W., latitude 19° 28′ N., the eclipse commences at 9h. 30m. A.M. local mean time, at 130° from the sun's north point towards the west (direct); and the annulus is formed, according to the *Nautical Almanac* elements, at 10h. 49m. 10s., and continues 10 seconds. This point is a little south of Kaavaroa, by the Admiralty chart, and close to the spot where the monument to Captain Cook was erected; the central eclipse leaves this island, Hawaii, near Manienie, also marked on the Admiralty chart of this group. The eclipse will be central and annular also in Vancouver Island and British Columbia. The central line appears to enter Vancouver at Refuge Cove, Sydney Inlet, leaving it at Orange Point, Duncan Bay, whence its course is to George Point, British Columbia. In Vancouver Island the annulus may continue 7 or 8 seconds, being formed about 0h. 27m. P.M. local mean time. At New Westminster, British Columbia, calculation gives a large partial eclipse commencing at 11h. 22m. A.M., and ending at 2h. 3m. P.M., local times, magnitude 0·95; here the first impression of the moon upon the sun's disk is made at 127° from his north point towards the west. For further information on the track of the central line over these parts the large Admiralty chart of Vancouver Island and vicinity should be consulted; the above names of points traversed by the central eclipse are taken from it.

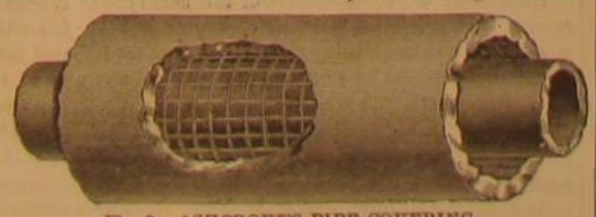


Fig. 3.—ASHCROFT'S PIPE COVERING.

On the central line this eclipse must prove one of very considerable and unusual interest.—*Nature.*

THE proper velocity for the periphery of a circular saw is nine thousand feet per minute, or one hundred miles an hour. A saw 12 inches in diameter should make 3,000 revolutions per minute.

Coal Dust Fuel.

The grounds on which are erected the works of the Loiseau Pressed Fuel Company belong to the Philadelphia and Reading Railroad Company, and have been leased for five years. All the coal dust made at the wharves at Port Richmond, Pa., during the same number of years, has been secured by contract. When the works are started, if the supply at Port Richmond is not sufficient, additional quantities, as required, will be shipped from the coal regions. The buildings are erected at the southwest corner of Bath and Linden streets. Their length on Bath street is 128 feet, and on Linden street 275 feet. They are seven in number.

The clay is dried in a kind of core oven, and is ground by one of Baugh's grinding mills. In the same room is an iron tank, six feet high and six feet in diameter, in which is prepared a composition of lime, rye flour, and water, which, in a liquid state, is discharged into a wooden reservoir or tank placed under the coal dust and clay pockets. In front of these pockets is placed a very ingenious machine by means of which 95 per cent of coal and 5 per cent of clay are continually and mechanically taken out of their respective pockets and delivered under a chain elevator, and there sprinkled, through a perforated pipe, with the liquid from the wooden reservoir. All the materials which are to make the lump of fuel are here brought mechanically together and are taken up by the chain elevator, which carries them up and discharges the whole into the mixing machine. This machine has a capacity of six tuns, and it delivers through two openings at the bottom, regulated by hand wheels, the materials on a leather belt, 3 feet wide, which carries and discharges them into the hopper of the press, between two rollers, on the face of which are milled out semi oval cavities, connected by small channels. These are the molding rollers, and the materials passing between them are compressed and molded in the shape of eggs, and delivered in that shape on an endless wire cloth belt, which enters the drying oven on top. In this oven, which is a brick construction, 86 feet long, 14 feet wide, and 26 feet high, there are five endless wire cloth belts, geared together, and traveling in opposite directions. This oven is heated, by a fire placed at each end, to from 250° to 300° Fah. The coal enters, as said before, on the upper belt coming from under the press, travels five times in succession the entire length of the oven, at the speed of 12 feet in one minute, falling from one belt to another, and finally comes out perfectly dry on the lower wire cloth belt, which enters the waterproofing building. In this building the lumps of coal are discharged into a tank containing a certain liquid composed of candle gum dissolved in crude benzine. In the same tank, and guided on both sides by a curved groove, travels a wire cloth belt on which the lumps are discharged from the lower belt coming from the oven. The lumps are thus immersed mechanically into the waterproofing liquid, while the belt describes a curve into the tank; and the same lumps are then carried, waterproofed, into the evaporating oven, where all the vapors of the benzine are collected and carried through large pipes into a condensing coil 200 feet in length. The condensed benzine returns to the main tank, and the coal, perfectly dry and waterproof, is carried up by a chain elevator, and discharged on another wire cloth belt, which runs the entire length of the coal pockets (100 feet), and delivers the coal in any desired pocket.

From beginning to end the coal is in motion, from the point where it is dumped as dust until it reaches the coal pockets as fuel. It travels about 800 feet, in about one and a half hours. Buildings and machinery are of the most substantial character. The production with the machinery erected will vary from 125 to 150 tuns per day.—*Saward's Coal Trade Journal.*

American Salmon in New Zealand.

Intelligence has been received of the safe arrival in Auckland, New Zealand, of 40,000 salmon eggs from Columbia River. These eggs were sent from San Francisco by steamer, consigned to the Napier Acclimatisation Society; but on arrival at Auckland they were found to be so far advanced that it was determined not to risk sending them all to Napier, but to distribute them immediately in suitable localities in the neighborhood. One half was thus treated, and the remaining 20,000 were sent on to their original destination, Napier. There is every probability that an actual colony of salmon has now been planted in New Zealand, for the fry were in a healthy condition, and great care was taken by Mr. Firth to protect those placed in the rivers from all enemies.

NEW PHOSPHIDES OF SILVER, AND A METHOD OF ESTIMATING SILVER QUANTITATIVELY BY MEANS OF PHOSPHORUS.

BY WILLIAM FALKE, PROFESSOR OF NATURAL AND PHYSICAL SCIENCES IN MANHATTAN COLLEGE.*

In continuation of my communication commenced on page 148 of the last issue of the SCIENTIFIC AMERICAN: The question now occurred whether the phosphorus solution could be advantageously employed for the estimation of silver; for, as has been previously observed, the whole of the silver can be separated, in a short time, from many of its salts. Silver is generally estimated as chloride, and this is a process in which the very greatest care is requisite to produce accurate results. At first it must be precipitated as a chloride and be allowed to settle, then collected upon a filter and washed very rapidly to prevent any silver from being reduced by the organic matter of the filter, and, lastly, it must be transferred to a crucible and ignited. This method involves more or less difficulty and loss. After a series of experiments, the following phosphorus method is suggested as superseding the use of a filter, and in which the silver is at once weighed in the metallic state. Into a carefully weighed and dried tube or capsule, the salt of silver (the nitrate) is put, and dissolved in a small quantity of water. Then at least one fifth of its weight of phosphorus, dissolved in carbon disulphide, is added, and the tube, with its contents, slowly warmed. At first the silver is reduced with some phosphide admixture, then the carbon disulphide evaporates, and lastly the water is removed by careful evaporation, so as to prevent any spurting. After the whole is nearly dry, which is generally accomplished in less than half an hour, the tube may be heated for a short time, by gradually applying the flame to it. The excess of phosphorus undergoes combustion, and the phosphide also, so that nothing remains in the tube excepting metallic silver and phosphoric oxide, which is dissolved out with some distilled water, and the solution is poured out, as the silver adheres together in a spongy or scaly condition. After washing a few times, by decantation, the tube containing the silver is well dried by semi-ignition, and weighed by subtracting the weight of the tube from the tube and silver, and thus the weight of the silver is known.

A few of very many experiments are given to show how accurate and simple the method is: Tube, 7·275 grammes (112·267 grains); silver nitrate, 0·068 gramme (1·049 grains); phosphorus, 0·025 gramme (0·3858 grains); carbon disulphide 0·5 cubic centimeter (0·0305 cubic inch); water, 3·000 cubic centimeters (0·183 cubic inch.)

After analysis: Tube + metallic silver, 7·318 grammes (112·929 grains) — tube, 7·275 grammes (112·267 grains) = silver 0·0430; calculated in the nitrate, 0·0432, showing a difference of only 0·0002 of a grain.

Another example showed: Silver calculated in nitrate, 0·2617: silver found in nitrate, 0·2615 = 0·0002.

From this it will be seen that (by simply taking a capsule or tube previously well dried and adding the salt of silver or its solution, then the phosphorus dissolved in carbon disulphide, and mixing the whole), by careful evaporation and lastly semi-ignition, and then washing out after cooling the phosphoric acid and again drying, the silver may, as such, be at once weighed and determined. Many other salts of silver are at present under investigation, of which, in the future, more will be heard.

For descriptions of the few compounds of silver and phosphorus thus far known, which are of a very unsatisfactory nature, on account of the difficulty of the investigations, the reader may see Watt's "Dictionary of Chemistry," volume V., page 303.

English Railway Car Signals.

How to establish a suitable means of communication between the interior of the passenger cars and the engine driver is still a harassing and unsettled problem in the minds of our British cousins. The simple cord used in this country, they think, will not do, because they fear that the unruly subjects of the Queen, pent up in the little apartments of the cars, will pull the string when they ought not. Hundreds of devices have been proposed. What John Bull wants is something that is simple, and that will show to a certainty in which of the thirty compartments of a train the signal originated. Here is the last contrivance: Mr. Stewart, patentee of a new flag signal for railway carriages, recently exhibited his invention in the theatre of the Society of Arts. The invention consists of an apparatus which is inclosed in a small wooden box and placed inside of the carriage against one of the top corners of the compartment. On a catch being released by means of a cord suspended from the roof, a flag is projected through the side of the carriage, and at the same time a rope in connection with the apparatus causes the ringing of a bell in the guard's van and the whistle of the engine to be sounded. The intention of the invention is to provide instantaneous communication simultaneously with the guard and driver of the train, and, at the same time, means of informing both, by the exhibition of the flag, of the exact carriage in which the apparatus has been set in motion. A rope, running from end to end of the train, keeps the boxes in the various compartments in connection with the guard's van and the engine. The general opinion of those who examined Mr. Stewart's model was that, provided the machinery should not be liable to get out of order in the working, and that the expense should not deter railway managers from its adoption, it would be a great improvement on the existing means of communication between passengers and guards in traveling trains. The projection of the flag from the side of the carriage in which the bell had been rung was considered to be very valuable, as directing the attention of the guard at once to the spot where his assistance had been called for. Mr. Stewart stated that the probable cost of fitting railway carriages with his apparatus would be about one per cent of the cost of the carriages, which would be $50 for a car costing $5,000.

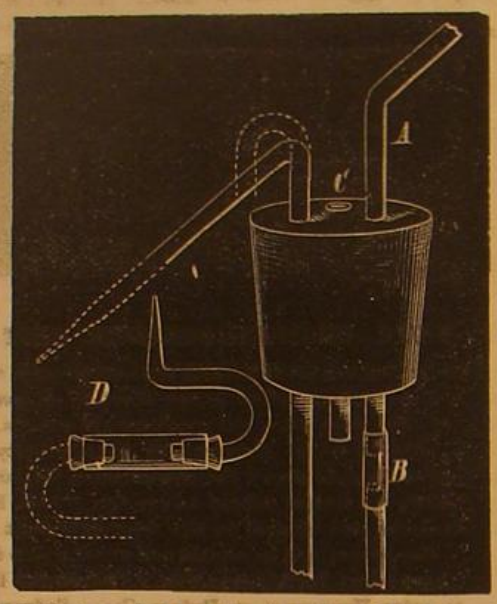
* A part of this article formed the subject of a paper read before the New York Academy of Sciences (late Lyceum of Natural History), December 13, 1875.

Correspondence.

An Improved Wash Bottle.

To the Editor of the Scientific American:

I recently noticed at the Stevens Institute of Technology a very handy form of wash bottle, devised by Mr. F. L. Bardeen, of which I inclose a sketch. It may be termed a constant bottle, for it throws a stream as long or longer than is required for most washing purposes. With a globe-shaped flask, holding about a liter (four fifths of a quart), the stream is constant for 45 seconds; and with the hot water bottle of the same size, for 1 minute or more, owing to the expansion of air within. With larger flasks, the time of flowing would of course be lengthened. The length of time, obviously, depends on the size of the jet and amount of air in jected; but for ordinary purposes, the time is about as stated. Globe-shaped flasks should be used. and they should never be more than two thirds full; and as the space for air increases as the water flows out, the stream remains constant for a greater length of time.



The device is made by perforating the cork in three places: the first for the exit tube, which extends to the bottom of the flask, the second for the tube through which the air is forced, and the third for an open tube for stopping the flow by relieving the pressure. On the lower end of tube, A, is a valve, made by slipping a short piece of rubber tubing over the tube, making a slit in the side, at B, and closing the lower end with a piece of glass rod. As this slit opens outwardly, all air forced through it is retained, and the expansion of this produces the jet. At C is the third opening in the cork, in which is a short piece of small tube, left even with the cork at the top and projecting a little way through the cork at the bottom.

The mode of use is as follows: Place the first finger of the hand that holds the bottle over the hole, C, and give a strong blast. If the finger remains over the hole, the water will flow for the space of 1 minute or more. The flow is instantly stopped by removing the finger. By using the movable nozzle, indicated at D, the jet may be directed to any required spot. It is especially convenient, as thus constructed, for washing down the precipitate from an inverted beaker; and as it is frequently desirable not to disturb the latter, in the above device the head is not obliged to follow the bottle into uncomfortable positions and remain so while the washing proceeds.

W. KNOWLTON.

New York city.

The Great Engineer for President.

To the Editor of the Scientific American:

"The right man in the right place." This oldfashioned doctrine is revived in your able article nominating James B. Eads for the Presidency.

A statesman, an anti-monopolist, an advocate for the rights of the laborer, a gentleman of the highest scientific attainments and literary culture, James B Eads has rendered more lasting service to the Republic than any man living in the United States.

He is truly a representative of the best type of American citizen. Progressive, energetic, endowed with inventive powers in an extraordinary degree, he has contributed more to the advancement of practical science than any man of the age. Constructing an ironclad navy for the Western waters, he originated many important improvements therefor, which resulted in the building of ironclads of lighter draught than had been deemed possible.

As a civil engineer, James B. Eads occupies an eminent position. There is nothing in scientific history to compare with the St. Louis and Illinois bridge, with its wonderful aisson work. Slender and airy as the masonry of this bridge in its perfect symmetry appears, it contains 103,000 cubic yards of masonry—almost double the amount contained in the piers of any other bridge of equal length. The reports of the projector have been translated into many languages, and form the basis of text books used in schools of engineering in America and Europe

Although yet in the prime of life, James B. Eads has accomplished grand public improvements which might compass a century. The records of the Patent Office exhibit him as the originator of many useful and varied improvements. The Jetty system, now being constructed by this distinguished engineer, at the mouth of the Mississippi river, is one of the grandest works of the nineteenth century. The Mississippi river drains one of the most extensive, fertile, and salubrious valleys on the face of the globe, yet the only outlet to the sea, of this grand region, has always remained blocked by a bar over which commerce has vainly striven to find unfettered passage. The success of this great enterprise is already nearly established.

An honest man, an enlightened gentleman, gifted with administrative abilities of a high order, a statesman of broad, comprehensive views and sound logic, James B. Eads is pre-eminently fitted to fulfil the duties devolving upon the Executive of this great nation.

A PATRON OF HUSBANDRY.

Can We Protect our Bank Vaults?

To the Editor of the Scientific American:

The article in your issue of February 20 on this subject is worth attention; but let me ask how it is that bank safes in London, Paris, and Vienna are not robbed? They certainly keep as much specie and currency generally on hand in London as we do here, yet I cannot call to mind a single case of a bank safe being robbed in that city. When I resided in London, I was informed by a friend who had been employed as clerk in a London bank that, when he first commenced his duties there, he was compelled to sleep on the premises with some three or four other junior clerks, and that it was made obligatory on them that two of them should always remain at home to look after the building, in conjunction with the janitor and his family. Thus a band of burglars could have no opportunity of robbing such a bank, save by collusion with four or five persons. The country banks in England, I am told, are guarded in the same manner. It seems to me that, if we give the burglars full opportunity to work, it is quite useless making strong vaults and safes. Guard the building: that is the true remedy. Our safe deposit institutions have wisely adopted this plan, and so far successfully.

DEPOSITOR.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for February, 1875.

Mercury.

Mercury, which was seen so beautifully after sunset in the latter part of January, can in March be seen before sunrise. On the 1st of March it rises at 5h. 30m. A. M., and on the 31st at 5h. 15m. A. M. The best time to look at it is on the morning of the 10th.

Venus.

Venus becomes more and more conspicuous in the evening sky, setting on the 1st of March a little before 9 0 P. M., and on the last of March a little after 10 P. M.

As Venus passes the meridian between 2 and 3 in the afternoon all through the month of March, with an increasing apparent diameter and at higher and higher altitude, it can probably be seen with the naked eye at its culmination.

Mars.

Mars rises on the 1st of March at 8h. 33m. A. M., and sets at 10h. 5m. P. M. On the 31st, Mars rises at 7h. 30m. A. M., and sets at 9h. 54m. P. M. The apparent diameter of Mars is now very small, in consequence of its distance, but on the 29th it may be recognized from its nearness to Venus.

Jupiter.

Jupiter continues to be very near to the star β *Scorpii* and its motions can be very nicely followed by comparing its position with that of the star. In the first half of the month of March, Jupiter is seen to be moving away from the star; on the 17th it is stationary, after which its motion becomes retrograde, and on the 31st it is very near the star.

Jupiter is coming into better position for evening observers; on the 31st of March it rises about 10h. 32m. P. M., and comes to meridian at 3h. 10m. the next morning, at which time the star β *Scorpii* is west of Jupiter by about half the diameter of the moon.

Saturn.

Saturn sets before the sun in March, but it rises earlier and earlier through the month, and in the latter part can be well seen in the morning. On the 31st, Saturn rises at 4h. 28m. A. M., and sets at 3h. 5m. P. M. Mercury and Saturn are in conjunction on the morning of the 18th.

Uranus.

On the 1st of March Uranus rises at 3h. 36m. P. M. On the 31st, Uranus rises at 1h. 34m. P. M. Uranus can be found at meridian passage, which on the 1st is at 10h. 37m. P. M., at an altitude (in this latitude) of about 58°. On the 31st, Uranus passes the meridian at 8h. 36m., at an altitude of 58¼°

Sun Spots.

The report is from January 19 to February 20, inclusive. The photographs of January 20 and January 21 show a large spot (followed by a very small one) coming on, a small group near the center, and another on the western limb.

Clouds prevented photographing till January 25, when the group seen going off on January 21 had disappeared; the

group then near the center was now on the western limb, and the large spot had separated into a group, composed of one large and several small ones.

From January 26 to February 12, when observations could be made, the sun's disk appeared free from spots. On February 12 a large spot, measuring nearly $\frac{1}{45}$ of the sun's diameter, with very marked penumbra and followed by faculæ, was observed. On February 16 this spot was seen to have broken up into a chain of small ones, which measured when last seen, February 20, nearly $\frac{1}{18}$ of the diameter of the sun. Observers should look for the return of this spot about March 9.

PRACTICAL MECHANISM.

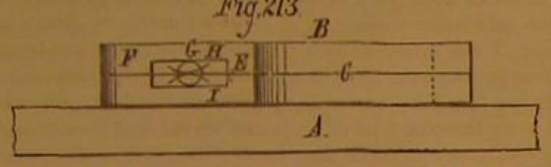
BY JOSHUA ROSE.

NUMBER XLIII.

MARKING OUT A CONNECTING ROD.

Our next operation is to mark out the keyway, which is performed after the butt end of the rod and the inside and outside of the strap have been planed. We first, with a pair of compass callipers, which are better for the purpose than compasses, mark the center of the strap edgeways, and then, laying it with its broad surface on the marking-off plate, we mark off the keyway as follows: In Fig. 213, A represents

Fig. 213

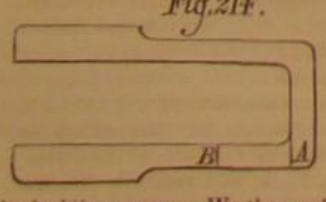


the table, and B the connecting rod strap. C is the center line of the strap, and therefore of the keyway; the end, E, of the keyway should be drawn the necessary distance from the inside crown of the strap, as denoted by the dotted line, because it is that distance upon which the thickness of the brasses depends. Hence the line, E, is the first one to be drawn; then, from the line, E, we mark the length of the keyway, and strike the line, F; the breadth of the keyway we mark by setting the compasses to the radius of a circle whose diameter will be equal to the required breadth of keyway. Then using the center line as a center, we mark the circle, G, and (parallel with its diameter, the center line) the lines, H and I, thus completing the marking of the keyway on the strap. Our next operation is to mark the oil hole of the strap, which should be placed exactly in its proper position, for the following reasons:

A connecting rod whose crosshead end has a strap with a gib and key (or, what is better, two gibs and a key to hold it, the crank pin end having its strap held by bolts, and the key between the bolts and the brass) would maintain its original length, provided the wear on the crosshead brasses were as great as is the wear on the crank pin brasses; but since that on the latter is the greatest, the rod wears longer to half the amount of the difference of the wear between the crosshead and crank pin journals. If both the straps of a rod are held by bolts, the key of one end being between the brasses and the main body of the rod, and the key of the other end between the brasses and the crown of the strap, it would maintain its original length if the wear on both ends was equal; but this not being so, it wears longer, as above stated. The oil hole of a strap, for either a connecting or side rod, should therefore be in the exact center of the space intended to be filled by the brasses. It will thus be central with the joint of the brasses, and from center to center of the oil holes, and will, therefore, represent the proper length of the rod. When, therefore, the brasses of a rod end, whose strap is held by a gib and key, have worn so that the key is let down, the brasses must be lined up to bring the key back to its original position, the back brass being lined up so that its joint face comes even to the center of the oil hole, and the other brass being lined up sufficiently to bring the key back to its original position; then the rod is sure to be of the proper length. But if the strap is held by the bolts (in which case it does not move when the brasses are let together and the key further through), lining the back brass up to the center of the oil hole at once insures the rod being of its correct length, without any reference as to what thickness of liner is put on the other brass, or how far the key may come through. In either case it will be observed that the center of the oil hole, when placed as described, forms a gage to keep the rod its proper length.

To mark off the oil hole, we lay the strap on its side face, as shown in Fig. 214, and, placing a straight edge along the inside crown face of the strap, we mark a line even with it and across the jaw of the strap, as shown at A, in Fig. 214,

Fig. 214.



and from that we mark with the compasses the line, B, the distance between the two being half the total depth of the brasses, or, what is the same thing, the thickness of the crown brass (when new) from its joint face to its bedding crown. We then, with a square and scriber, carry the line, B, over to the center line of the edges of the strap (C in Fig. 213), and the junction of the two is the center of the oil hole. In centerpunching the center for the oil hole to be drilled, make a deep centerpunch mark to prevent the drill from running to one side and thus deceiving the machinist (who may have to line up the brasses when they become worn) as to thickness of the liner to be placed behind the back brass to keep the rod to its original length.

The marking of the keyway in the butt or stub end of the rod is performed in the same manner as that of the keyway in the strap, care being taken to make the edge of the keyway nearest to the end of the rod at the exact proper distance from that end: otherwise the amount of space left, when the strap is in its place, between the end of the rod and the crown of the strap (which regulates the thickness of the brasses), will not be correct, and the oil hole will not stand in its correct position on the strap, unless the key and gib are made to suit the inaccuracy of the position of the keyway in the rod end. For example: Suppose the keyway of the rod to approach too near the rod end; then the strap will, if the gib and key are made of the proper width (when placed together, as shown in Fig. 215) across, as at A, not pass sufficiently along the block end, and there will be too much space allowed for the brasses, and the oil hole will stand too near the crown of the strap. The only method of correcting this defect is to make the width of the key and gib, at A, Fig. 215, wider to the necessary amount, and to cut the keyways, both in the strap and the rod end, wider, by cutting out the metal on the edge of the keyway furthest from the rod end, and the metal on the edge of the keyway in the strap at the end nearest to the crown of the strap. If the keyway of the block end errs in the opposite direction, the keyways must of course be made wider, the metal being cut out in the exact opposite to the above direction. By marking out the two keyways as above described, we have no occasion to take any account of the draw, since that will come right of itself when the brasses are put in their places in the strap, and the strap is put in its place upon the rod end. In marking off the rod end from keyways already cut in the strap, the following plan must be adopted: Place the strap upon the rod end, leaving the space between the rod end and the crown of the strap narrower than is required to receive the brasses (when the latter are new) by an amount equal to the amount of taper there is in the full length of the key, and mark the keyway in the rod end even with the strap, taking no account of the draw required on the keyway, which is provided for in the position in which the strap is placed on the rod end, as will be perceived when we consider that the length of a keyway is always the width of the key and gib, at A, when placed together, as shown in Fig. 216. Hence, by marking off the keyway in the rod end with the keyway in the strap, the latter is in the position in which it will stand when the key and gib are in the position shown in Fig. 216. Supposing then the gib and key to be in their

Fig. 215.

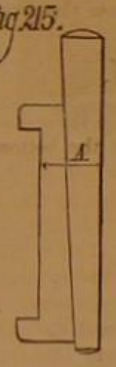
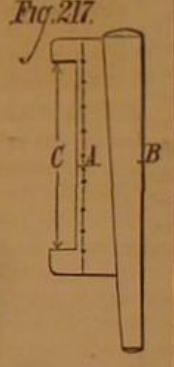


Fig. 216.



Fig. 217.



places in the rod and strap, and in the position shown in Fig. 216, and that we then lift the key up so that it will stand in the position shown in Fig. 215, and that we then pull the strap as far off the block end of the rod as it will come, the key will then stand in its correct position, and there will be the proper amount of draw in the keyway, both in the strap and on the rod end, and the space between the end of the rod and the crown of the strap will also be correct. To mark off the key and gib, we proceed as follows: After the keyways are filed out, we take a piece of thin sheet iron and fit it to a tight fit in the breadth or thickness of the keyway, and have the thickness of the key and gib planed, using the piece of sheet iron as a gage; we then mark off the key on both edges to the proper width at top and bottom, and hence give it the correct amount of taper. We also have the plain or straight edge (that is, the edge opposite to the jaws) of the jib planed straight; we then place the jib and key in the position shown in Fig. 217, and mark off (from the edge face, B, of the key) the line, A, on the gib, using the compass callipers set to the full width of the keyway in the strap or rod end, taking no account of the draw. Hence the key and gib will, when in the position shown, just fill the keyway. The width between the jaws of the gib, as denoted by C, should be marked a trifle less than is the extreme outside width of the jaws of the strap, so as to allow for the metal taken off in filing up the outsides of the jaws of the strap and off the inside of the jaws of the gib.

When the rod is fitted up and ready to mark off the brasses, to bore them out by, we proceed as follows: We take the top brass and mark on its outside face two lines level with the faces which fit against the inside jaws of the strap,

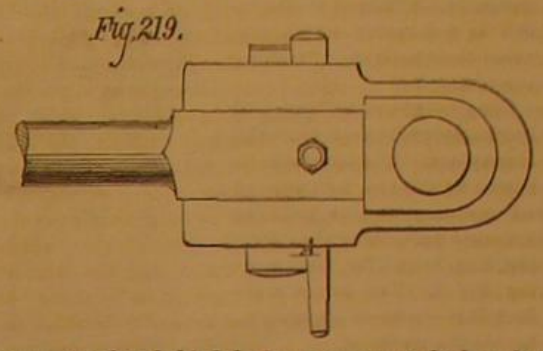
Fig. 218



as shown in Fig. 218, A and B being the lines referred to. We then key up the brasses in their places in the rod and fasten a center piece in the brasses at each end of the rod. Upon these centerpieces we first mark a line parallel with and central between the lines, A B, and then a line across the joint of the brasses if the joint faces meet, and in the center of the space between them if they do not meet, and in either case to the center of the oil hole, if the rods have been correctly made; and the distance between the junction of the lines so obtained will, from one to the other, be the length of the rod. The rod should, however, always be tested with a pair of trammels set to the necessary distance between the brasses from center to center of their bores, care being taken to stand the rod, while trying the trammels, in the position in which it works, for all rods deflect by their weight, the amount of such deflection depending upon the position in which the rod is suspended. The trammels also deflect, it is true, but their deflection is allowed for in setting them, whereas the deflection of the rod will not be accounted for unless it is trammeled when standing or lying in the position in which it works.

We now come to ascertaining what thickness of liner it is necessary to insert on the back of each brass, when such is necessary on account of the wear of the brasses and on account of the key having passed through the keyway so that its head is level with the top of the jib, and hence requires to be set back. Beginning with the back or bottom brass, which beds against the crown of the strap, we find that the brass at each end of the rod furthest from its key will, no matter what the construction of the rod may be, require lining up so that the center of its bore is even with the center of the oil hole in the strap, that is, providing the oil hole has been marked off as directed. The thickness of liner

Fig. 219.



necessary to place behind the brass nearest to the key should be ascertained as follows: The brass furthest from the key having been lined up, we put the rod end, together with the brasses and keys, in position, and key the rod up properly, when, as shown in Fig. 219, the key will pass too far through the rod end. Then we mark across the face of the key a line, A, even with the edge face of the strap; we then put the key back to its proper position, and mark another line B, even with the edge face of the strap; and taking the key out, we shall find the two marks shown in Fig. 220, A being the first and B the second line struck upon the face of the key; and the difference between the width of the key at A and its width at B will be the thickness of the liner necessary to be placed behind the brass nearest to the key. To ascertain the precise amount of this difference (because a very small error as to this amount causes a great deal of extra labor), we set a pair of outside callipers to the width at A; and then passing the calliper points down to B, we keep one of the points even with the line, B, and insert a wedge until it just fills the space between the other point and the side of the key, as shown in Fig. 221, C being the wedge, which should be chalked along its surface so that, when inserted (as shown) until it touches against the calliper point, the latter will leave a mark on the wedge, denoting exactly how far the wedge entered and hence the exact required thickness of liner.

Fig. 221.

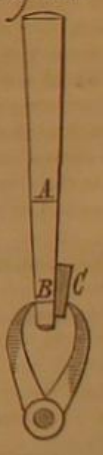
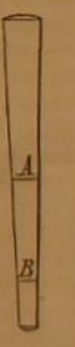


Fig. 220.



Bicycle vs. Horse.

A ten mile race, between a fast horse named Happy Jack and a velocipede rider named Stanton, recently took place at Lillie Bridge, England, for $250. For the first three miles the horse kept level with the bicyclist. The ground was rather sticky—owing to late rains—for both, and Stanton seemed laboring, but this is his peculiar way of riding. Stanton was the favorite at as much as 3 to 1, for the start allowed him was generally considered too much. For three miles the horse went easily; where he lost at the corners he made up in the straight. This style he kept up until the sixth mile, when his stride began to falter, not being ridden so well as on the last occasion, combined with the effect of the extra weight he was carrying. Stanton from this point gradually went ahead, and in the next mile he had gained fifty yards. The horse was now beaten, and after going another lap was pulled up at eight miles. Stanton went on and finished the distance, ten miles less 764 yards, in 34 minutes 34 seconds, being at an average velocity of nearly eighteen miles an hour. He rode a 58 inch machine made by Keen, weighing 40 lbs. He seemed to have a good deal more in him had it been required.

A correspondent says: For kitchen and pantry floors there is nothing better than a coat of hard paint; the cracks should be filled with putty before it is applied, and the paint allowed to dry at least two weeks before using. Then it is easily kept clean by washing (not scrubbing) with milk and water; soap should never be allowed to touch it. "Red lead and yellow ocher I prefer for coloring; the former makes a hard paint that wears well."

PATENT GEAR-CUTTING ATTACHMENT FOR LATHES.

We illustrate herewith a new and powerful device designed for the use of machinists who require a gear-cutting machine, but who have not sufficient work for an apparatus of that description to warrant their purchasing one of the larger and more expensive appliances now in the market. The present invention is claimed to be able to perform all the work peculiar to it that is necessitated by the average machine shop; and through its low cost, the advantages which it offers are brought within the reach of mechanics generally.

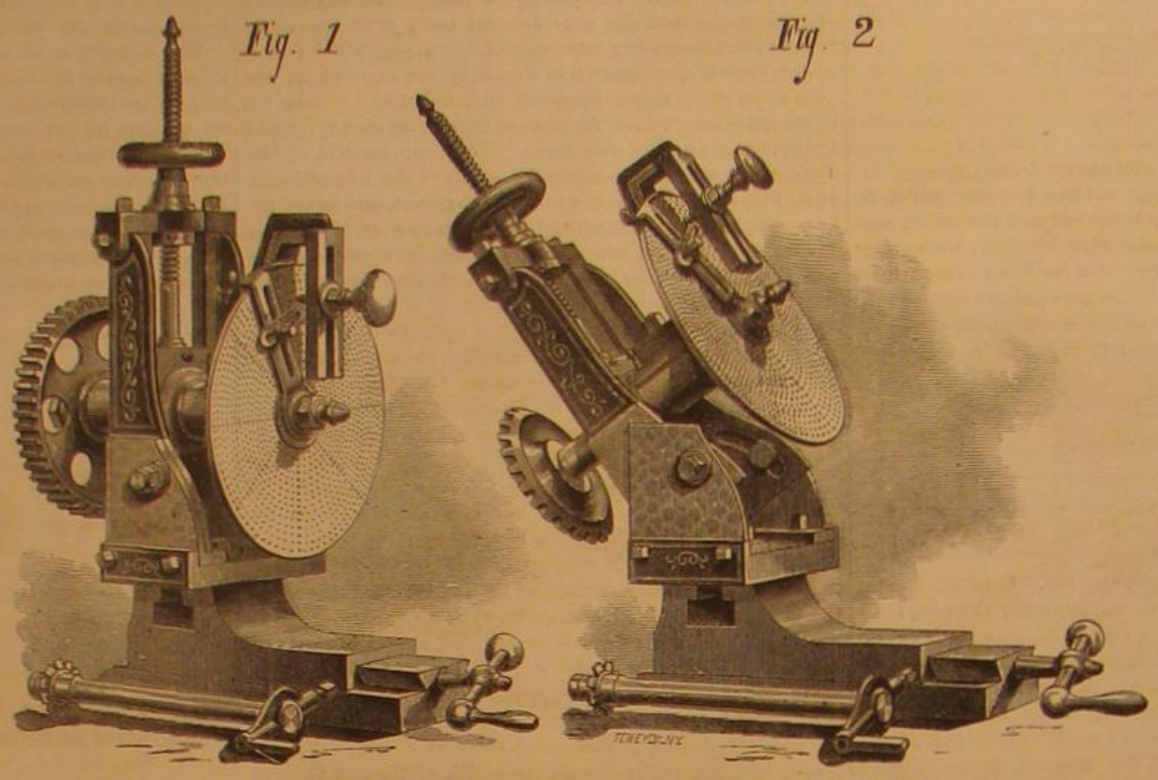
This machine will cut all kinds of gearing—spur, bevel, miter, spiral, and worm—and also taps, reamers, and indexed milling. It is 24 inches in hight, weighs 96 lbs., and its index plate is 12 inches in diameter, and has 38 circles of holes, dividing every number up to 75, and every even number up to 150, or 112 different numbers. Attached to the index is a counter which prevents the possibility of making mistakes.

The general construction will be clearly understood from the engravings. The apparatus is shown on the tool post slide of an ordinary engine lathe as arranged for cutting spur gearing, Fig. 1, and for bevel gearing, Fig. 2. The cutter mandrel is represented separately, beside the machine.

Patented to Mr. Thomas O. Mills, and manufactured under his supervision by the Michigan Manufacturing Company, of Kalamazoo, Mich., to whom inquiries for further information may be addressed.

Fig. 1

Fig. 2



MILLS' GEAR-CUTTING ATTACHMENT FOR LATHES.

SMITH'S FLOUR AND MEAL CHEST.

The annexed engraving represents a handy receptacle for flour and meal, which protects its contents from inroads by rats and mice, and allows of the withdrawal of the exact quantity of material required in a sifted state ready for immediate use. The upper portion of the device is separated into two compartments, one of which serves for flour, the other for meal, the partition being immediately over a bottom orifice. A separate canvas spout, as represented, leads from each compartment to a sieve beneath, which is sustained in a simple holder, which is vibrated and the sieve so shaken by suitable mechanism operated by the crank shown. Slides



are provided to shut off or admit meal or flour to the chutes and are controlled by the knobs shown respectively in front of the chest and beneath the crank. The lower compartment receives the vessel into which the meal or flour is sifted, and also answers as a convenient closet for storing bread, tray, rolling pin, bread board (which last, with a sieve, is provided with the chest), biscuit cutters, and baking utensils generally. Each compartment may be made to hold a bushel of meal and one hundred pounds of flour, or it may be constructed smaller.

The inventor points out that, with this device, no material is wasted in removing it from the receptacle in which it is kept, and moreover that the same is kept from becoming stale and wormy, as is often the case. No old flour remains at the bottom, as that at the bottom is used first, and every time the slide is drawn the bulk is disturbed and fresh air admitted. In this way the contents of the chest are always kept in a fresh state. The hinged lid at the top admits of ready access to the upper compartments; and when the doors below are closed, the device becomes a neat piece of furniture, fit to be located in the dining room if desired.

Patented January 5, 1875. For further particulars regarding sale of rights, etc., address the inventor, Mr. A. W. Smith, Lexington, Mo.

KEROSENE flames are readily extinguished by throwing a rug or cloth over them. But cloth is not always in the kitchen, where kerosene accidents are most likely to occur. Flour is recommended as a substitute. Thrown upon the flames, it quickly absorbs the fluid and deadens the flame.

CORNELL'S IMPROVED LIFTING JACK.

The new jack herewith illustrated offers the advantage of a continuous lift or press from bottom to top, while its mechanical construction is such as to apply the power with great effect. It is thus well adapted to situations where the jack screw cannot be used. It is always ready for operation, is claimed to be perfectly safe under a load, and admits of lowering the weight gradually when desired.

Between projecting flanges, Fig. 2, upon the two vertical metal bars which form the body, is pivoted the hand lever. On the side nearest said lever, of the wooden standard which plays in the hollow body, is secured a metal rack bar. The lever near its inner end is provided with two pawls, one of which works upon the lever bolt between the prongs of the

Fig. 1.

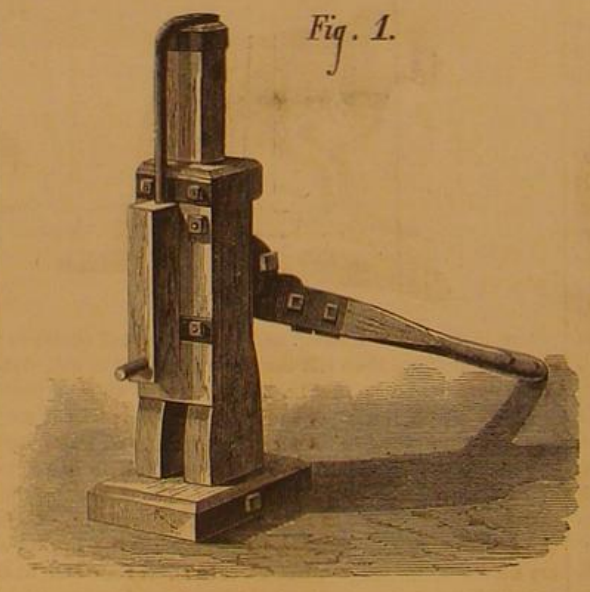
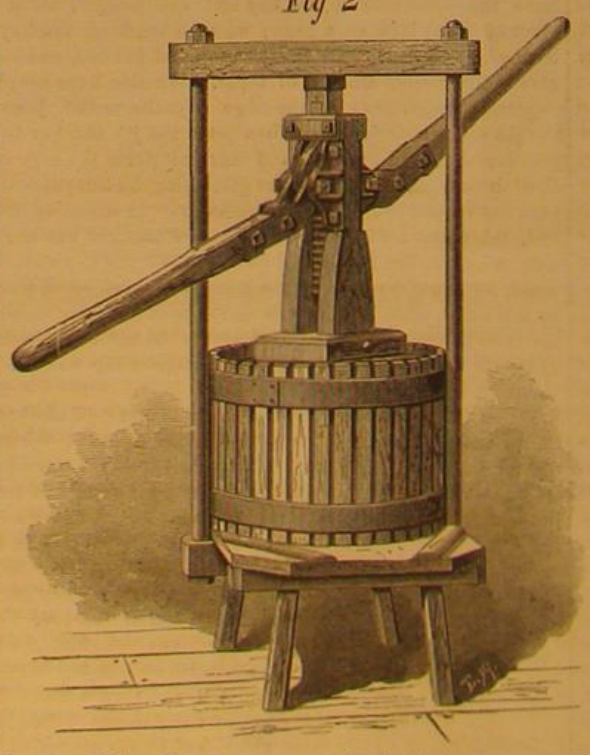


Fig 2



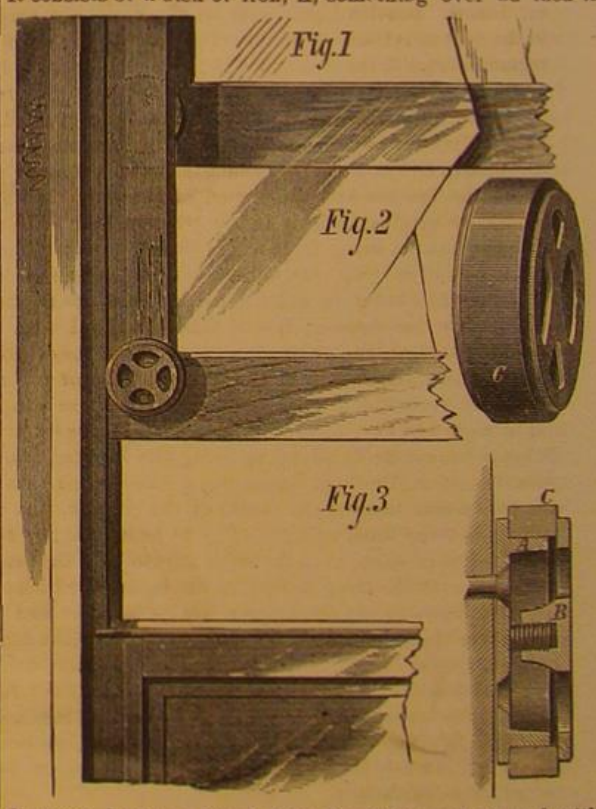
lever, and the other has a separate pivot also between the prongs. The longer pawl on the lever bolt is stationary; the other moves with the lever, so that the first acts as a lifter and the second as a detent. By operating the lever, these pawls are so caused to catch into the rock bar as to lift the standard upward. On the back of the body are attached metallic plates, which form the bearings for metal friction rollers. The latter play through slots in the body and rest against the standard, so that, in lifting heavy weights, the lever and pawl press upon one side of the standard while the rollers relieve the friction on the other. Also at the rear of the machine is a metallic bar, Fig. 1, which has its ends bent at right angles to its length, but in opposite directions. A pin passes through the upper bent extremity and into the top of the standard, so as to keep the bar in place and secure it to the latter. The lower arm of the bar is used to hook under objects which are lower than the top of the jack. A wooden block may also may be added, as shown, for loads to rest upon, so that the machine can easily be adjusted to objects of any hight. The bar is detachable by simply lifting it from its resting place.

In Fig. 2 the application of the jack to a cider press is represented. Here there are two levers, each with its pawls acting on standards on each side of the standard, so that a greater amount of power can be applied. As regards this especial adaptation of the jack, the inventor points out that the iron in a cider or wine press comes in contact with the acid of the fruit, and soon becomes corroded; and this does not happen in the present case. It will be seen that the invention is useful as a wagon jack, fence or timber lifter, and a press for a large variety of purposes. Patented February 1, 1876. For further particulars address Munsell & Dexter, 165 Greenwich street, or 49 Courtland street, New York city.

STELLER'S IMPROVED SASH HOLDER.

We illustrate herewith a simple and effective little device for sustaining window sashes in any position in which they may be placed. In addition to this, it may also be employed as a sash lock, on sashes which are supported when raised or lowered by cords and weights or like means.

Fig. 1 shows the holder as applied to sashes, and Fig. 2 is a perspective, and Fig. 3 a sectional, view of the invention. It consists of a disk of iron, A, something over an inch in



diameter, having a broad flanged portion, and pierced with holes for the reception of the fastening screw. In the center of the disk is a threaded projection, upon which screws another disk, B. The whole thus forms a grooved wheel, of which the flange constitutes the periphery. Around the latter is slipped a rubber ring, C. To apply the device the disk, C, is removed, and the remainder attached by a single screw to the window sash. It thus is secured eccentrically; and consequently, when the rubber covering takes against the casing, the holder becomes jammed through the downward pressure of the sash, so that the latter cannot possibly descend further. This is clearly shown by the dotted lines on the upper sash in Fig. 1. It will easily be seen that, by turning the holder so that its greater portion is above instead of hanging below the screw, the jamming will then take place when the sash is sought to be lifted, and thus the apparatus becomes a simple, self adjusting, and very efficient lock. The invention is neat, tasteful in appearance, and cheap, and doubtless will meet a ready welcome from carpenters and the hardware trade generally. Patent now pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. C. E. Steller, 352 East Water street, Milwaukee, Wis.

HAECKEL ON THE HUMAN PEDIGREE.

The "Schöpfungsgeschichte" of Professor Ernest Haeckel, of the University of Jena, has recently been translated into English and published under the title of "The History of Creation." The work is a greatly condensed epitome of the thoughts of one who has probably reached the *ultima thule* of scientific rationalism; but the admirable clearness with which the great theories which are dividing the scientific world into two hostile camps, and which are constantly widening the breach between scientific thought on one hand and theological dogma on the other, are here presented and amplified will command for the treatise the attentive study even of those to whom the doctrine of man's origin and development, as here enunciated, is most repugnant.

Dr. Haeckel's theory includes both that of Lamarck and that of Darwin. With Lamarck, he holds that all animal and vegetable species are descended from common, most simple, and spontaneously generated prototypes; and then he adopts Darwin's conclusions in showing us why a progressive transformation of organic forms took place, and what causes, acting mechanically, effected the uninterrupted production of new forms and the ever-increasing variety of animals and men. Dr. Haeckel, however, sets before himself the task of establishing, in the light of the above theories, a probable scheme of the genealogical relationship of organisms. And to this he brings the ripe fruits of extended research, and of a vast store of knowledge in biology and kindred sciences, a knowledge in which he is unexcelled. He thus deals with the descent of man in a directly practical sense, while Darwin only treats it in a general way; and at the very outset he disagrees wholly with Darwin in the latter's final conclusion relative to the descent of all organic beings "from some primordial form, into which life was first breathed by the Creator." In a word, Haeckel sets about constructing a genealogy for the race—and indeed for all animated nature—with the same coolness with which an antiquary would hunt for a family pedigree or a lawyer prepare an abstract of a title to a piece of real estate. And in this work he uses three powerful aids: first, the study of the development of the individual, which he declares to be a short, quick repetition of the development of the tribe or chain of ancestors to which it belongs, determined by the laws of adaptation and inheritance;" second, the study of the development of the tribe from palæontological and geological records; and third, the study of comparative anatomy, or the investigation of the chain of different, but related and connected, forms which exist side by side at any one period of the earth's history. Regarding all these, he affirms that the laws of inheritance and adaptation known to us are completely sufficient to explain the perfect parallelism of the three developments.

In the beginning was the fire mist, thinks our author, adopting the theory of a gaseous chaos which formed the basis of Kant's "Cosmogony." By a universal rotary movement in this nebulous Universe, portions aggregated, and these aggregations, by refrigeration, changed into masses of fiery fluid. The latter, cooling and condensing, became as molten metal. An outer crust formed on the new worlds, and thus, "by the inherent forces of eternal matter, entirely without supernatural interference, the solar and planetary systems came into being. When our earth's crust had so far cooled that the water, present hitherto as a gas, could condense into liquid form, then came into existence the primordial germs of life.

In the narrow limits of this article it would be impossible to trace every link of the chain which, from this point, Haeckel forges with infinite care; but we may note the stages into which he divides the pedigree of man, and, by the aid of the accompanying engravings (which are not drawn to relative scale), convey an idea of the being which forms or formed a near or exact type of each stage of development.

We are now able to produce in the laboratory certain combinations of carbon, oxygen, nitrogen, and hydrogen, which are similar, in the complexity of their constitutions, to the combination entering into the mere lump of albumen which forms the body of the still existing moneron (1). This is the simplest of all organisms—as simple as any crystal which consists of a single inorganic combination. "Now," says Dr. Haeckel, "there is absolutely no reason for supposing that there are not conditions in free nature, also, in which such combinations could take place;" and he inclines to the view that such conditions existed at the early epoch of the earth's history, following the formation of liquid water. This combination, taking place, produced a primeval mucus or plasma, capable of life; and this plasma simply needed to individualize itself, in the same way as the mother liquor of crystals individualizes itself, in crystallization, to produce crystals. Thus in the Laurentian period arose the earliest progenitor of life—a mere lump of protoplasm, but capable of nutrition, and of multiplying its species by self-division (1 *a*).

By the process of segregation, taking place in the homogeneous viscid body, a kernel was formed within, differentiated from the surrounding plasma, and producing thus the simple cell, of which the low organism, still existent and known as the amœba (2), is a type. By self-division, the cell fell into a mass of simple and equiformal amœba-like cells, each exactly similar to the other, and each containing a kernel. These groups of cells are termed synamœbæ (3), and the conformation of the organism reminds one of a mulberry. But as development progressed, the cells lying on the surface extended hair-like processes, which, by striking against the water of the primeval ocean in which the creature existed, kept the body rotating; and so another differentiation occurred, the external cells covered with cilia differing from the non-ciliated internal cells. These organisms are called ciliated larva or planeads (4). From the planeads arose the primeval stomach animals, the gastræads (5), possessing a simple oval or globular body, which enclosed a simple cavity having a mouth.

At this point we reach two divergent lines: One branch of gastræads gave up free locomotion, adhered to the bottom of the sea, and developed into zoöphytes or animal plants; the other branch retained free locomotion and developed into the primary form of worms. In these last appeared the first formation of a nervous system, the simplest organs of sense, secretion, and generation. The nearest akin to these primeval forms are the ciliated gliding worms (*turbellaria*), of which one is represented at 6. Through the formation of a true body cavity and blood, within the gliding worms, arose the soft worms, which include very many different intermediate stages. A type of one of these links is shown at 7. Next, by the formation of a dorsal nerve marrow, and of the spinal rod which lies below it, were produced the sack worms (8 and 8 *a*). It is just the position of this axial skeleton (8), between the dorsal marrow on the dorsal side and the intestinal canal on the ventral side, which is most characteristic of all vertebrate animals, including man, and also of the larvæ of the ascidiæ here represented. Now followed the formation of body segments, the further differentiation of the organs, a more perfect development of dorsal marrow and spinal rod, and probably the separation of the two sexes—producing the acrania or skull-less animals, of which the still living lancelet (9) affords a faint dea

We next meet the development of the first brain. It was formed out of the anterior end of the dorsal marrow, while the anterior end of the dorsal chord developed into a skull. The first animal possessing a brain was similar to the lamprey (10), a single nostriled creature. This single nostril divided into two lateral halves; a sympathetic nervous system, a jaw skeleton, a swimming bladder, and breast and ventral fins appeared, and so, in the Silurian period, originated the shark-like ancestors (11) of all fish. By adaptation to life on land, by the transformation of the swimming bladder into an air-breathing lung and of the nasal cavity into air passages, arose the mud fish, to which the still living ceratodus or grass-eating fish (12), the lepidosiren (13), bear a near resemblance. At the same time originated the now extinct sea dragons, like the plesiosaurus (14). Out of the mud fish, by the transformation of the paddling fins into five-toed legs, and also by the more perfect differentiation of various organs, came the most ancient amphibians, which, like the axolotl (15) of the present day, besides possessing lungs, retained throughout life regular gills. From these arose the tailed amphibians, which, like the newts or salamanders (16) lost the gills which they had possessed in early life, but retained the tail. They originated by accustoming themselves to breathe only through gills in early life, and later in life only through lungs. In the mesolithic or secondary period, the tailed amphibian, through loss of gills, by the formation of the amnion, of the cochlea, of the round window of the auditory organ, and of the organs of tears, produced the primeval amniota, of which the true lizard (16) may be taken as a type. Here we meet another branching, for on one hand the amniota developed into reptiles and thence into birds, and on the other into mammalia. Following the second branch, we find that, by the transformation of scales into hair, and by the formation of a mammary gland, were next evolved the promammalia, closely related to the beaked animals, such as the ornithorincus (18). Now comes the transition to placental animals, by the promammalia and the evolution of the marsupials, such as the kangaroo (19).



THE MODERN THEORY OF THE DESCENT OF MAN.

Out of the rat-like marsupials, by the formation of the placenta, development of the commissures of the brain, etc., come the semi-apes, of which the lemur (20) is an existing type. From the semi-apes, by the transformation of the jaw, and by claws on the toes becoming nails, arose the narrow-nosed tailed ape (21). Then the tail disappeared, the hairy covering partially departed, and the brain above the facial portion of the skull developed, producing the orang-outang (22), or the chimpanzee, or the gorilla—the human apes of the miocene period. These apes gradually became accustomed to an upright walk, and the separate pairs of legs differentiated. The fore hand became a human hand, the hind one, a foot. Thus was produced the ape man, the pithecanthropus (23), who existed toward the end of the tertiary period. Genuine man developed out of the ape-like man by the gradual development of the animal language of sounds into a connected and articulate language of words. These went hand in hand with the higher differentiation of the larynx and the brain. Primæval man, Haeckel divides into the straight haired and the wooly-haired. From the last arose the Papuans (24), the oldest of all still living human species, and nearest related to the original primary form of wooly-haired men. Next come the Hottentots, belonging to the same branch as the Papuans. To the other branch belong the Negroes and the Kaffirs.

The straight-haired men generated the Australians and Pro-Malays, the latter, the Mongols and the Malays. The Mongols produced the eighth and ninth species, the Americans and the Arctic Men, and the last produced the Esquimaux. The Malays have developed into no other distinct species. A third branch of the Pro-Malays, however, produced the Dravidas, from whom sprang the Cingalese, the Nubians, and the Mediterranese, thus completing the series of twelve species and thirty-six races.

Tracing, lastly, the history of nations or historic tribes, the Mediterranese gave rise to four races, the Semites and Basques in one branch, the Indo-Germans and Caucasians in another. From the Indo-Germans, in regular progression, came Sclavo-Germans, the primeval Germans, the Germans, Low Germans, Saxons, and, lastly, Anglo-Saxons. And here our chronicle ends, for thus over a lapse of thousands of millions of years—ages, according to Haeckel, countless and incalculable save by mere approximation—we have traced the development of man from the clot of albumen to the race which now populates these United States.

The Heat of Slags and Economy of Furnaces.

From two recent papers of Professor Grüner we obtain the following interesting data: The experiments on which they are based were made with a water calorimeter of 18 kilogrammes (nearly 40 lbs.) weight, and upon quantities of molten material varying from 50 to 100 grammes (1·6 to 3 2 ozs.). The heat is given in French calories, or centigrade units.

The less fusible slags of the blast furnace (accompanying gray pig) possess, on issuing from the furnace, 450 to 500 units. Those proceeding from non-fusible ores, and most frequently associated with white pig, have 400 to 450; white glass (70 per cent silica) heated to the temperature for glass-blowing, 415 to 420; bottle glass under the same circumstances, 380 to 400. The ferruginous and manganiferous scoriæ from the Martin process (54 to 55 per cent silica) require for smelting 410 to 415 units; porphyroidal copper slags from Swansea (60 per cent silica and quartz), 405 to 410; bisilicate protoxide of iron slags (45 per cent silica), 380 to 400; puddling or reheating cinder (30 to 35 per cent silica), 320 to 330; monosilicate slags from lead and copper furnaces (28 per cent silica), 275 to 300. Pure, well carburized pig requires for melting 225 to 230 units; gray silicious pig (3 per cent carbon), 250 red copper, which, like the foregoing, has its melting point at about 1,200° C. (2,192° Fah.) may be brought to that temperature with 160 to 165 units of heat. Iron copper matte requires 230 to 240; iron lead matte, 200. Lead, which has, like platinum, a very low specific heat, can be brought to clear orange redness with 45 to 50 units.

From the foregoing figures, and other researches which he has previously made public, Professor Grüner has deducted the following interesting statements:

In the wind furnace, which is from this point of view the most imperfect apparatus, there is utilized, in the fusion of steel in crucibles, but 1 7 of the total heat capacity of the fuel, or at most 3 per cent of the heat generated. In the reverberatory, when steel is melted in crucibles, the useful effect is 2 per cent of the total heat, or 2 per cent of the heat generated. In the Siemens crucible furnaces, 3 to 3·5 per cent; in Siemens glass furnaces, operating on a large scale, 5·5 to 6 per cent; in ordinary glass furnaces, 3 per cent; in fusion upon the open hearth of a reverberatory, of glass, 7 per cent; of iron, 8 per cent; in well arranged Siemens and Ponsard furnaces, up to 15, 18, and even 20 per cent of the total heat is utilized.

The caloric effect is much greater when the fuel is mixed with the material to be fused. In old cupolas, 29 to 30 per cent; and in modern cupolas, higher, more rapid in working, and narrower in zone of fusion, upwards of 50 per cent is realized. Large iron blast furnaces utilize, according to their working, 70 to 80 per cent of the heat generated, or 34 to 36 per cent of the total heat which the complete combustion of the fuel would set free.—*Engineering and Mining Journal.*

Cat Racing.

Since the siege of Paris a great deal of interest in the breeding and training of homing pigeons has been created by the admirable service rendered by these swift-flying messengers from the besieged inhabitants of that city to friends outside. The birds in which the homing powers were found to be most strongly developed were of a breed of Belgian pigeons now pretty generally known as Antwerps. This homing faculty, it seems, a Belgian society is now endeavoring to develope in the domestic felines of that country by inaugurating cat races, on much the same principles as pigeon-flying matches. A cat race was very recently instituted in Liège. There were thirty-seven competitors, all of which were liberated some distance from the town, and the prize was awarded to the animal which reached its home in that town first. They were started at 2 P. M., but the distance they had to traverse is not stated; suffice it to say, the first prize animal won in a canter, as he arrived at home at 6:48 P. M. the same *evening*, the second cat not appearing until 2:24 A M., the following morning.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

R. C. ANTHONY *et al. vs.* JOHN CARROLL.—ASSIGNMENT OF CLAIMS FOR PATENT DAMAGES.

[In equity.—Before SHEPLEY, J.—Decided October, 1875.]

SHEPLEY, J.:

This bill in equity, filed July 27 1874, alleges the grant of letters patent of the United States to Marie Amédée Charles Mellier for a new and useful improvement in making paper pulp; the assignment, by Mellier, to one Buchanan, June 19, 1857, of all Mellier's right and title to the invention secured by the letters patent; the assignment by Buchanan to Buffam, trustee of the American Wood Paper Company, October 14, 1863; and the assignment by Buffam to that company, June 16, 1865, of his legal estate in the patent. The infringement by the defendant, and consequent profit to defendant, and damage to the American Wood Paper Company, is alleged from October 14, 1865, to August 19, 1867.

The bill alleges an assignment, August 19, 1867, from that company to Gardner Harland of "all their claims against the said defendant for the said damages and profits for the said infringement during the said period," and an assignment by Harland to R. C. Authony, one of complainants, October 4, 1873, of all said claims. The bill is brought by R. C. Anthony, a citizen of New York, and the American Wood Paper Company, a corporation created by the Legislature of the State of Rhode Island and located at Providence in said State, against the defendant, a citizen of Massachusetts, for a discovery and account of profits, and for damages and other relief.

The defendant has demurred generally to this bill, and in support of his demurrer relies upon the bar of the statute of limitations of the Commonwealth of Massachusetts, and also upon the character of the claim alleged in the bill. The limitation in cases of *tort in this* Commonwealth is six years. (Gen. Stat. of Mass., Ch. 155, Sec. 1.)

As a general rule, the laws of the State in which a national court sits must be the rules of decision in such court. The thirty-fourth section of the judiciary act provided that "the laws of the several states, except when the Constitution, treaties, or statutes of the United states shall otherwise require or provide, shall be regarded as the rules of decision in trials at common law in the courts of the United States in cases where they apply." It is too well settled to require the citation of authorities that, in ordinary actions at common law, the statutes of limitation of the State where the suit is brought may be pleaded in bar under this provision of the judiciary act.

Whenever the cause of action is one cognizable by a court of common law, a court of equity, in accordance with the general rules of equity jurisprudence, follows the law in relation to the limitation of actions. The question presented is whether this rule applies to actions, the subject matter of which is under the exclusive control of the national legislature and judiciary.

Mr. Justice Swayne held, in the case of Collins *vs.* Peebles (2 Fisher, 541), that the State statutes could not limit the time within which actions for the infringement of letters patent might be brought in the courts of the United States; that Congress having failed to legislate upon this subject, there was no limit to the time for bringing such actions; and Mr. Justice Grier is reported, in a note to the above case (2 Fisher, 543), to have so decided in the case of Parker *vs.* Halleck. To the same effect is the decision in Read *vs.* Miller (3 Fisher, 319).

In the case of Parker *vs.* Hawk (2 Fisher, 58), the learned Judge of the Southern District of Ohio decided that the limitation act of Ohio applied to an action on the case in the Circuit Court of the United States for an infringement of a patent. It is stated, in a note to that, that the decision was affirmed by Mr. Justice McLean. Parker *vs.* Hawk was decided on the authority of McCluny *vs.* Silliman (3 Peters, 270). But McCluny *vs.* Silliman is by no means decisive of the question. That was an action on the case against the defendant as register of a land office in Ohio for non-feasance, in refusing at the request of the plaintiff to enter his application for the purchase of certain government lands, as required by an act of Congress. Such an action against an officer for non-feasance could have been prosecuted in the State as well as in the federal courts. The cause of action was one over which the national and State courts had concurrent jurisdiction. Such a case clearly falls within the provisions of section thirty-four of the judiciary act. It is one of the cases where the laws of the State apply. But how it can be contended that the laws of the States apply to an action for the infringement of a patent, when the right of action is exclusively under the Constitution and laws of the United States, when the form of the remedy is prescribed by the acts of Congress, and when the Circuit Courts of the United States are clothed by statute with exclusive jurisdiction over the whole subject matter?

Should the legislature of a State pass an act in express terms limiting the time for bringing an action in the federal courts for infringement of patent rights, there can be no reasonable doubt that such a statute would be unconstitutional and void. The policy of the government to provide a uniform system of rights and remedies throughout the United States upon the whole subject matter of patents for new and useful inventions and discoveries, by placing it under the control of Congress and the federal courts, would be frustrated if such State legislation could directly or indirectly limit, restrict, or take away the remedy. For these reasons, I think no State statute of limitation can be pleaded in bar of this action.

It is contended in support of the demurrer that a court of equity will not entertain a suit for the benefit of an assignee of a right of action for a tort. The question whether a court of equity would entertain this bill, if brought only in the name of an assignee, of a right of action for a tort, does not necessarily arise in this case, as this bill is brought by the assignor, who is also the owner of the patent, and who, under the rules of equity pleading, joins with him, the assignee, he being beneficially interested therein. The better opinion seems to be that, if the claim be for an injury to one's estate or property, and not to a mere solatium for an injury done to the person or personal feelings of the assignor, the claim may be assigned. (The People *vs.* Tioga, Common Pleas, 19, Wendell, 73; McKee *vs.* Judd, 2 Kernan, 622; Milnor *vs.* Metz, 16 Pet., 221.)

The demurrer of defendants is not sustained.

[*Francis C. Nye* and *L. C. Ashley* for complainants.
Browne & Holmes for defendant.]

United States Circuit Court--- District of Massachusetts.

JOHN KENDRICK *vs.* THOMAS A. EMMONS.—WEAVING APPARATUS.

In equity.—Before SHEPLEY, J.—Decided October, 1875.

An English patent, taken out surreptitiously by any person, who, without the knowledge of the American inventor, and without authority from him, endeavored to appropriate the benefits of his invention, would not thereby deprive the real inventor of any of his rights.

SHEPLEY, J.:

The principal questions presented in this case were fully heard and argued upon the motion for an injunction *pendente lite*. Upon a careful revision of the case and of all the new evidence now before the court, no good reason appears for any modification of the views expressed upon the hearing of the motion. The reasons are fully stated in the opinion upon that motion, and it is not necessary to repeat them. The conclusion is that the bifurcated plate in the English machine, constructed substantially according to the patent to Ellis and Sladdin, sealed July 12, 1864, and sometimes described as the retainer or fork, as well as the contrivance substituted for it in the Sladdin machines in evidence, which perform the same office, are infringements of the third and fourth claims of the reissued patent No. 5,282 to Joseph Winsor, for an improvement in machines for making weaver's harness.

Additional evidence and elaborate opinions of experts have been introduced at the final hearing upon the disputed point, whether in the machines of the Sladdin type the size of the loop is gaged by the needle or by the retainer and its substitutes. Question is also made whether the fingers in the Winsor machine, in fact, gage and determine the size of the loops. The theories of the defendant's experts upon this subject are ingenious and elaborate; but upon a close examination of the two machines, when operating to make heddles, one cannot fail to discover that, as a practical result, the length of the loop in the heddle is limited in the Winsor machine by the fingers W1 and W2, and in the sladdin machine by the bifurcated plate or retainer. Each of these devices determines the size of the eye or loop by a gage outside of the eye itself, and this operation constituted one of the prominent features of Winsor's invention. This feature of his invention enables him to dispense with the use of the laying bar, around which the eye of the heddle had before been formed, and thus to dispose of one of the great obstacles in the way of making a loom harness automatically, which Winsor was first to accomplish. This office of determining the distance from each other of the two extremities of the eye by a limiting device outside of the eye itself, the retainer of the English machine performs for the same and in substantially the same manner as the fingers in the Winsor machine.

The mistake in copying the specifications in the re-issued patent, by which the hooks are supposed to be described as gaging the length of the eyes, is so obviously a mistake in description, and so easily corrected by reference to the other parts of the patent and the machine described, that it does not impair the rights of the patentee. The word "they," when used in that clause of the specifications for the second time, evidently refers to the fingers and not the hooks, as determining or gaging the size of the eye.

It is contended that, as letters patent had been granted on the invention in England in April, 1864, for the term of fourteen years from their date, prior to the application for letters patent of the United States, the letters patent of the United states expired with the English patent, and could not be legally extended after the expiration of the patent.

The English patent was not sealed previous to the 15th of June, 1864. It was taken out surreptitiously by some one who, without the knowledge of the American inventor and without authority from him, endeavored to appropriate the benefits of his invention. If a person had thus surreptitiously taken out letters patent in this country for the invention of another who was diligently perfecting his invention, he would not thereby have deprived the real inventor of any rights. It is not believed that, by taking out in advance an English patent, he could accomplish more than he could have done by taking out letters patent in this country. Moreover, as the English patent was not sealed prior to June 15, 1864, it was not more than six months prior to the application for letters patent in this country; and under the act of 1836, he had a *right to* take out his patent in this country for the full term, although he had taken out one in a foreign country, the same having been published at any time within six months next preceding the filing of his specifications and drawings. The act of 1839 was not intended to limit the inventor's rights under the act of 1836, but to enlarge them. He still had the right to take out his patent for the full term, notwithstanding that he had obtained and published a foreign patent within six months. But after the six months he had, for a further specified time, a right to take out his patent, subject to the conditions and specifications specified in the act of 1839. But the provision in the act of 1839, with reference to the effect of his invention, having been patented in a foreign country more than six months prior to his application, evidently refers to the fact of its having been patented by him, the applicant for the American patent.

In the interlocutory decree made on the motion for a preliminary injunction, and in what has hereinbefore been stated upon the subject of *infringement, reference* has been had solely to the infringement of the third and fourth claims of the reissued patent. The question of *infringement* of the eighth claim remains to be considered.

The eighth claim is for—

"8. The combination of the sliding bar, or its equivalent, and the rods acting together, substantially as described, whereby the leese is preserved after it is formed, and the heddles are drawn away from the locality where they are formed on the stationary slats, and the movement of the sliding bar, or its equivalent, and the band attached thereto, to which heddles are tied in the process of formation."

Winsor's rights under this claim also are to be considered in the light of the fact that, prior to the date of his invention, there had never been a machine constructed in which was organized any apparatus for making the difficult side of a weaver's harness, combined with a sliding bar, or its equivalent, for drawing away the heddles, nor had there, prior to the invention of Winsor, been any machine having any combination of the sliding bar, or any equivalents of any such rods as are described in the Winsor patent, for receiving and preserving the leese of the heddles. The evidence in the record proves that *the Winsor* invention antedates any devices which are relied upon as anticipating this portion of the Winsor invention.

In the Ellis and Sladdin machine we find the same sliding bar for removing the heddles from the locality where they are formed, combined with automatic arrangements for making the heddles. We find, also, slats securing and preserving the leese supported by one end only, as in the Winsor machine, so as to afford the facility of securing the twine at one of their sides or the other by passing them by the end, and by receiving them as they are formed upon the free end, in combination, as in the Winsor machine, with the screws and yoke for moving the heddles along. The Ellis and Sladdin devices appear to be equivalent devices acting in the same combinations to accomplish the same result of preserving the leese after it is formed; and although they, by assisting to form the leese, do more than similar devices do in the Winsor patent, that does not relieve them from liability to the charge of infringement.

The defendants must, therefore, be held to have infringed the third, fourth, and eighth claims of the reissued patent.

Decree for injunction and account as prayed for in the bill.

[*Chauncey Smith, Benjamin F. Thurston,* and *William W. Swan,* for complainant.
Benjamin F. Butler and *A. K. P. Joy,* for defendant.]

NEW BOOKS AND PUBLICATIONS.

THE ELEMENTS OF PHYSICAL GEOGRAPHY, for the Use of Schools, Academies, and Colleges. By Edwin J. Houston, A.M., Professor of Physical Geography and Natural Philosophy in the Central High School of Philadelphia. Price $1.75. Philadelphia, Pa.: Eldredge and Brother, 17 North Seventh street.

This is one of the best school books that we have lately received. It is full of information, which has been thoroughly condensed without losing any of its clearness of explanation; and it is written in a style to interest the young reader, and to induce him to give proper attention to every branch of the subject. The maps and other illustrations are excellent, and the book is evidently the work of a writer who knows how to teach.

THE ECONOMY OF WORKSHOP MANIPULATION, a Logical Method of Learning Constructive Mechanics. Arranged with Questions for the Use of Apprentice Engineers and Students. By J. Richards, Author of a "Treatise on Woodworking Machines," etc. New York city: E. & F. N. Spon, 446 Broome street

Mr. Richards' works on the economy of the mechanical arts are well known, and his new book will enhance *his reputation* as a fluent and pleasing writer. His views are always sound and enlightened, and his precepts deserve to be learnt by heart by every young mechanic. The chapter on mechanical drawing in the book now before us is an excellent piece of instruction.

THE POLYTECHNIC REVIEW, Devoted to Science as Applied to the Useful Arts. Published Monthly. Subscription $3 a year, payable in advance. Philadelphia, Pa.: Drs. Wahl & Grimshaw, 119 South Fourth street.

This publication is intended to occupy some portion of the extensive field in which we are diligently laboring, and to present to its readers, monthly, all the current information on the many subjects included under the generic name of Science. Its first number has a creditable appearance.

PAPERS RELATING TO THE FOREIGN RELATIONS OF THE UNITED STATES, transmitted to Congress with the Annual Message of the President, December 6, 1875. In Two Volumes.

NOTES ON THE YUCCA BORER. By Charles V. Riley, Ph.D. St. Louis, Mo.: R. P. Studley Company, 221 North Main street.

SCRIBNER'S MONTHLY for March offers its usual attractive table of contents. The number opens with an excellent description of the new buildings of Trinity College, Hartford, Conn., with illustrations. The architecture of these proposed edifices is altogether different from that of any other college buildings in the country, and will attract considerable popular interest. The kindergarten system of instructing very young children is clearly expounded by Dr. Eggleston. Mr. Dorsey Gardner writes upon the struggles and successes of Wilson, the celebrated ornithologist. The editor has some thoughtful essays on "Public Halls" and "Common Schools." Mr. P. T. Quinn contributes some timely directions about laying out small places and suggestions relating to rural topics, and there is a goodly variety of entertaining serial and short stories. Subscription price $4 a year. Scribner & Co., publishers, 743 Broadway, New York.

ST. NICHOLAS for March is, as usual, preternaturally good. If the editress would occasionally introduce something poor within its covers, we should be half inclined to welcome it as a pleasing variety, just as a discord in music often adds to the beauty of the surrounding harmony. Mr. Whittier sends a new and beautiful poem, Mrs. Oliphant the beginning of a series of interesting papers on Windsor Castle, Mr. Charles Dudley Warner and Mr. Bayard Taylor contribute interesting sketches of foreign countries, Miss Alcott continues her pleasant talks; in fact, we cannot pretend to tell half the good things with which the youngsters are provided. The illustrations are as charming in subject and variety as they are artistic, and that is saying a great deal. Subscription price $3 a year. Scribner & Co., publishers, 743 Broadway, New York.

The ATLANTIC MONTHLY for March begins with Mr. T. B. Aldrich's new poem "the Legend of Ara Coeli;" Mr. John Fiske concludes his papers on the "Unseen World," imparting results of modern scientific religious thought; Mr. Charles Francis Adams publishes the first chapter of his excellent essay on the "State and the Railroads," one of the most valuable and thoughtful contributions to the literature of the railway that we have ever read. The beauty of inflation and the advantages of a paper currency Mr. Henry Carey Baird attempts to show in an article, none the less well written and interesting, even if its writer, in the opinion of most people, is on the wrong side of the present important financial controversy. Mrs. Fanny Kemble continues her pleasant "Gossip," Mr. E. W. Jones tells us some new facts about the Welsh in America; and besides a variety of short poems by Dr. Holmes and other well known writers, the editor contributes his usual careful and critical reviews of current literature. Hurd & Houghton, publishers, New York and Boston. $4 per year.

THE ALDINE.—The Aldine Company, 18 and 20 Vesey street, New York, have issued, of this year's numbers, Parts 1, 2, 3, and 4. The engravings, letterpress, and paper are all of the highest standard of art work. Published fortnightly at 50 cents a number, and sold only to subscribers. The publishers announced it as their intention to make it the leading art journal of America. They are fulfilling their promise.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From January 7 to February 3, 1876, inclusive.

BOAT DETACHER.—R. F. Hyde, Springfield, Mass.
BOILER, ETC.—B. T. Babbitt, New York city.
CAR AXLE.—T. S. E. Dixon, Chicago, Ill.
CASTING COPPER, ETC.—J. Turner, Bridgewater, Mass.
CONCRETE BLOCK PRESS.—T. Cook, Sing Sing, N. Y.
COP TUBE.—G. H. Simmons, Bennington, Vt., *et al.*
COP TUBE.—J. Essex, North Bennington, Vt.
CUTTING OIL CAKE.—A. B. Lawther (of Chicago, Ill.), Liverpool, Eng.
ELECTRIC REGULATOR.—J. Sangster *et al.*, Buffalo, N. Y.
EXTINGUISHING FIRES.—J. L. Hastings *et al.*, Pittsburgh, Pa.
FLANGING MACHINE.—R. C. Nugent, Dayton, Ohio. Two patents.
FRICTION CLUTCH.—W. F. Holske *et al.*, New York city.
FURNACE.—E. Savage, West Meriden, Conn.
GLOVE FASTENING.—F. G. Farnham, Hawley, Pa.
HARVESTER SHOE.—Johnston Harvester Co., Brockport, N. Y.
HORSESHOE.—E. L. Tevis, Philadelphia, Pa.
HOT WATER SUPPLY.—J. Archer, Denver, Col.
LAMP.—A. Burbank, Rochester, N. Y.
LIQUID METER.—D. W. Huntington *et al.*, South Coventry Conn.
LOCK WASHER.—S. E. Gee, New York city.
LUBRICANT.—H. V. P. Draper *et al.*, Hannibal, Mo.
MAKING CIGARS, ETC.—J. T. Hannaman *et al.*, Baltimore, Md.
MAKING CONCRETE BLOCKS.—T. Cook, Sing Sing, N. Y.
MAKING GAS, ETC.—J. P. Gill, Newark, N. J.
MAKING SACKS.—H. P. Garland (of San Francisco, Cal.), Dundee, Scotland.
MAKING STEEL.—J. Baur (of Brooklyn, N.Y.), London, Eng. Two patents.
MAKING STEEL RODS, ETC.—C. P. Haughian, Brooklyn, N. Y.
METAL-TURNING LATHE.—H. M. Quackenbush, Herkimer, N. Y.
PRINTING AND CUTTING MACHINE.—R. M. Hoe *et al.*, New York city.
PROPELLER.—J. Ellis, Freeport, N. Y.
RAILWAY GATE, ETC.—S. A. Jenks, Lincoln, R. I.
RAILWAY WHEELS, ETC.—J. Bowron, Senr., Philadelphia, Pa., *et al.*
REEFING SAILS.—P. C. Marsh, Northampton, Mass.
REFRIGERATOR.—J. J. Bate, Brooklyn, N. Y.
REVOLVING PISTOL.—E. P. Boardman, Lawrence, Mass.
ROCK DRILL.—M. D. Converse, New York city.
ROLLER SKATE.—S. O. Brown (of San Francisco, Cal.), London, England.
ROWLOCK.—F. A. Gower, Providence, R. I.
SCREWING MACHINE.—F. P. Sheldon, Providence, R. I.
SEWING MACHINE, ETC.—R. H. St. John, Springfield, Ohio.
SEWING MACHINE.—Howe Machine Company, Bridgeport, Conn.
SEWING MACHINE.—J. E. A. Gibbs, Steele's Tavern, Va.
SEWING NEEDLE.—H. M. Jenkins, New York city.
SHARPENING SAWS.—W. L. Covel, Providence, R. I.
STEAM ENGINE.—W. C. Wilcox *et al.*, San Francisco, Cal.
TREATING OIL SEEDS.—A. B. Lawther (of Chicago, Ill.), Liverpool, Eng.
TYPE WRITER, ETC.—G. H. Morgan, Alexandria, Va.
WOOD SCREWS, ETC.—T. J. Sloan, New York city.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BUTTER PACKAGE.

Andrew Jackson Dibble, Franklin, N. Y.—This is a new package containing butter, so constructed that the cover may be readily attached and detached, and when attached will be held securely and airtight in place, and will prevent the tub from spreading. It combines a novel arrangement of grooved catch blocks on the side and cover of a tub, together with a locking latch.

IMPROVED MILK PAN COVER.

Alfred F. Morgan, Mason City, Iowa.—This is a cover for milk pans, made of wire gauze for the top, tin or other sheet metal for the rim and for the flange which shuts down the sides of the pan.

IMPROVED HARVESTER RAKE.

Samuel M. Morrison, Fairfield, Iowa.—This is an improved attachment to harvesters that raise the cut grain to the binders' table by the action of vibrating rakes, so as to cause the grain to be delivered to the binders straight and even, without regard to its condition. The invention consists in the combination of the upper rakes and their crank shafts with the lower angular rakes and their crank shafts. There is a slight variation of speed of the rakes during a portion of their revolution, and the consequent jostling of the grain has a tendency to cause tangled grain to become parallel with the teeth, which are set in horizontal lines. The upper rakes are so set that their teeth may slightly overlap the teeth of the lower rakes, while leaving sufficient space between the rake bars, so that light and heavy grain will be carried up with the same facility.

IMPROVED COTTON PLANTER.

Leonidas M. Rhodes, Warrenton, Ga.—This is an improvement upon a machine hitherto patented to same inventor, in which the seed is discharged through a slot in the bottom of the hopper. It is now found that a better result may be attained by constructing the hopper without a slot, and providing the traveling wheel with pins or fingers inclined rearward, so as to draw the seed toward the side of the wheel and deliver it through the space between the hopper and wheel.

IMPROVED STUMP EXTRACTOR.

John Platten, Fort Howard, Wis.—This is a vertical windlass operated by a horizontal sweep, to which the power is applied. The windlass winds the fall of a single purchase, from the moving block of which connection is made to the stump by a series of bars secured together. The lower end of the windlass cylinder revolves in a ring formed in the center of a lower bar, and rests and revolves in a cup-shaped plate connected with and supported from the bar, a space being left between the edge of the cup and the ring of the bar, to enable any sand or dirt that may get into the said cup to be conveniently removed.

IMPROVED GRIT SEPARATOR.

Walter M. Jackson, Augusta, Ga.—This consists of a pair of riddles, which detain and transversely shake the grain until the latter passes through their perforations, while the lighter impurities are eliminated in front of the winnower by a blast from the fan, coming lengthwise. Beneath the lower riddle is placed a pair of conveyers, converging toward each other in a downward direction, and toward the middle of a subjacent grading sieve.

IMPROVED CHURN.

David L. Epperson, Mill Shoals, Ill.—The novel feature here is a dasher geared with a crank shaft, so as to be rapidly revolved, and thus cause the cream to flow continuously into the wheel at the top, through and out of it at the periphery, and back to the top, by which it churns the cream into butter in a short time.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SHIRT.

Geo. D. Eighmie, Poughkeepsie, N. Y.—This invention relates to certain improvements in shirts, designed to obviate the breaking and rumpling of the bosom produced by the bending of the body and the girding of the suspenders. It consists in a bosom or front attached to the shirt about an inch from the edge, so as to leave a loose edge all round, beneath which the suspenders pass when bending forward. The upper part of the bosom is attached to the neck band below the yoke band, so that the pressure of the suspenders on the shoulders does not cause the top of the bosom to bend or rumple.

IMPROVED HARNESS.

Benjamin H. Cross, Byron, Ga.—In order to connect the trace chain and back strap, this inventor suggests a couple of rings and a buckle tongue suspended from a bar fastened in a loop attached to the back strap, so that the trace chain passes through the rings and is fastened by the tongue.

IMPROVED CARTRIDGE.

Louis T. De Froideville, Paris, France.—This inventor interposes between the powder and the bullet a layer of grease to keep out dampness, to operate as a gas check, and lubricate the gun; and then, to prevent the grease from permeating the powder grains, he places between the grease and the powder two wads, with a metallic plate placed between them to prevent the absorption and penetration of the grease through the wads.

IMPROVED HARNESS SADDLE.

Robert Spencer, Brooklyn, N. Y.—The object of this invention is to increase the flexibility of a harness saddle, so as to cause the same to automatically adjust itself to the horse's back. It consists in the combination, with the bearings and trimmings of a harness saddle, of a thin main plate of elastic steel, securely attached to, and worked up with, the other parts of the saddle. The crupper loop also, being held in place by the crupper, and the water hook, being held in place by its rein, cannot turn.

IMPROVED LOCK FOR TRUNKS, ETC.

Christian H. Stall, Red Falls, N. Y.—This consists of a system of checks to obstruct the turning of the key and prevent the unlocking of the lock, except by one acquainted with the order of operation by which the checks may be displaced or avoided.

NEW HOUSEHOLD ARTICLES.

IMPROVED COMBINED SKIMMER AND FORK.

Emerson E. Flagg, Brattleborough, Vt.—A skimmer and a fork are here connected with each other in such a manner that they may be slid back and forth upon each other, to adapt the instrument to be used as a skimmer or as a fork.

IMPROVED CUPBOARD.

Lewis Spangler, Auburn, Ind.—This is a cupboard constructed to extend through two stories, connecting the kitchen and dining room floor with the cellar floor below. It is set into the dividing wall of the kitchen and dining room, and arranged with doors at both sides to give access from either side. The cupboard is arranged with sinks, hinged tables at both sides, and an elevator that is raised and lowered by hoisting mechanism, to connect with the cellar. A refrigerating and other shelves serve to preserve articles that have to be kept in a cool state.

IMPROVED FLOUR SIEVE.

Ferdinand Blair, Pleasanton, Kas.—This invention relates to supporting the rotating crank shaft of the sifter upon arms which are bent upward at the middle: the object being to provide a space at the center of the concave wire bottom of the sifter for reception of hard particles in the flour, or worms, insects, or other foreign bodies.

IMPROVED LAMP.

George Sherwin and Edmond Hoople, New York city.—In this device the chimney is fitted on guides, with or without friction rollers, to enable it to be raised up and let down for lighting, trimming, filling, etc. The guides control and keep the chimney in place, so that it will not fall when raised up, and will drop into its place with certainty when down.

IMPROVED WEATHER STRIP.

Thomas Walker and Washington A. McCrery, Pleasantville, Md.—The object of this invention is to provide a weather strip for closing the crack between the door sill and the bottom of the door. It consists in the particular construction of a strip of molding having an extensible slide held to the molding by a spring, with a strip of rubber upon its bottom, and the whole so arranged that, when the door is open, the spring holds the slide up and away from the carpet, and out of sight, and when the door is closed the said slide is extended downward, so as to entirely close the crack.

IMPROVED MOTH-PROOF COMPOSITION.

Wm. H. Hall, Jersey City, N. J., and John Kennell, Passaic, N. J.—The invention relates to that class of preventives which have been long employed to deter moths from attacking woolen goods, furs, and pictures, and consists in dissolving purified tar and mixing it with camphor, merbane, citronella, bitter almonds, and extract of cedar. The solution may then be sprinkled on the wrapper or envelope in which the article is to be enclosed.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED TIRE UPSETTER.

Charles H. Reynolds, Brooklyn, N. Y., assignor to himself and William Freudel, same place.—This invention consists of gripper jaws fixed on pivots so as to adjust automatically to tires of any radius; and it also consists of a novel contrivance of the pivots for both the stationary and movable jaws, arranged so that the resistance is taken directly by the supporting blocks instead of being expended on pivot bolts.

IMPROVED THILL COUPLING.

William O. Hanby, Osceola, O.—In this thill coupling, the inventor employs a clip having a perforated block, through which passes the pintle, to which the thill iron is hinged. The invention is a non-rattler, the work and wear being brought upon the coupling bolt, while the knuckle at that point is subject to the pressure of rubber.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMBINED BARREL HOOP MACHINE AND COILER.

George C. Skidmore, Grand Rapids, Mich.—This invention relates to a novel construction of a machine for making barrel hoops. It consists in the arrangement of devices for feeding the boards to a reciprocating shuttle, carrying a knife which at each stroke cuts off a hoop slip. It also consists in the means for automatically reversing the motion of the reciprocating shuttle, and in the means for trimming the ends of the hoop slip, crimping it into the circular form, and coiling them into bundles for the market.

IMPROVED BELT COUPLING.

James K. P. Shelton, Gaston, Ala.—A series of square holes is made in each end of the belt. On the under side of the latter are placed transverse wires. The lacing is first secured to one end of the belt, passed through the first hole around the wire, then led to the other end of the belt, carried through the opposite hole and around the wire, and so on until all the holes are laced. Notched strips of belting are inserted between the wires and the belt to prevent wear.

IMPROVED CAR COUPLING.

Horace Resley, Cumberland, Md.—This invention relates to certain improvements in that class of automatic car couplings in which a gravity catch is pivoted in the draw bar so as to rise above the entering link and fall through the same to effect the coupling It consists in the particular construction and arrangement of the said gravity catch, provided with a hole which receives a coupling pin of the ordinary construction, to secure the short links of cars unprovided with the gravity catch, whereby the devices are equally as well adapted to be coupled with the draw bars of the ordinary form.

IMPROVED TREADLE.

Henry Reese, Baltimore, Md.—The object of this invention is to lessen the fatigue of operating sewing machines and other devices run by treadle power by means of a peculiar construction of treadle which permits the movement of the latter to be made without bending the ankles, and enables the operator to run the machine with a very light expenditure of muscular power. This result is accomplished by a peculiar construction of two independent treadles hinged or pivoted upon opposite sides of the fulcrum of the main treadle, held in proper horizontal position by means of springs, and arranged adjustably for either foot foremost.

IMPROVED SCREW-CUTTING DIES.

Shadrach N. Cudworth and George R. Stetson, New Bedford, Mass., assignors to the Morse Twist Drill and Machine Company, same place.—The die consists of two parts, held together by means of a guide, which has holes for screws formed in it, which are elongated to admit of adjustment of the dies to which the guide is connected. The invention also consists of two adjusting screws fitted in the body of one part of the die to secure the die positively after being adjusted, and an improved adjusting die and guide connected with a screw plate.

IMPROVED BELT STRETCHER.

Frederick L Spiess and William Spiess, New York city.—Bars are clamped on the meeting ends of the belt. On the ends of said bars are journaled two or more loose pulleys; also hooks are fastened on two or four of the extremities. To the hooks are attached the standing parts of cords which, passing over the pulleys of the bars, form tackles whereby the ends of the belt may be drawn together.

IMPROVED PUMP PISTON.

Lorenzo D. Hovey, Clinton, Ill.—This piston has tapering base rings, between which an elastic packing ring is secured. The rings are perforated to allow the entrance of guide rods, which are of such a hight that a heavy cylindrical valve may slide vertically within them. Their upper ends are attached to the connecting socket of the pump rod. On ascent of the plunger, the valve's leather-lined packed bottom bears on the interior wedge ring, so as to close the opening through it watertight. The descent of the piston lifts the valve and allows the passage of the water through the base rings.

IMPROVED GIGGING MACHINE.

Carl Gerber, Sr., and Christian Woelfel, Webster, Mass.—This invention consists in combining, with the stretching and guiding rolls of a napping machine, sliding napping cards, arranged between each pair of guide rolls, and adapted to reciprocate in planes at right angles thereto. The quick withdrawal of the cards from the cloth gives them, it is claimed, no chance to stick, and overcomes thereby the objectionable rigidity of the rotating wire cards, while doing the dressing in a more perfect and rapid manner than the teasels, but without the expensive and troublesome features of the same.

IMPROVED NAIL MACHINE.

Stephen Butterfield, Boston, Mass.—This invention consists of two sets of dies, arranged like comb teeth and fixed on slides. The latter are caused to move the teeth of one set into the spaces of the other set, in which condition they form dies, which shape rods hanging down from a feeder, so that they are caught between the fingers and shaped into nails by them. Below these fingers the projecting ends of the rods are upset, to form heads, by a header forced up nearly against the dies by the slide which works the dies. The points are formed by the upper margins of the dies, and by cutters immediately above the dies the points of the nails are separated from the rods. The header then moves laterally a little, and opens passages for the escape of the nails when freed by the opening of the dies.

IMPROVED ROTARY ENGINE AND WATER WHEEL.

John Lucas, Hastings, Minn.—This invention consists in the construction of a revolving piston wheel, which is formed of two parts, in diametrical registering slots, in which is arranged a piston plate, the journals of which are seated in recesses made in the parts of the piston wheel. The pivoted piston is arranged to oscillate in a line at right angles to the rotation of the piston wheel, by the action of the water or steam admitted into the engine casing. Said casing is provided with an oblique opening for the passage of the piston-wheel shaft, so as to cause the beveled sides of the piston wheel to bear against the inner sides of the casing. The pivoted piston plate is made in two or more parts, to adapt it to receive and hold packing between said parts.

IMPROVED POST DRIVER.

Isaiah W. Norton, Memphis, Mo.—This is an improved portable post driver, that may be used on sloping ground for the purpose of driving in the posts in perpendicular position with great rapidity. The hammer is raised by bringing one of the cams on the end of a lever, and the post is then placed into position in the guides The hammer is then adjusted to the hight of the same by raising or lowering its pivoted supporting frame. When the hammer is in the required position, the drum is operated and the cams of the actuating wheel will engage the hammer lever, producing powerful strokes of the hammer in rapid succession, until the post is driven into a level with the hight of the bed frame.

IMPROVED WATER ELEVATOR.

Andrew B. Flowers, Thibodeaux, La.—This consists mainly of an endless bucket chain. The buckets are provided with suitable guards to prevent the escape of water. There are devices for changing the tension of the chain, and also an adjustable spout. The apparatus is suitable for draining marshes, irrigating land, and the like.

IMPROVED CHEESE CUTTER.

Bowne G. Yates, Madelia, Minn.—A hinged section is opened for the purpose of cutting off a portion of the cheese; the knife is then raised and the platform turned till a piece of required size is below the knife, which is then carried down, cutting the pieces in radial direction from the cheese. After the piece is taken out the front section is brought back on the base part, so as to inclose thereby the cheese completely, and keep off flies, etc.

IMPROVED SPRING POWER.

Charles M. Frahm and William Scharnweber, Chicago, Ill.—This is a new arrangement of a series of coiled springs and gears, whereby a large number can be arranged in a small space, and each spring can be wound up independently of the others, and while the machine is running. There is an ingenious regulating apparatus and stop mechanism, the whole forming a machine designed for wherever light power is required.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The "Catechism of the Locomotive," 625 pages, 250 engravings. The theory, construction, and management of American Locomotives. Sent post paid, on receipt of $3. H. P. Stein, RR. Gazette, 73 Broadway, N.Y.

"Wrinkles and Recipes" is the best practical Handbook for Mechanics and Engineers. Hundreds of valuable trade suggestions, prepared expressly by celebrated experts and by correspondents of the "Scientific American." 260 pages. Elegantly bound and illustrated. A splendid Christmas gift for workmen and apprentices. Mailed, post paid, for $1.50. Address H. N. Munn, Publisher, P. O. Box 773, New York city.

Wanted—Machines for Knitting Fancy Worsted Webs suitable for borders. H. E. Dillingham, 39 and 41 West Broadway, New York.

For the manufacture of experimental machinery, correspond with the Allen Fire Supply Co., Prov., R.I.

$1,000 for any Churn ahead of "The Prize." A. B. Cohn, 197 Water Street, New York.

Parties familiar with the Sewing Machine Business may hear of good business, by applying, by letter or in person, to the Pennsylvania Tack Works, Norristown, Pa.

Wanted—A large size second hand Vacuum Pan, also large size Hydraulic Press. Address A. G. Pinkerton, 103 South Street, Baltimore, Md.

Sash and Door Factory, Planing Mill, &c., for Sale. See advertisement on page 172.

For Sale—Wood Working Mill, 2 Story, 35x60, and Machinery complete, near N.Y.C.R.R. Depot, S. North, Syracuse, N. Y.

Painters & Grainers—Send for descriptive Catalogue, & Sample of first class & quick Graining. Executed with my new perforated Metallic Graining Tools. 40,000 in daily use. J. J. Callow, Cleveland, Ohio.

Wanted—Every Machine Shop to send for one of Gardiner's pat. centering and squaring attachments for Lathes. On five days' trial, to be returned at our expense if not satisfactory. 700 one inch shafts centered and squared up per day. Price $35. R. E. State & Co., Springfield, Ohio.

Wanted—A good Second-hand Pulley Lathe, about 48 inch swing. Address Bentel, Margedant & Co., Hamilton, Ohio.

Family Dish Drainer—Shop right deed and patterns, one year or more, $10 per year. J. R. Abbe, Lawrence, Mass.

Locomotive—A No. 1, 10 ton, Narrow Gauge, for Sale, very cheap. C. M. Hart, Clarksburg, West Va.

For Sale—6 good Millers, $175 each; No. 1 Brown & Sharpe Screw Machine, $400; 1¼ in. Bolt Cutter, $175; 66 in. Gear Cutter, $375; 36 in. x 16½ ft. Lathe, $400; 15 in. x 8 ft. Lathe, $175; 6 ft. Planer, $350. Shearman, 45 Cortlandt.

3 Water Powers for Sale—15, 30 & 50 H.P. (concentrated would average over 90 H.P.), on the "Bushkill," at Easton, Pa., and 25 a. Land, 5 Dwellings, 3 Mill Sites, with 2 good Dams. Sale March 7, 1876, on the premises, at 2 P.M., by Daniel Wagener's Trustees.

For 6 1st class Shapers and other tools, new and 2nd hand, address E. P. Bullard, 43 Beekman St., N. Y.

Makers of Metal Button Machinery, address Smith & Wicks, Baltimore, Md.

Seeds and Implements—200 illustrations just out. Enclose 5 cent stamp. A. B. Cohn, 197 Water St., N. Y.

For Sale—125 Horse Power Beam Engine, with parallel motion, suitable for a steamboat. P. O. Box 1208, New Haven, Conn.

Yocom's Split-Collars and Split-Pulleys are same appearance, strength, and price, as Whole-Collars, and Whole-Pulleys. Shafting Works, Drinker St., below 147 North Second Street, Philadelphia, Pa.

Piles—A sure cure. Sample free, post paid. A trial is its best advertisement. Wonder Worker Medicine Company, Salem, N. J.

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings, from one lb. to five thousand lbs. Invaluable where great strength and durability are required. Send for Circular. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

Boult's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

For best and cheapest Surface Planers and Universal Wood Workers, address Bentel, Margedant & Co., Hamilton, Ohio.

Mach'y Depots, Mech. Eng'rs, Millwrights, New Manuf'g Enterprises—Send for Catalogue of best line Shaft outfit in the country. A. B. Cook & Co., Erie, Pa.

Our new catalogue of drawing materials will be sent on receipt of 10c. Add. Keuffel & Esser, New York.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Water, Gas and Steam Goods—Send eight stamps for Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co. Pittsburgh, Pa.

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

American Metaline Co., 61 Warren St., N.Y. City.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

G. C. will find a recipe for liquid glue on p. 9c, vol. 32.—F. G. S. will find a description of the ventilation of the Paris opera house on p. 134, vol. 33.—J. O. M. will find a description of artificial ivory on p. 234, vol. 30. See above for liquid glue.—R. W. E. will find directions for making an æolian harp on p. 315, vol. 33.—J. H. P. will find a recipe for a light metal on p. 347, vol. 32.—N. M. E. will find directions for cleansing water pipes on p. 49, vol. 34.—F. L. J. will find full directions for making paper boats on p. 163, vol. 27. This also answers F. T. H.—E. S. S. will find full directions for constructing a windmill on p. 241, vol. 32. This also answers B. W. S.—N. will find directions for filling black walnut on p. 315, vol. 30.—F. B. M. will find the information he wants, as to condensation on a cold vessel, on p. 43, vol. 31.—A. J. should address the School of Mines, Columbia College, New York city.—J. H. K.'s query as to color of gold, etc., is answered on p. 363, vol. 53.—N. E. F. will find a description of toughened glass on p. 20, vol. 33.—J. W. B. will find a description of a brown stain for wood on this or the next page.—S. B. will find a description of a battery suited for plating on p. 26, vol. 32.—G. H. W. should read Chevreul's book on color, to be obtained through any good bookseller.—A. N. will find directions for gilding on stone or marble on p. 59, vol. 30.—J. B. will find full directions for bending gas pipes on p. 150, vol. 33.

(1) P. C. says: Please state the number of shots that can be fired from the best kind of mitrailleuse. A. About 400 rounds a minute, we believe.

(2) J. M. R. asks: 1. How much steam will pass through a 2½ inch pipe in 1 minute at a pressure of 60 lbs. to the square inch? A. The question cannot be answered generally, as it depends on the length and arrangement of the pipe, the quality of the steam, etc. As a rough approximation, the amount may be taken as between 1,600 and 1,700 cubic feet a minute. 2. How many cubic feet of steam will 1 cubic foot of water make? A. It will depend upon the pressure of the steam. You will find tables in any good modern treatise on the steam engine. 3. How many cubic feet of water will a boiler (diameter 62 inches, 15 feet long, with 40 three inch tubes) evaporate in one hour, fired externally, to maintain a pressure of 60 lbs. to the square inch? A. Between such boilers in practice, about the following range of results is obtained: Coal burned per square foot of grate per hour, 5 to 15 lbs., water evaporated per lb. of coal, 6 to 10 lbs. Hence you see that it would be tolerably difficult to answer so general a question as you have proposed, in a definite manner. 4. How many cubic feet of steam will pass through an 12 x 14 engine in one hour, running at a speed of 150 revolutions per minute, at 50 lbs. pressure per square inch? A. There is about the same range in engines of this size as there is in the boilers, the amount of water used per horse power per hour varying from 30 to 100 lbs.

(3) W. M. asks: What is the name and what is the mode of drawing the proper curve upon which to turn the points of piles in order to have them sink the deepest with a given blow? A. We imagine that you refer to the so-called antifriction curve, or tractrix. Its equation, referred to rectangular axes, is as follows: $x = h \times \log. \left(\frac{h + \sqrt{h^2 - y^2}}{y}\right) - \sqrt{h^2 - y^2}$

(4) F. T. T. asks: Can you point to a series of experiments upon the resistances to transverse stress on very short bars, the lengths of which are, as a maximum, but little greater than the lines that are the measures of their cross sections? A. If, as we understand you, you refer to a load uniformly distributed over a very short beam, fixed or supported at the ends, we imagine that you might safely proportion the part by a consideration of the shearing resistance. We shall be very glad, however, to receive and publish any experimental data that our readers may have.

(5) A. J. asks: 1. In driving a sawmill, is it practicable to transmit power by a cog wheel on the engine shaft geared to one on the saw mandrel? A. No. 2. How would this compare for safety with the usual method of using a long belt? A. Not well. 3. How many feet of soft timber per hour, with suitable feed, can be sawn with a 52 inch saw driven by a 15 horse power engine? A. This depends on a variety of conditions. 4. Is it true that the bore of a new engine cylinder is always an even number of inches? A. No.

(6) J. W. P. says: I am about making an engine to drive an ordinary skiff. I think that two oscillating cylinders, each about 1½ inches bore by 3 inches stroke, will be about as good a form as any: but I do not know how to build the boiler. I wish you would be so good as to tell me the proper size and form of boiler, also the best kind of fuel to burn, and what degree of power it would be likely to develope. A. Make a boiler from 18 to 20 inches in diameter, and 3½ feet high, with two inch tubes. Use anthracite coal, nut size, for fuel. In regard to the horse power of this or any other boiler, we can give you no information.

(7) B. L. asks: What is meant by sulphuric acid at 50° B.? A. 50° of Beaumé's hydrometer.

What shape of tool is most suitable for turning felt wheels, such as are used for polishing with crocus, etc.? A. A carpenter's chisel.

(8) W. T. says: I am about to put an engine of 1½ horse power, making usually 300 revolutions per minute, into a boat 18 feet long, 5 feet wide, drawing 8 inches forward and the diameter of the propeller aft. What should be the size and pitch of the propeller? A. If you use one propeller, it should have a diameter of at least 18 inches, and about 2½ feet pitch. 2. Should the shaft be placed parallel to the surface of the water or parallel to the keel? A. Make the shaft approximately parallel to the keel. It is difficult to give a general estimate of the slip of small propellers, but for a small boat like yours you will do very well if the slip does not exceed 25 or 30 per cent.

(9) J. E. R. says: Will you please inform me how I can restore edge tools, such as plane bits, chisels, etc., to their original temper, after they have gone through a fire? A. Heat them to a cherry red, and quench them endwise in lukewarm clean water. Then brighten the surface with emery and reheat them slowly over a piece of heated iron until a brown color appears, then quench them in water.

(10) J. B. J. says: I wish to roll sheet brass and crimp the same while hot. The heat softens the metal and takes all of the stiffness out of it. By what process can it again be hardened? A. By rolling it cold.

(11) C. B. asks: 1. Is there any way of making wiped joints on water pipes other than freezing the pipes, in case the water could not be turned off? A. We know of none. 2. What is the use of an air chamber in a force pump? A. To make the supply and delivery of water even. 3. Why does a water pipe burst when frozen? A. Because the water expands in freezing.

(12) D. H. asks: Does the pressure on the valve of a common slide valve engine depend on the area of the valve or the area of port? A. On the area of the valve.

(13) J. S. asks: 1. What temper is required for a butcher's steel? A. The steel may be hardened as hard as fire and water will make it, or tempered to a brown color. 2. Is there a certain quality of steel for sharpening steel? A. Use cast steel.

(14) J. H. says: It is proposed to change the course of a slow, circuitous, and now unhealthy stream. It has a fall of 1 in 700 feet. The bridges are 50 feet wide, and are ample to resist spring freshets. It is proposed to cut through a bank of clay above the town: this cut would be 1,000 feet in length by 22 feet deep, and in it a fall of 10 feet would be obtained, and the water would go clear by the town. With this additional fall, what width would we require to cut to carry off the amount of water mentioned? A. The proposed fall of 10 feet in 1,000 would create a velocity too great for the permanent stability of the bottom and sides of the cut, on account of the scouring effect it would have upon them. This would, therefore, involve the necessity of paving the bottom and sides, to prevent the gradual abrasion of their surfaces and the ultimate caving in and destruction of the cut itself. Considering this necessity and the depth of the excavation required, you will find it more economical to construct a light, brick, cylindrical aqueduct, and to effect your excavation by tunneling, through the 1,000 feet, the neat size of the aqueduct, without disturbing the surface of the ground. The size of the excavation should be 6 feet 8 inches in diameter, cut true to a mold or pattern, and then lined with a brick arch 4 inches thick, carefully laid in cement: this would give a clear section of 10 feet, and would discharge all the water of the stream, even in the season of freshets. In excavating, begin at the lower end and follow on at once with the brick arch, being careful to pack the earth well over the top of the latter, and behind the sides of it, as fast as a course may be constructed; in this way you will support the earth as you progress, and make all safe. You can secure the proper grade by means of a leveling instrument, having the bottom edge inclined at the gradient of 1 inch in 100 inches, and the top edge level; this can be applied to the bottom of the aqueduct. In removing the excavated material, let it be done upon boards laid upon the bottom to protect the brickwork. If you should strike a vein of sand, this need not prevent your proceeding, as in this case you can use the shield tunnel excavators.

(15) L. M. S. says: I have care of an engine which is 12 x 25 inches, and runs at 130 revolutions per minute. It cuts off at ¾ stroke, and has ⅛ of an inch lead (that is, the port is open ⅛ an inch when the engine is on the center). Is the lead too much? A. The $\frac{1}{16}$ inch lead will be better. You may cut off at ⅞: but if you give steam to the full length of the stroke, your engine will be less powerful for want of a free exhaust.

(16) D. P. P. asks: 1. If a water wheel is attached to a force and lift pump, could the pump throw up as much water as the wheel would require to operate it? A. No. Such a machine would be a perpetual motion, which is absurd. 2. If I fill a small strong chamber with air and compress it sufficiently to drive a small air engine, could I get power enough to operate one or more air pumps to keep up the pressure in the air chamber for any length of time? A. No. This is another version of the idea in your first query.

(17) T. D. W. says: I am about to make a foot lathe to swing 8 inches. Will you give me your opinion as to the bearings for the spindle? I want it to run as light as possible, and to turn solid and not to require setting up very often. I tried a cone on each end of spindle, but found that the spindle ran very hard. It would jamb or shake, no matter what care was used. Were the cones at a wrong angle? They were at 30° from the horizontal. A. Place two broad projecting rings on the first bearing of the lathe spindle, and your lathe will run all right.

(18) I. B. asks: 1. What is the best quantity of grate area in proportion to heating surface in a boiler? A. From 30 to 38 square feet of heating surface per square foot of grate. 2. Does this proportion vary for different kinds of fuel? A. Not essentially. 3. What is the proportion of cross section of area of tubes to grate area? A. From ⅛ to ⅙. 4. What is the proportion of area in the second row of return tubes? A. Generally somewhat smaller; for instance, if ⅛ in first row, ⅛ in second. 5. Would you consider it just as economical in fuel to get the same amount of cross section by one row of 5 inch return tubes as by two rows of 3 inch return tubes? A. Generally, there would not be any great difference.

(19) L. G. C. asks: Is there a method to find a true circle if there is not room to put the center? A. Any number of points may be found, in a similar manner to that in which they are determined for a railroad curve. Perhaps some of our readers will be sufficiently interested in the problem to try their hands at a geometrical solution.

(20) H. S. T. asks: How can I make a stain for wood to imitate mahogany? A. A simple way of effecting the object is to brush the wood with aquafortis, and dry it at the fire. This is good for veined birch and beech. The latter may also be stained by putting 2 ozs. dragon's blood into 1 quart rectified spirit; let the bottle stand in a warm place and shake it frequently; and when the gum is dissolved, the stain is fit for use.

(21) J. B. Jr. asks: How can I make lime water? A. Slake 4 ozs. lime with a little distilled water, then add distilled water to make 1 gallon. Cover the vessel and set it aside for 3 hours. Pour off the clear liquor for use.

(22) J. P. M. says: A trough is 12 inches wide, 1 inch deep, and has a fall of 3 inches. How many feet of water will run through the same per minute? A. You do not send sufficient data, as the discharge will depend upon the length of the trough, as well as the other elements. You can make the calculation, approximately, by the following formula: Velocity in feet per second = $\sqrt{\left(\frac{\text{area of way in sq. ft.}}{\text{wet perimeter in ft.}} \times 2 \times \text{fall in ft. per mile}\right)}$

(23) R. R. Z. asks: How high a column of water can air be forced through with a pressure blower? How many lbs. air pressure would it take to force air through a 2 inch pipe and up through a column of water 12 feet high, with no obstruction to the passage of the air on the top of water? A. A question of this kind could best be determined by experiment. If any of our readers have data, we would be pleased to hear from them.

(24) G. B. asks: How can I make impression paper? A. Take the very thinnest writing paper, and smear it with lampblack made into a paste with pure tallow. Let the paste remain on 12 hours, then wipe smooth with a piece of cotton waste. Any colored pigment may be used in place of lamp black, but it must be very finely pulverized.

(25) W. P. C. asks: How can I obtain iron in the form of impalpable dust? A. The iron obtained by hydrogen, commonly kept in the drug stores, answers your description; it can be prepared as follows: Take 30 troy ozs. subcarbonate of iron, and wash thoroughly with water till no traces of sulphate of soda are shown by the appropriate tests; then calcine, in a shallow vessel, till free from moisture. Spread it on a tray made by bending an oblong piece of sheet iron in form of an incomplete cylinder, and introduce into this a wrought iron reduction tube, about 4 inches in diameter. Place the reduction tube in a charcoal furnace; and by means of a self-regulating generator of hydrogen, pass through the mass a stream of that gas, previously purified by bubbling successively through a solution of sub-acetate of lead, diluted with three times its volume of water, and through milk of lime, severally contained in half gallon bottles, about one third filled. Connect, with the further extremity of the reduction tube, a lead tube bent so as to dip into water. Lute all the junctions airtight; and when enough hydrogen has passed to exclude all atmospheric air from the apparatus, light the fire, and bring that part of the reduction tube occupied by the subcarbonate to a dull red heat, which must be kept up as long as the bubbles of hydrogen contain aqueous vapor. When the reduction is complete, remove the fire, allow the whole to cool, and withdraw the product from the reduction tube.

(26) W. S. H. M., of Reading, England, asks: Has it ever been proposed to utilize water and other power, now running to waste, by storing it up for future consumption? A. Yes, very often. The compression of air in strong vessels, for conveyance to where the power is needed, is frequently suggested.

(27) L. L. H. asds: How can I prevent oil paintings from cracking? A. Cracks occur in oil paintings when the colors were ground in oil containing impurity or otherwise unfit for the purpose. Linseed oil is the best, poppy oil the next; but purity is the essential quality of all vehicles for colors.

(28) J. D. R. asks: Is there any remedy for tender fingers? I am a printer, and my fingers get sore and the skin peels off. A. Printers frequently burn paper on an iron surface, and rub the sore place with the resulting oil.

(29) G. H. C. W. asks: 1. Does multiplying the square of the diameter of a circle by 0·7854 give the area in square inches or circular inches? A. In square inches. 2. What is a circular inch? A. A figure the square of the diameter of which multiplied by 0·7854 gives 1 square inch.

(30) A. B. D. says: I am finishing wire work with paint mixed with varnish; it takes too long for it to dry hard. What will dry quickly and not break off easily? A. Boil good linseed oil with enough litharge to make a stiff paint; add 1 part by weight of pigment to every 10 parts of the litharge. Boil for 3 hours over a gentle fire.

(31) G. H. S. asks: Is there anything that will remove the smell of tobacco from old cigar boxes? A. Varnish the box on the interior with a thin covering of shellac in alcohol.

(32) Q. C. asks: 1. How many degrees or what portion of a degree is an ohm according to Oersted's law? A. That depends upon a number of conditions, and consequently varies with different instruments. You will find full information on the subject of testing rods in No. 1 of the SCIENTIFIC AMERICAN SUPPLEMENT. 2. How can I tell if a current of electricity is passing through a lightning rod? A. If occasional tests show little or no appreciable resistance, there is no occasion to trouble oneself further. As a general thing, however, it may be assumed that currents are always traversing the rod. 3. Could a pocket compass be arranged for that purpose? A. See article above referred to.

(33) J. A. asks: 1. Which is the most effective, a glass or a hard rubber plate, for an electrical machine? A. Ebonite plates are recommended as preferable to glass. 2. Is the construction of the machine the same with either plate? A. Yes. 3. Must an amalgam be used on the cushions of a hard rubber plate machine? A. Yes.

(34) E. A. F. asks: Why is it that a circular saw, after being used long enough to require two or three gummings, becomes rim bound, or, in other words, becomes expanded in the center, and the saw becomes dished? A. There exists in the minds of many persons, who are not fully acquainted with the principle upon which circular saws are made, an erroneous opinion that a saw should work the same until worn out, if it is not accidently sprung in use, or strained in gumming. So far as any damage to the saw is concerned, there is no difference between the use of a burr gummer and a file; but if proper care is not exercised in the use of the emery wheel, there is more danger from their use than with the file or the burr. After a few times gumming, the saw will be enlarged on the rim, so that the slightest warmth will cause it to buckle, and there is no remedy left but to send it to a saw maker and have it rehammered. Some, however, entertain the erroneous impression that a saw rehammered will never run as well as when new. Never was there so great an error; on the contrary, a saw rehammered will generally run better than when new, because all the elasticity (or nearly all) is worked out of the saw by using, and it generally works stiffer than when new. A saw must become red hot to change the temper. Inserted toothed saws are not as liable to become expanded on the rim as solid saws.—J. E. E., of Pa.

(35) J. M. H. says: I wish to give a nice finish to the walls of my parlor, and propose to use the recipe on p. 53, vol. 12. Would you recommend it? Is the size spoken of a paste or preparation of glue? Please give me proportions of ingredients, etc.. A. We have not tried the process referred to, and cannot vouch for it. We presume the size intended is the ordinary glue water. You would do well to try experiments with it on a piece of wall that it would not injure.

(36) S. B. Jr. asks: I. Which electro-magnet requires the least number of coils of a given sized wire, one to lift an armature weighing ½ lb. suspended $\frac{1}{16}$ of an inch from its poles, or one where the distance is $\frac{1}{32}$ of an inch and the weight 1 lb.? A. Electro-magnets, such as are used for telegraph sounders, having three or four ohms resistance, will answer for either case. 2. How many cells of Callaud battery are required to enable such an electro-magnet, through the medium of ½ mile of ordinary line wire, to lift the armature as above? A. Six or eight cells of Callaud battery will answer, provided the resistance of the circuit does not exceed 30 ohms.

(37) C. F. S. says: I want to make a magnetizing coil that will take a core ¼ inch in diameter and 6 inches long, and magnetize it to saturation. Will you please tell me what size of wire, number of layers, and battery power will serve my purpose? A. A couple of sounder coils like those to be seen in any telegraph office, with two or three cells of battery, will charge a soft iron core highly.

(38) N. Y. S. asks: Is the compound used in charging fire extinguishers a secret? A. No. Carbonates of the alkalies or alkaline earths are commonly employed for this purpose, such as carbonate or bicarbonate of soda, carbonate of lime, etc, etc. These are placed in the lower part of a suitable vessel; and immediately over it is placed a vessel containing a strong acid, such as muriatic or sulphuric, so arranged that, when the instrument is required for use, the vessel containing the acid may be inverted, thus emptying its contents upon the carbonate below. A violent action immediately ensues, and carbonic acid gas is liberated in great quantity. This gas is the fire extinguisher. Various modifications of this instrument, in the method of placing and manipulating the reagents, etc., have been invented since the value of carbonic acid gas as a fire extinguisher was first recognized; but the principle is the same in all.

(39) J. H. P. asks: How is prepared rubber made? A. We do not recognize any material by this name. Do you mean ordinary vulcanized rubber, vulcanite, or ebonite?

(40) J. H. P. says: A lady in the N. Y. *Times* says that ¼ lb. saltpeter dissolved in 1 pint alcohol is an excellent remedy for swollen joints caused by rheumatism. I attempted to dissolve some niter in alcohol of 95 per cent, and it would not dissolve. What is the matter? A. Niter is almost absolutely insoluble in strong alcohol. Dissolve the saltpeter in the smallest quantity of cold water possible, and add the alcohol in small quantities at a time, with constant stirring. The addition of too much of the alcohol will precipitate the salt.

(41) P. L. & Co. ask: How can we make sensitive cards, which, when placed upon the hand, immediately curl up with the heat? A. By passing a good quality of gelatin, previously softened by hot water, between oiled rollers set so as to propuce a film of the required thickness.

(42) H. F. B. says: In constructing a grinding mill, the grinding being done by cast iron rings, it is very desirable to have them of the hardest metal. I believe that an extremely hard metal can be obtained by mixing cast iron with spiegeleisen. Am I correct? A. Yes. According to the percentage of spiegeleisen employed, the percentage of carbon may be changed in the pig produced, with a similar change in properties.

(43) P. S. B. says: 1. I have in my possession an oriental ruby of great hardness, weighing about ½ lb. What is it worth? A. A ruby of extremely fine color, brilliancy, etc., is said to be even more highly valued than a diamond of the same weight. The exact value of your ruby could not be given without seeing it. 2. What book or books must I consult in order to obtain the most the most exhaustive knowledge of the finer metals and precious stones? A. Consult Emanuel on "Diamonds and Precious Stones," and Jones on "The Treasures of the Earth."

(44) D. L. asks: Would it be possible to restore vision in an eye of which the lens is destroyed, by putting in an artificial lens? A. Theoretically, yes; but the science of surgery has not, as yet, become sufficiently skilled to attempt such an operation on this most delicate and susceptible organ.

(45) S. R. asks: 1. Can sulphuric acid be concentrated to sufficient strength in lead kettles to treat the refractory silver ores of Colorado and Nevada? A. Concentrated sulphuric acid must be employed, and for this lead vessels are not adequate. Instead of making the ore digesters of platinum, the practice of late in Europe has been to employ digesters of cast iron, white or mottled iron being preferred. It has been found that these vessels are unacted upon by the strong acid, since the surface becomes coated with a thin layer of metallic silver. 2. In using iron pyrites and ores heavily charged with sulphur, what fuel would be the best? A. Such ores should first be calcined, either in a special furnace or in heaps in the open air; the ignition of the sulphur in the ore being effected by placing the latter upon a layer of brushwood. The roasting must not be carried too far, but sufficient sulphur must be left to produce a proper regulus. The roasted ore may then be reduced with coal, etc.

(46) S. C. P. asks: What is the origin of the symbols used in apothecaries' weight? A. These symbols are supposed to have been derived from inscriptions on the ancient monuments of Egypt. This supposition is made more probable by the recent discovery of a papyrus concealed between the bones of a mummy in a tomb of the Necropolis at Thebes. This papyrus contained a treatise on medicine, written about 1552 B. C., and is consequently more than 3400 years old. In it the volumes are indicated by special signs, and figures with dots above them represent weights. The unit of volume is thought to be the *tenat*, which is equivalent to $\frac{6}{10}$ of a liter. The sign for a half *tenat* bears a striking resemblance to our sign for a drachm.

(47) D. D. asks: Can you inform me how white wine or whisky vinegar is made? A. Obtain a large cask, and about a foot above the bottom construct a false perforated bottom. Above this fill the cask with good, well burnt charcoal in coarse lumps, over which pour first a sufficient quantity of good vinegar to thoroughly moisten it. Let the whole stand for a short time, when it will be ready for the introduction of the alcoholic liquors. This should be introduced in small quantities at a time, and the apparatus kept in a moderately cool place to prevent too energetic an action. This method will give you a pure vinegar, which will suffer considerable dilution. Use a very small quantity of annatto as coloring matter.

(48) E. G. A. says: A glass globe has two yellow spots marked on the opposite sides. The globe holds five gallons, and is placed close to the wall on a table directly between two windows. The light from the windows passes through the water in the globe and strikes the opposite side. The spots are of a soft, slimy nature, easily rubbed off. Can you tell me what they are composed of? A. The spots may consist of several substances. Send some of the material, and we will tell you what it is and the mode of formation. It is not improbable that the water held bicarbonate of iron in solution, which gradually became decomposed on standing in a warm room, and, from some peculiarity in the currents generated in the vessel, deposited hydrated sesquioxide of iron in the manner indicated.

(49) W. C. says: Please give me a recipe for dyeing veneers green. A. Put the veneers in a box or trough with clean water, and let them remain immersed for 3 or 4 days, changing the water once or twice as occasion may require. Let them dry for about 12 hours before they are put into the dye: by observing this the color will strike quicker, and be of a brighter hue. Prepare the dye as follows: To 1 gallon of strong vinegar add 1 lb. of the best verdigris finely ground, 2 ozs. sap green, and 2 ozs. indigo. Place this in an iron or copper vessel, with as many of the veneers as the liquor will cover, and boil for several hours or until the requisite intensity of color is obtained.

(50) J. M. says: I am building a small engine. The boiler is 5 feet long x 16 inches in diameter, without flues; it is made of ⅛ inch iron. Could this boiler afford steam enough to run a drag saw requiring 2 horse power, and what pressure could it stand to the square inch with safety? A. We do not think the boiler would be large enough to do the work satisfactorily. You could maintain a working pressure of about 50 lbs. per square inch.

(51) A. J. H. asks: 1. What preparation will produce a good sensitive surface? A. A collodion film holding iodide and bromide of silver. 2. Can the camera obscura be utilized for photography? A. Yes, but not so conveniently as the ordinary camera. 3. Does any number of the SCIENTIFIC AMERICAN contain directions for photography? A. No complete treatise, but valuable suggestions will be found in almost every number.

What is the enclosed substance? A. Caramel and salt.

(52) C. L. asks: What effect (if any) do the many steam mills, locomotives, and steam vessels have upon the humidity of the atmosphere? A. We do not know of any observations especially relating to this point: but we imagine that the effect, if any, is very slight and strictly local.

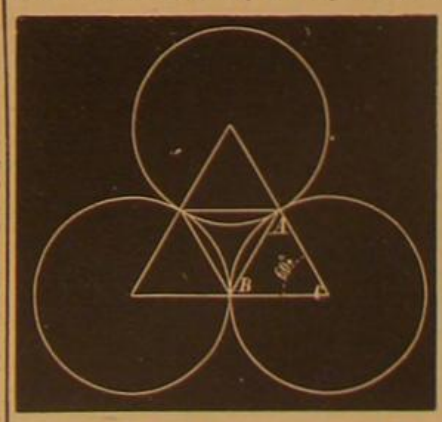
(53) F. G. W. says: The Boston and Albany Railway Company has some 240 locomotives, most of which have no steam domes; and if you ask the men who handle these engines how they carry their water, they will tell you that no engines work drier steam or less water than they do, under all circumstances. It is well known that much of the track of this line, on the mountain slope between Westfield and Washington, lays on a grade of 83 feet per mile. Steam domes are not only expensive, but are a decided injury to a boiler, and if locomotives work as well, they are certainly much better without them. This company is continually building locomotives without domes, which seems to be the best evidence possible that they are as useless as a steeple to a church. A. There are many locomotives which have no steam domes. The celebrated Crampton engines, made in 1847, had none, and gave excellent results. It is usually considered, however, that drier steam is obtained from the top of the dome than from the shell of the boiler.

(54) W. H. B. asks: Where was the first railroad located? A. Railroads or tramways, used in mines, worked by horses, are very old. The first mining road worked by steam was at Killingworth, England; the first passenger road worked by steam was the Stockton and Darlington Railway, England.

(55) I. L. asks: 1. How can I construct a float, to use in a steam boiler to indicate the water level or to operate a valve? Can it be made sufficiently light and yet stand the external pressure of 100 lbs. per inch? A. Make your float of copper. 3. I have thought that a float made of common tin, made airtight, with a small quantity of water in it, would answer, as the water inside the plate would be converted to steam from the heat of the steam outside the float, the quantity of water used to be equal to that required to fill the float with steam at the required pressure. Would this be practicable? A. Your plan of a tin float is impracticable. 3. Is the fusing point of common tinner's solder sufficiently high that 100 lbs. of steam would not fuse it? A. Yes.

(56) R. W. R. says, in answer to W. H., who asks as to preserving a cotton rope used in the open air: We are carrying 20 horse power by a cotton rope 1 inch diameter and 800 feet long, over V-shaped pulleys 5 feet in diameter. To protect it from wear and the weather, it is slushed occasionally with ½ black lead and ½ tallow.

(57) W. C. S. says, in solution of his problem proposed on p. 107, vol. 34: The answer is as follows: Assume that R, the radius, =1. Then area of circle=3·14159264, area of sector, A B C,=0·52359877, area of triangle=0·4330127, area of segment A B=0·09058507, area of centerspace=0·16125449, Thesefore 0·16125449: 43560 (feet in an acre) :: 1: 270132. 270132=520·6+feet, the required radius.



J. E. N., F. L. R., M. B., F. E. B., D. E. Q., J. H. B., C. J. T., J. W. I., C. A., E. L. W., M. R., P. J. D. S., J. E. N., A. W. F., Dr. B., J. R. D., E. I. T., T. S. M., S. N. M., J. M. G., F. W. W., G. W. C., A. G. F., M. C., P. M., R. F., A. F. C. & Co., and K. Q. X. send answers which, like the above, are approximately correct. J. S. W., C. H. B., G. D. T., E. McC., L. B., N. M. B., V. P. B., F. G. G., I. D. S., H. M. A., G. D. T., R. C., R. J. McL., W. J. McG., and G. H. O. send erroneous answers; and L. S. W. sends different solutions with no results stated. C. W. M.'s answer is incomplete. C. says: "One curious fact I notice is that the division of the 160 rods by the exact figure, which is a trifle less than 0·162, gives the following regular arrangement of numerals, the root of which we extract for the answer: $\sqrt{987654321}=31·4269$."

(58) H. S. says, in answer to F. H. D.'s query as to cast iron and steel sleigh shoes: Wrought steel sleigh shoes are not tempered, as it would crook them out of shape; and cast iron shoes, if they are what they ought to be, are made of quite hard iron, that cannot be drilled or filed, and shows a white crystaline fracture when broken.

(59) G. G. W. says, in reply to several correspondents who ask for recipes for casehardening: To casebarden wrought iron, take wood soot and urine, mix and work them up into a dry mastic, and cover the article to be hardened with it: heat to a red heat slowly in a charcoal fire, so as to heat through. Take out and knock off the soot, and plunge in cold water; then draw the temper, as done with steel.

E. M. M. asks: How can I make and use a good oil finish, similar to that used on parlor organs?—A. S. B. asks: Can you give me information as to the actual number of miles of railroad laid in England, Ireland, and Scotland?—E. P. asks: How is printing in gold or bronze done, to produce a smooth surface and a clear, sharp, outline?—J. J. T. asks: How is wall paper varnished after it has been hung?

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 Resources of Georgia. By M. E. C.
On the Angora Goat. By H. G. O.
On Magic Squares. By J. S.
On the Epicycloid. By L. F.
On Spontaneous Combustion. By J. S. W.
On a First Class Tool Maker. By D.
On the Power of Figures. By G. B. M.
On a Singular Medical Case. By R. W. B.
On Spirit Photography. By C. M.
On Head Work. By J. K.
On Bank Vaults. By S. K.
On Food. By C. S. P.

Also inquiries and answers from the following:

S. G. H.—J. M. S.—Z. S.—J. G. McC.—H. J. M.—E. J. P.—T. G.—J. N.—J. H. M.—G. M.—J. K.—C. K—B. L.—W. B.—R. N.—T. W.—W. M.—M. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes rake teeth? Who publishes works on pottery and porcelain? Who makes phosphorus in large quantities? Who buys bone dust? Why do not makers of microscopes advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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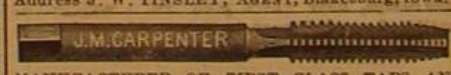


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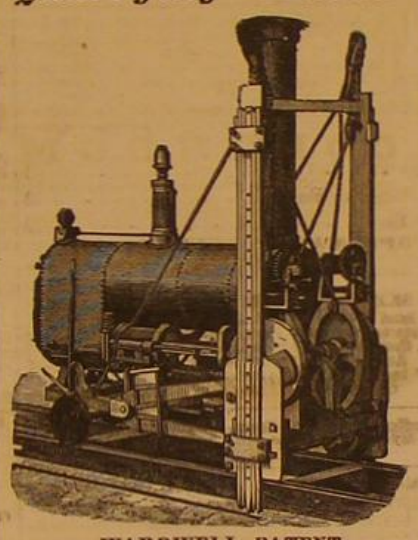
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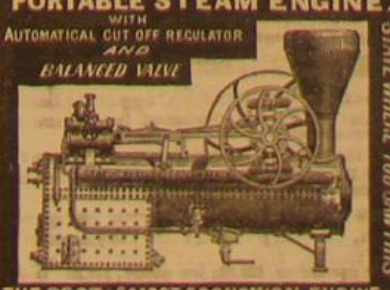
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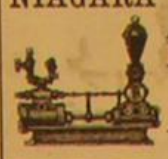
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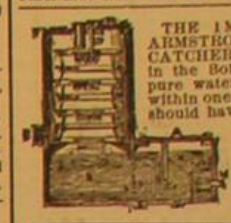
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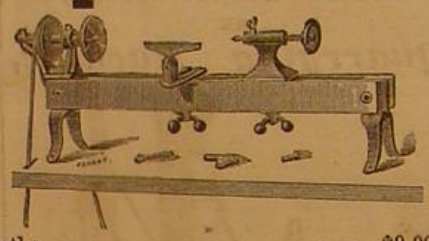
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SCIENTIFIC AMERICAN

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

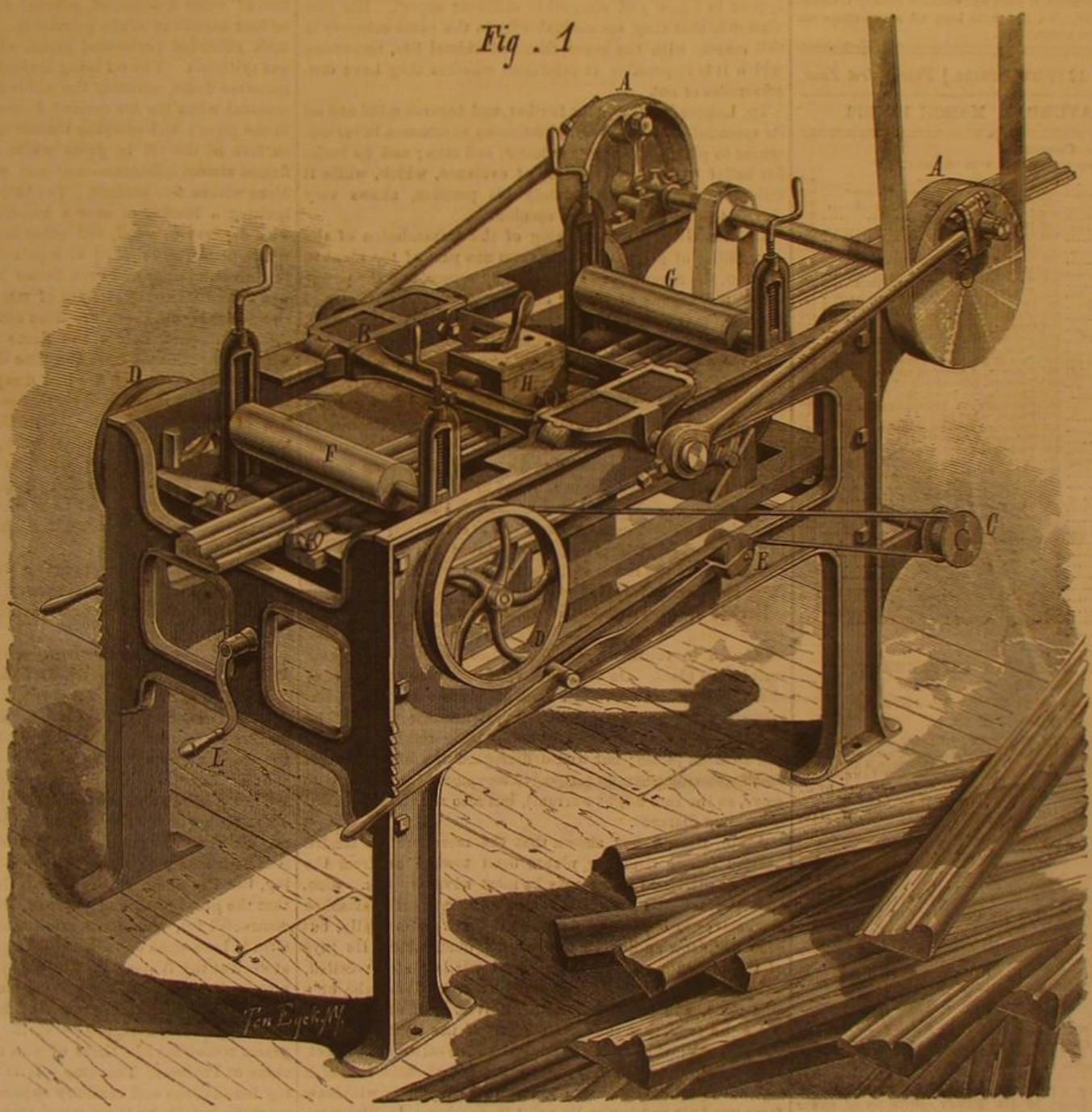
Vol. XXXIV.—No. 12. [NEW SERIES.] NEW YORK, MARCH 18, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED MACHINE FOR POLISHING MOLDINGS AND SURFACES.

In the ordinary process of making wood moldings, when the strips leave the cutting tools, they have a rough face, which must be finished before they can be oiled or painted. This operation is now done by hand by the use of sand paper, emery, etc. Like all hand labor, in which the workman becomes a mere animated machine, this proceeding is both tedious and costly; besides, it is at best imperfect, since the peculiar forms of certain patterns frequently prevent neat and careful work. In brief, the operation is one which so specially invites the labor of the machine that it will probably be a matter of some surprise for our readers to learn that, despite the immense variety of woodworking apparatus in the market, apparatus seemingly capable of converting wood into every possible shape and form, there has hitherto been no device for accomplishing so necessary and yet, as compared with a score of other every-day processes, simple a requirement. We need hardly preface the following description by saying that the machine referred to, and herewith illustrated, bids fair to be a very useful invention, the more so since its capabilities are not confined to moldings alone, but include the scraping and finishing of veneered surfaces, and the polishing of coach bodies, of metal work, of glass, and of marble.

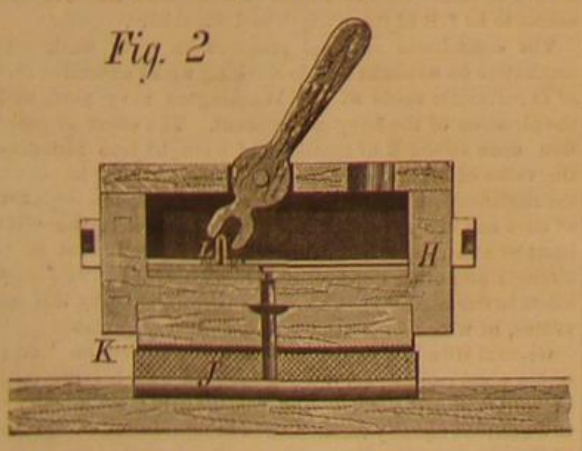
In Fig. 1 we give a perspective view of the invention, from which its mechanical construction will easily be comprehended. Either of the pulleys, A, may receive the belt and serve as the driver, each having a pitman which connects with, and so imparts a reciprocatory motion to, the carriage, B, in which the polishing arrangements, described further on, are located. From a small pulley on the same shaft as pulleys, A, descends a belt to another parallel shaft, on the ends of which are two more small pulleys, one of which appears at C. The pulleys last mentioned are connected to the wheels, D, at one side of the machine by a crossed, on the other by a straight, belt. Against each of said belts rests a tightener, E, having a handle conveniently located, as shown, and so arranged as to be firmly secured, so as to hold the idler away from or against the belts, as desired. The object of this arrangement is to enable either belt to be thrown into action at will, so that the shaft of pulleys, D, may be caused to travel in either direction. Said shaft imparts motion to the lower feed rolls, the upper ones of each pair of which are respectively represented at F and G. These rolls are covered with rubber so as to grasp the molding placed between them, and carry it under the reciprocating polisher, H, and so out of the apparatus. It will be seen, however, that, since the machine, as already described, may be caused to run in either direction, the strips may be introduced at either end, or may run through one way and (the motion being reversed) sent back again, and thus kept traversing to and fro under the polisher as long as may be desired. The rolls may be easily adjusted, as to their separation, by the screws shown above them, and are rigidly connected to the table, which last, however, is entirely detached from the frame on which the polisher works. It has a vertical motion, imparted by the handle at L, and thus the work held between the rollers may be raised or lowered bodily, and so adjusted with any degree of pressure against the rubbing materials.

Fig. 1



DAYTON'S MACHINE FOR POLISHING MOLDINGS AND SURFACES.

Fig. 2



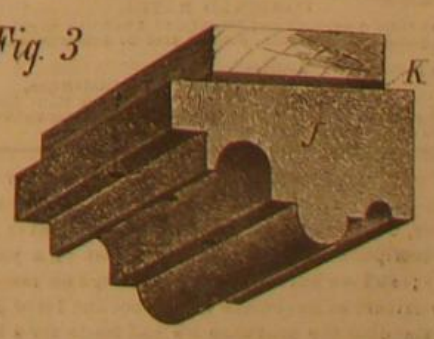
So far we have described merely a neat mechanical contrivance of well known devices—the practical appliance whereby the gist of the invention is adapted for use. The essential feature of the whole lies in the rubber, H, an enlarged sectional view of which is presented in Fig. 2; and in the making of this, resort is had to a simple and ingenious process, namely, artificial stone manufacture. It being required to dress a certain pattern of molding, a small piece of the material is very carefully finished by hand to the exact form. This serves as a mold for a concrete of prepared materials, which set and crystallize very rapidly, producing, in hard fine-grained stone, every curve and angle of the pattern, reversed, of course, but duplicated with sharpness and accuracy.

It remains now to secure the slab shown at J, Fig. 2, and separately in Fig. 3, to a wooden back, interposing between it and the latter a sheet of india rubber, K, to add to the elasticity, and then to fasten the whole in the box, H, by means of the set screw shown on the latter in Fig. 1. In the box, however, as will be further seen from Fig. 2, is a simple arrangement for supplying emery dust, glass, or pumice, between the stone and work, or even for admitting water to the same locality when desired. The emery is introduced through the aperture shown in the cover, and falls to the bottom of the box, whence, if not prevented by the closing of the slide, L (operated as shown by the handle above), it gradually escapes through small holes to the face of the stone. The polisher then, as already described, travels to and fro, constantly rubbing the molding; while at the same time, having a free lateral play, it readily adapts itself to any twist in the same.

We have witnessed this machine in operation and can state that it turns out excellent work, the moldings certainly possessing much cleaner and sharper angles and corners than could be produced by the hand process, unless the polishing stone were removed from the apparatus and operated by hand, as it well might be, although of course at the expense of time. Hard wood or soft wood surfaces are polished with equal ease, a matter of some difficulty in the last instance, as soft faces are usually gummy and difficult to dress, and the use of loose powder effectually relieves this trouble.

Patented June 29, 1875. For further particulars regarding price of machines, and for rights, address the patentee, Hon. John A. Dayton, 20 Hanson Place, Brooklyn, N. Y.

Fig. 3



A NEW cheap coating for wood, which is very adherent even when exposed to the weather, consists in simply brushing the surface with a solution of persulphate of iron of 2° to 2½° Baumé. The blue gray tint which this acquires on drying changes to an agreeable brown when linseed oil varnish is applied.

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If our own experience is any evidence of improvement in the times—and we believe it is—there is a vast change for the better, over last year. Our patrons have never renewed their subscriptions at the commencement of a year more promptly; and we have never had so large an accession of new subscribers as have come to us since the 1st of January. Notwithstanding the provision we had made for a large increase in our circulation, by printing several thousands extra of the first ten numbers of the year, we find some of the editions are already exhausted, which will prevent our sending complete sets of back numbers from the commencement of the volume. The first six numbers can be supplied, and some of the subsequent issues, but, we regret, not all. If persons, when remitting their subscriptions, express a wish for such back numbers as we can supply, those not out of print will be sent: otherwise, the subscriptions will commence from date of their receipt.

MIND IN PLANTS.

"'Tis my faith that every flower
Enjoys the air it breathes."

So wrote Wordsworth long ago, and very often the poet's prophetic spirit anticipates results which slowly demonstrating Science arrives at only after many years of patient observation and logical deduction. Is it possible that Wordsworth's faith in the capacity of vegetation to enjoy was really such an anticipation, that the consciousness which enjoyment presupposes is in any degree a function of plants?

There is certainly a growing disposition on the part of scientific men to accept such a position, and the evidence in support of it has already become too abundant to be overlooked or despised.

As Dr. Forbes Winslow has remarked, vegetable life is so universally assumed to be, as a matter of course, unconscious that it appears to many a mere folly to express a doubt of the correctness of the assumption. But, he continues, let a close observer and admirer of flowers watch carefully their proceedings on the assumption that they not only feel but enjoy life, and he will be struck with the immense array of facts which may be adduced in support of it. Endow them hypothetically with consciousness, and they appear in a new and altogether different aspect. His conclusion is that they are undoubtedly in the same category in this respect with the lower forms of animal life, respecting which it is impossible to determine whether they have consciousness or not.

Dr. Lander Lindsay goes further, and regards mind and all its essential or concomitant phenomena as common in various senses to plants, the lower animals, and man; and he backs his belief with a cogent array of evidence, which, while it fails to demonstrate absolutely his position, shows very clearly the drift of scientific opinion.

Dr. Asa Gray, after speaking of the transmission of the excitability of sensitive plants from one part of the plant to another, the renewal of excitability by repose, and the power which the organs of plants have to surmount obstacles to positions favorable to the proper exercise of their functions, goes on to say that, when we consider in this connection the still more striking cases of spontaneous motion which the lower algæ exhibit, and that all these motions are arrested by narcotic or other poisons—the narcotic and acid poisons producing effects upon vegetables respectively analogous to their effects upon the animal economy—we cannot avoid attributing to plants a vitality and a power of making movements toward a determinate end, not differing in nature, perhaps, from those of the lower animals. Probably, he adds with characteristic cautiousness, life is essentially the same in the two kingdoms; and to vegetable life faculties are superadded in the lower animals, some of which are here and there indistinctly foreshadowed in plants.

Darwin has observed in the *drosera rotundifolia* a faculty for selecting its food, which in animals would certainly be attributed to volition. Mrs. Treat has described the same trait in the plant. On being deceived by means of a piece of chalk, the drosera curved its stalk glands towards it, but, immediately discovering its mistake, withdrew them. The plant would bend toward a fly held within reach, enfold it, and suck its juices; but would disregard the bait if out of reach, showing not only purposive movement (or a refusal to move, as the case might warrant), but also a certain power of estimating distance.

Again, Darwin has shown that the more perfect tendril bearers among climbing plants bend toward or from the light, or disregard it, as may be most advantageous. Also, that the tendrils of various climbers frequently attached themselves to objects presented to them experimentally, but soon withdrew on finding the support unsuitable. He says of the *bignonia capreolata* that its tendrils "soon recoiled, with what I can only call *disgust*," from a glass tube or a zinc plate, and straightened themselves. Of another bignonia, he says that the terminal part of the tendril exhibits an odd habit, which in an animal would be called an instinct, for it continually searches for any little dark hole in which to insert itself. The same tendril would frequently withdraw from one hole and insert its point in another. In like manner, spirally twining plants seem to search for proper supports, rejecting those not suitable.

Speaking of phenomena of this sort, Dr. Lindsay makes this strong remark: "In carnivorous and climbing plants, there is a choice or alternative between action or inaction, acceptance or refusal; and the choice made is not always judicious. There may be an error, and the error may be corrected; but in order to such correction, there must surely be some kind of consciousness or perception that a mistake has been committed: an exercise of will in making further efforts at success, and a knowledge of means to an end, with their proper adaptation or application."

According to Professor Laycock, organic memory is common to both animals and plants, and certain *lianas* seem to exhibit it in a marked degree in their antipathy to certain trees. The botanist Brown has remarked that the trees which the lianas refuse to coil round are physically incapable of supporting the climbers.

And not only do many plants act, as one might say, reasonably, but some exhibit the opposite quality. In his "Vegetable Physiology," Professor Lawson speaks of the eccentric movements of the side leaflets of *hedysarum gyrans*, which make it appear as though the whole plant were actuated by a feeling of caprice.

In many cases observers are, no doubt, self-deceived, and mistake a mechanical and wholly unconscious mimicry of intelligent action for an actual exhibition of intelligence: still such men as Dr. Gray and Mr. Darwin are not apt to be deluded by mimicry or figures of speech; and however much it may run counter to popular notions of what is proper to plant life, the hypothesis that intelligence does not end with animal life seems by no means inconsistent with a multitude of trustworthy observations.

FIRE EXTINGUISHER TRIALS.

A large vacant lot in the upper part of this city was recently the scene of some remarkable experiments upon a new fire-extinguishing apparatus. The trials were devised by Mr. Joshua Rose, and were prepared on a scale of magnitude sufficiently near to a good-sized conflagration to put the invention to a test of exceptional severity. The apparatus, like most fire extinguishers, involves the use of carbonic acid gas, which, after being produced in a generator, is either mingled with water in large receptacles, or else forced under heavy pressure into a battery of six strong cylinders. The general idea is to avoid making the gas on the spot where it is used, and either to convey it thither compressed in the cylinders, whence it is allowed to escape and mingle with the hydrant stream, or else conduct it by pipes to the surface of oil tanks, for extinguishing petroleum fires.

On the experimenting ground, a large brick tank, 20 feet wide by 30 feet long, was constructed, and into this about a foot of water was placed, covered with the contents of three or four barrels of crude petroleum. Along two sides of the tank extended perforated pipes, which connected with the gas cylinders. The oil being ignited, the vapor burned with immense flame, covering the whole 600 feet of area. At the moment when the fire seemed fiercest, the gas was admitted to the pipes; and escaping therefrom it rushed out over the surface of the oil in great white clouds, cutting off the flames almost instantaneously and wholly extinguishing the blaze within five seconds. The succeeding trial consisted in igniting a bonfire of over a hundred rosin barrels packed with dry leaves, wood, and other inflammable material, the whole plentifully soaked with petroleum. In a few minutes this made a larger and even fiercer fire than did the oil. It was then attacked by streams of mingled gas and water from two seven-eighths inch fire hose nozzles. Probably not ten seconds elapsed before the flame was under control; and within four minutes from the time the streams were first applied, every vestige of fire had disappeared. A heap of dry wood was next raised, and on this were placed two full barrels of crude petroleum. With the blaze thus produced the gas and water made short work, putting it out in about two minutes. Lastly, it was shown, by practically comparing the stream delivered from the hydrant with the same stream after gas had been admitted to mingle with it, that the latter was projected to a distance of some fifty feet beyond the former.

The inventor of the apparatus is Dr. J. H. Connelly, of Pittsburgh, Pa. We expect shortly to publish a fine engraving of it, together with a complete description of its capabilities.

THE UNITED STATES METAL-TESTING BOARD.

A session of this Board was recently held at the rooms of the American Society of Civil Engineers in this city. Our readers will remember that the board was appointed by the President, under authority of an act of Congress, last spring, and the circulars of the Secretary and of the Committees of the Board have given the readers of the SCIENTIFIC AMERICAN a knowledge of the scope and the plan of its work, and have awakened an unusual degree of interest in a scheme which is of national importance. We are informed that at this meeting, the President of the Board, Colonel Laidley, reported that the great testing machine of 400 tuns capacity had been contracted for, and that a considerable amount of work had already been upon done it. It is expected to be completed and at work at the Watertown Arsenal before the close of the current fiscal year. It is the invention of A. H. Emery, but has an independent straining mechanism, fitted with a strain diagram apparatus, designed by C. E. Emery to produce diagrams somewhat like those of the autographic testing machine of Professor Thurston. It is expected to cost, including foundations and auxiliary apparatus, about $50,000. The machine is said, by those members of the Board with whom we have conversed, to be a beautifully ingenious apparatus, and it is expected to do wonderfully accurate work. The beam of a ten tun scale, made on a similar plan, has been known to turn with the weight of a nickel cent. No doubt seems to be felt of its strength and durability.

The committees reported progress in their work. The committee on wrought iron is working up an extensive series of experiments made at the Washington navy yard, under the direction of the navy department. The effect of proportion upon strength of members of wrought iron structures, the value of various sizes and qualities of metal for chains, the modification of quality by change of size, and the effects of time and the phenomenon of the elevation of the elastic limit by strain, as well as the simple determination of the strength and other qualities of iron of the various well known kinds in our markets, are all under investigation by this committee, of which Commander Beardslee is chairman.

General Gilmore, chairman of the committees on iron for armor plate and on cast iron, is engaged with his committee in collating information and planning experimental work in directions equally important. The records and experiments of the war department are extremely rich in this kind of material; and the reports of these committees will embody a vast amount of valuable practical knowledge. The distinguished officer who is directing the work will probably be able to put it in most useful and accessible form.

Chief Engineer Smith, of the U. S. Navy, gave an account of the work undertaken by the committee on steel for tools at the Washington navy yard. All of the best steels in the

market are obtained and made into tools, and their value is determined by actual use in the machine shops of the navy yard. A dynamometer is used to determine the power expended, while the losses in weight of the tool and of the metal cut by it are carefully determined and compared. Finally, a careful chemical analysis of the tools is made; and the comparison of their constitution with the data, derived, as described, will indicate what a good steel really is. It was stated that no comparisons by name—which might well be deemed "odious" by the less fortunate makers—will be made in the report. It is intended that the work of the board shall be entirely impersonal, and that its results shall do as much good and as little harm as possible.

General Sooy Smith, chairman of committees on girders and columns, gave the board an outline of the results obtained during a very valuable series of experiments, recently carried on at the shops of the Cincinnati Southern Railroad, to determine the strength of compression members of structures, and stated that other equally important investigations were to be made for the board at an early date. Incidentally, the effect of cold in altering the resisting power of the metal, a subject which has been discussed at length in the columns of the SCIENTIFIC AMERICAN, had received some further elucidation, both at Cincinnati and at Washington.

Mr. A. L. Holley, the well known pioneer in the introduction of the Bessemer process in the United States, and who is chairman of the committees on chemical research and on modern steel processes, stated that a chemist—Mr. Andrew Blair, of St. Louis, Mo.—had been appointed under authority of the board, that a laboratory had been fitted up at the Watertown Arsenal, and that the chemist had been for some time engaged in the analysis of irons and steels sent in for test, and on metallic alloys tested by the committee on alloys. Promise was given of securing much information that may prove of exceptional interest and value. Coincident chemical analysis and mechanical testing have never before been systematically attempted on such a scale, and this one peculiarity in the method of investigation followed by the Board is likely to make its work one of vastly greater value and of more permanent usefulness than any similar investigation ever attempted. In this matter the work of this Board is unique. Mr. Holley's committees are gradually collecting a very complete assortment of metals, and the work of testing can be commenced immediately upon the completion of the machine and the appropriation of the required funds. A Pittsburgh firm is preparing a set of several series of steels, each of which series is peculiar in its gradation of some one element. It is expected that by testing these series, the precise effect of each of the more important elements present in steel may be traced with accuracy. Nothing like this has been attempted before, except in the determination of the effect of varying proportions of carbon in researches by Professors Leeds and Thurston, recently, at the Stevens Institute of Technology.

Professor Thurston, chairman of the committees on abrasion and wear, on metallic alloys, and on the effects of temperature, reported a large amount of work accomplished. A specially devised apparatus for determining the effect of variations of temperature on the quality of material had been designed and partly constructed, and this research had been planned. Another season will probably see the work done. The work of the committee on abrasion and wear will be commenced immediately upon the completion of preparations now being made under the direction of the chairman of the committee. Meantime, a series of experiments on the value of the various standard kinds of unguents in the prevention of abrasion and wear of the metals is in progress, under the eye of the chairman, in the laboratory for technical research of the Stevens Institute of Technology.

The work of the committee on alloys is reported to be well advanced. A large amount of valuable information and a very extensive collection of important data are recorded; and the time of the Board was largely occupied in the examination of the results of a long series of experiments on bronzes, for the publication of which all engineers and mechanics will look with interest. No investigation so complete, so extended, or so accurate has ever been undertaken previously. Every grade of bronze, from the copper to the tin end of the series, has been examined. The transverse, tensile, compressive, and torsional resistance, the elasticity and the modulus of elasticity, the changes of chemical composition due to fusion and to liquation or separation, the density, co-efficient of expansion, state of crystallization, character of fracture, mechanical condition of aggregation, and, in fact, all that the engineer wishes to know, are to be determined; and Professor Thurston is directed by this committee to make the research so thorough that, if possible, the necessity of its repetition at any time in the future may be avoided.

There are many other matters in hand, which the Board are expected to make useful to the country and to the engineering profession; but we have no space to consider them here. Some of this work will be described at greater length hereafter, and we shall endeavor to keep our readers informed of the progress made by the Board, whenever the publication of their work may enable us to do so. When the extent and importance of this national work is fully comprehended, we shall expect to see that the assistance, which the circulars issued by the several committees ask of other members of the engineering profession, is rendered gladly and effectively. The members of the Board state that, with the exception of that given by a few of the most distinguished and public-spirited engineers and manufacturers, but little valuable aid has been given them in their investigations, although they have received encouragement from all sides by the generally awakened interest in the subject. Some very interesting and valuable material has been sent from Europe, where great interest is, evidently, felt in this subject. MM. Tresca, Launhardt, Millar, Thompson, and other equally distinguished men have shown such practical appreciation of the work.

[For the Scientific American.]

ARTIFICIAL ICE MANUFACTURE.

BY P. H. VANDER WEYDE.

The ice crop has failed this winter, and ice will be consequently dear during the next season; it will therefore be interesting to investigate how far artificial ice, of which so much has been said in late years, can supply this want, and form, besides, a lucrative business for those who feel disposed to commence it. In order to understand the following descriptions, it must be remembered that the thermometer alone cannot be relied on for measuring definite quantities of heat, as the amount of heat which will raise the thermometer 10° will depend largely on the quality and quantity of the matter to be tested, in which the thermometer is suspended. When, for instance, one thermometer is suspended in a pint of water, and another in a pint of mercury, it will be found that it will take nearly 2½ times as much heat to raise the temperature of the water than to do the same with the mercury; but mercury is 13½ times heavier than water —1 pint of water weighing about 1 lb., and 1 pint of mercury weighing 13½ lbs—so that it takes 2½ times more heat to heat 1 lb. water than 13½ lbs. mercury, and $2\frac{1}{2} \times 13\frac{1}{2} = 30$ times more to heat 1 lb. water than to do the same with 1 lb. mercury. This number 30, divided into 1, adopted to denote the specific heat of water, gives 0·033, and this is called the specific heat of mercury, and so the specific heat of iron is found to be 0·11, of copper 0·095, of lead, 0 03, etc. So much for the influence of the quality of the matter, but the quantity still more affects the amount of heat required: for to heat a gallon of water will evidently take 8 times as much heat as is required to heat a pint. And as these differences in the required amounts of heat cannot be indicated by degrees on the thermometer alone, it is necessary to establish a standard or unit of heat which actually indicates its amount; and it has therefore been agreed upon to accept an amount of heat sufficient to raise the temperature of 1 lb. of water 1° Fah. as the unit of heat, by which all other amounts can be measured and compared.

It is obvious, from the specific heat of iron, copper, mercury, and lead, given above, that 1 unit of heat will cause a rise in temperature of 1° Fah. in 1 lb. water, in 9 lbs. iron, in 10½ lbs. copper, in 30 lbs. mercury, and in 33 lbs. lead: which numbers correspond to 1 divided by the fractions respectively denoting the specific heat of the different metals.

Of more importance than the specific heat is the latent heat, that is, the heat which bodies absorb when changing from the solid to the liquid state, and which they again give out when returning from the liquid to the solid condition. So ice when melting, on changing into water, will absorb heat, and cause it apparently to disappear; and this to such an extent that 1 lb. of ice of 32° Fah. will require 1 lb. of water of 174° to melt it, when the result will be 2 lbs. of water of 32°. It is then seen that the ice has absorbed 142 units of heat to change it into water of 32°. These 142 units are called the latent heat of water; and in the process of congelation they have to be extracted. On this principle is ordinarily based the method of making artificial ice. The practice of this manufacture, however, involves another principle, that of the latent heat of vapors. When water is changed into steam, it again absorbs heat; and when 1 lb. boiling water is evaporated and converted into steam of the same temperature, 212° Fah., it absorbs as much heat as would be sufficient to raise 5½ lbs. water from 32° to 212°, that is, $5\frac{1}{2} \times (212 - 32) = 5\frac{1}{2} \times 180 = 960$ units of heat. This is the latent heat of steam, and is given out again when steam condenses into water: hence the effectiveness of steam for heating buildings by the condensation of steam, in pipes and other contrivances.

MAKING ICE BY EVAPORATION IN VACUO.

On this principle is founded one method of making ice, namely, the forced rapid evaporation of water by means of a vacuum. In an old experiment in the physical lecture room, a small quantity of water is placed on a watch glass, under the bell jar of a good air pump; a vacuum is rapidly made, and the water will at first commence to boil, and the vapor evolved will absorb so much heat from the water that at last it will freeze, and form a small piece of ice. As the latent heat of the steam or watery vapor is 960 units, 6⅔ times as much as the 142 units of latent heat absorbed from the water to freeze it, it will require the evaporation of about $\frac{1}{7}$ of the water to freeze the remaining $\frac{6}{7}$. In order to aid the air pump in the rapid removal of the watery vapor arising, it is well to place also under the bell jar a cup of strong sulphuric acid, which has great affinity for watery vapor and absorbs it, causing the experiment to succeed in less time, and also with a less perfect air pump. This method of ice-making is now in operation, on a small but practical scale, in the leading restaurants in the principal cities of the European continent. A strong glass bottle is about ⅔ filled with water, and its neck is connected with the pipe of a good air pump, worked either by hand or by power. Between the bottle and the pump is a reservoir containing sulphuric acid, over which passes the air and watery vapor which the pump draws from the contents of the bottle; the sulphuric acid absorbs the vapor, and experience shows that, conformably to the theory above stated, when about $\frac{1}{7}$ of the water has been removed by evaporation, the rest will rapidly freeze to a solid mass. Then the bottle is detached and placed on the table of the guest; where, if necessary, some water may be added, which it will then soon cool to about 32°. If no sulphuric acid is used, it is hard work to freeze a pint of water with such a machine, requiring, as it does, the continuous labor of a man for about half an hour, and also the condition that extraneous heat is carefully excluded by covering the bottle with non-conducting material, the absence of which would lead to a loss of the cold produced. The amount of labor required is perfectly in accordance with the theory of the mechanical equivalent of heat, which is that 1 unit corresponds with 776 foot pounds; and as from every pound of ice-cold water 142 units have to be extracted to transform it into ice, the abstraction will be equal to 142×776, or 110,192 foot pounds. As the power of a man is about 4,000 foot pounds per minute, it will take $\frac{110192}{4000}$, or 27 minutes' work, equal to 4,000 foot pounds each, to effect this abstraction. If the work is done by machinery, we find, in the same way, that a horse power, equivalent to 33,000 foot pounds per minute, will abstract 110,192 units in $\frac{110192}{33000}$ or nearly 3 minutes, that is, it will freeze 1 lb. of water every 3 minutes, or 20 lbs. per hour; and as in a good steam engine a horse power can be obtained at the expense of 2 lbs. coal per hour, we see that 2 lbs. coal will be sufficient to produce 20 lbs. of ice, or 1 tun of coal 10 tuns of ice. If, however, we use as an aid the intense affinity of sulphuric acid for watery vapor, we may surpass this estimate; but it must be considered that ice is usually wanted in warm climates or during hot seasons, and the loss of cold from, or rather the incursion of external heat to, the different parts of the apparatus is so considerable that it is necessary to use all possible precautions, and to employ all known means, if we expect to attain the theoretical maximum of 1 tun of coal producing 10 tuns of ice.

We have seen that it lately has been claimed that, with one of the modern ice machines, 1 tun of coal would produce 20 tuns of ice; but this is an estimate in which the loss of power involved in changing heat into motion by the intervention of the steam engine had been overlooked or intentionally neglected; and we are satisfied, as well by practical experience as by the theory above stated, that the ratio of obtaining 10 tuns of ice by the combustion of 1 tun of coal will be the maximum to be hoped for as long as we have to use the present form of steam engines; and more can only be hoped for when we shall have found how to obtain a horse power out of 1 lb. of coal or less per hour.

SCIENTIFIC AND PRACTICAL INFORMATION.

POISONING FROM PARIS GREEN.

A correspondent of the *Medical and Surgical Reporter*, Dr F. Horner, of Virginia, wrote recently that a case of poisoning from the effects of Paris green, arsenite of copper, occurred during the late summer, near Winchester, Virginia. Four members of the Van Meter family died, with symptoms of arsenical poisoning, after eating apples gathered from the ground of an orchard which was planted with potatoes, on which had been sprinkled Paris green in powder, and in the midst of which had fallen the apples subsequently gathered for domestic purposes. No example has been reported of this substance causing death by transmission through absorption by the plant.

RUSTING OF IRON.

It has usually been supposed that the rusting of iron depends principally upon moisture and oxygen. It would appear, however, from the late Dr. Calvert's experiments, that carbonic acid is the principal agent, and without this the other agencies have very little effect. Iron does not rust at all in dry oxygen, and but little in moist oxygen, while it rusts very rapidly in a mixture of moist carbonic acid and oxygen. If a piece of bright iron be placed in water saturated with oxygen, it rusts very little; but if carbonic acid be present, oxidation goes on so fast that a dark precipitate is produced in a very short time. It is said that bright iron placed in a solution of caustic alkali does not rust at all. The inference to be derived is that, by the exclusion of moist carbonic acid from contact with iron, rust can be very readily prevented

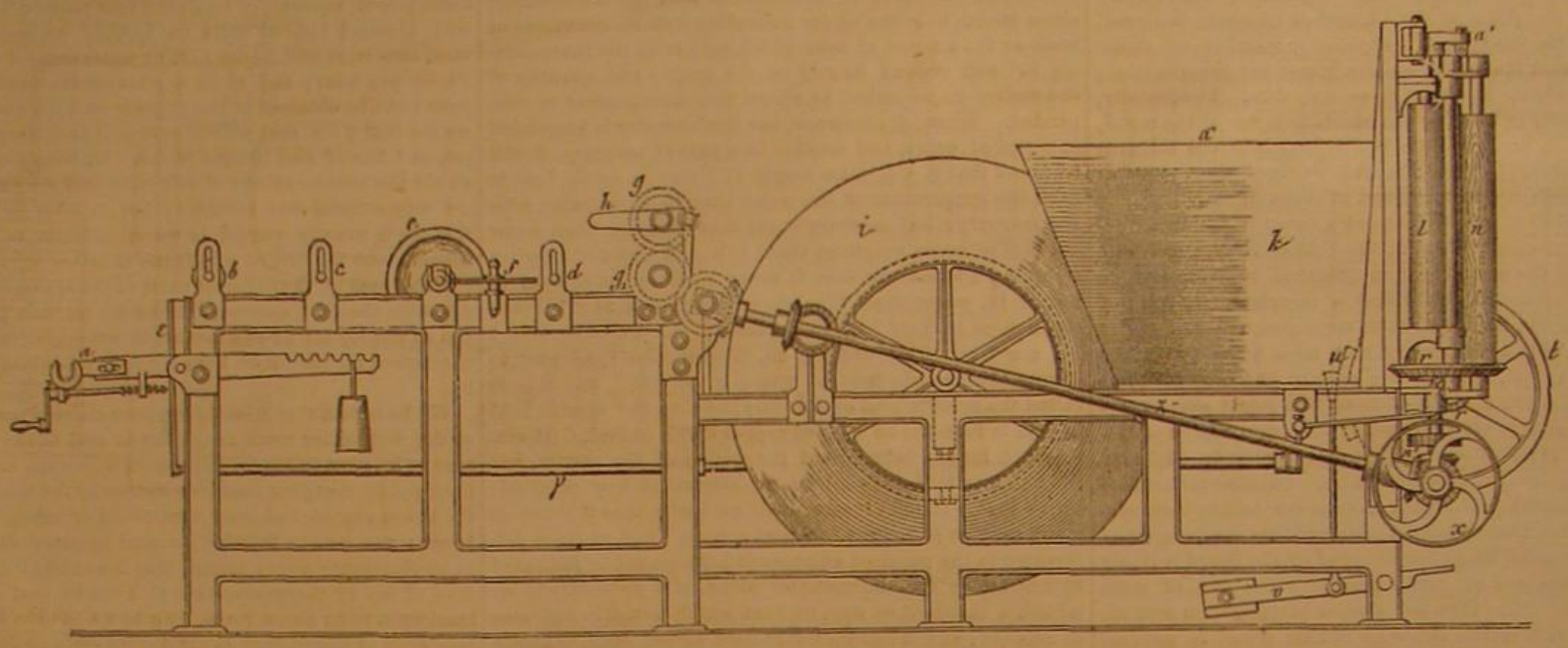
REFINING GLASS.

M. E. Frémy states that the difficult portion of the manufacture of glass is the process of refining, the object of which is to render the mass homogeneous, and expel as far as possible the bubbles of gas which are produced in abundance at the moment when the glass is formed. The nature of this gas is not exactly known, but it is evidently due to the action of reducing agents upon the sulphate of soda found in excess in the glass. This excess of sulphate of soda is destroyed by various methods, but chiefly by the use of sticks. At the instant when the sulphate of soda is thus submitted to the action of an organic body, the formation of sulphide is proved by the yellow coloration which the glass assumes, but which disappears afterwards from the action of oxygen. It is curious to point out here a certain analogy between refining glass and refining copper. In the former case, the excess of the sulphate of soda, which is the agent of vitrification, is destroyed by wood. In refining copper, oxygen is the agent of purification for the metal: but the excess of this gas forms protoxide of copper, which dissolves in the metal, and renders it brittle. The refining of copper, like that of glass, is therefore completed by making use of wood, which decomposes the oxide of copper, and restores to the metal all the useful properties which the oxygen had caused it to lose.

W. C. D. says: "I have a copy of *Wrinkles and Recipes*; and if I could not procure another, $25 would not purchase mine."

IMPROVED CLOTH-FOLDING MACHINE.

Our engravings represent a machine for folding woolen cloth and other textile fabrics longitudinally, which was recently described in the *Bulletin du Musée*. Fig. 1 shows a side elevation, and Fig. 2 an end elevation of the apparatus. The cloth to be folded is wound on a roller, the ends of the spindle of which are placed in the bearings, one of which is shown at *a*, Fig. 1. These bearings can be moved horizontally by the hand crank and screw shown in our engraving, to keep the fabric at the proper tension; and as the cloth passes from the roll and the mass becomes lighter, the weight can be moved along the notched lever to maintain the equilibrium. The fabric is kept uniform as to tension in both directions by the rollers, *b*, *c*, *d*, and *e*; and *g* and *h* are the feed rollers, which convey the cloth to the perpendicular



CLOTH-FOLDING MACHINE.—Fig. 1.

folding wheel, *i*. The feed rollers are driven by the rotating shaft, *z*, which takes its motion immediately from the driving pulley, *x*. The wheel, *i*, is elliptical in diametrical section, with the exception that the major axis of the ellipse ends in a pointed edge, circumferential to the wheel, as shown in Fig. 2; and this edge performs the folding operation, doubling the cloth, which then passes over a perpendicular V-shaped board, *k*, which prevents sagging; and then the doubled cloth is compressed between *l* and *m*, which flatten the crease made by *i* and *k*, and is finally wound on the wooden roller, *n*, on which it is carried from the machine.

The construction and working of the apparatus is clearly and fully shown in the engraving, and the designand arrangement seem well adapted for doing the work efficiently.

Currents in the Living Eyeball.

The existence of a continuous, though sluggish, current in the eye, flowing from behind forwards, has been demonstrated by Dr. Max Knies. The following was the method of investigation pursued: A minute quantity of a solution of potassic ferrocyanide was introduced into the posterior part of the vitreous humor. After the lapse of from one to four hours the animal was decapitated, and the eyeball soaked in a solution of ferric chloride; it was then hardened in alcohol, and subjected to microscopic examination. The distribution of the precipitate of Prussian blue furnished evidence of the displacement of the particles of ferrocyanide during life, and betrayed the paths along which it had traveled. The current mentioned above was found to exist in the interior of the lens as well as in the vitreous, the fluid required to nourish the former percolating through the latter, and thus following the same course as the blood in the hyaloid artery of the fœtus. The aqueous humor consists partly of a transudation from the ciliary body, partly of liquid which has made its way through the lens and vitreous. It serves to nourish the cornea. The nutrient fluid, whether in the vitreous, in the lens, or in the cornea, is conveyed along the intercellular substance; and the author is inclined to extend this proposition to all the tissues of the body, regarding the interstitial substance everywhere as the channel along which the nutrient juices are conveyed to the corpuscular elements of parenchyma or connective tissue.

The Greenhouse.

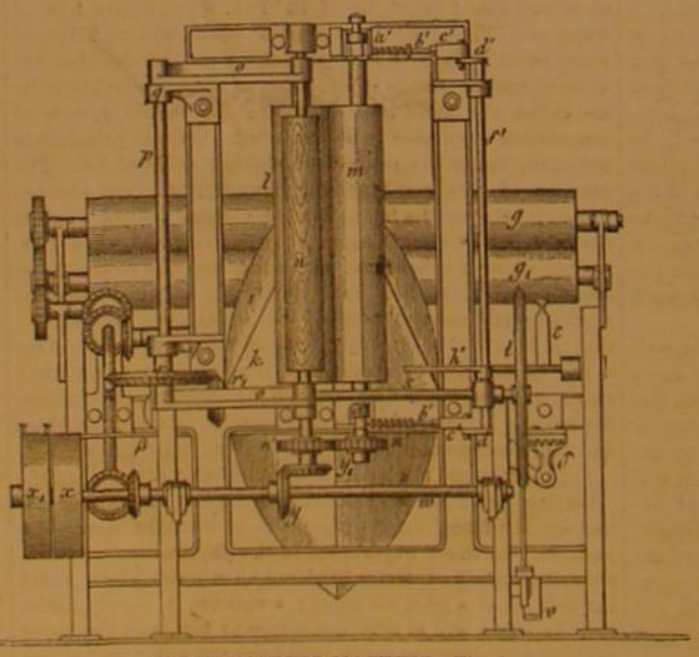
The following hints, suitable for the season, are furnished by a correspondent to the *Albany Cultivator*: If any seedlings which were sown a few weeks ago are large enough to transplant, it should be done before they get too large. At this season, unless the work is kept steadily along, and everything attended to at its proper time, some kinds of plants soon get into a condition, by growing too fast, that makes them unfit for potting or transplanting. If possible, transplant seedlings whenever the first characteristic leaves are formed, and cuttings should be potted as soon as they emit the first roots.

Plants of *callas*, *lilium longiflorum* and *candidum*, *camellia*, lily of the valley, etc., intended for Easter, should be kept free of insects, and brought into heat in time to produce their flowers at the proper season. The 16th of April being Easter this year, there is plenty of time yet to prepare for it. *Camellia candidissima* is one of the best for flowering at that season; and where many flowers are required, a good many plants of this sort should be grown. *Eucharis grandiflora*, if properly managed, can be had in flower at Easter, and is one of the best white flowers we have. Any plants which may be likely to flower too soon should be kept cool for some time.

Violets in frames should have all the air possible on clear days. A little every day is needful, but the plants must be covered well during the night. Plants in cellars should also get all the air possible, so that they may not be too tender for setting out of doors at the suitable season.

If a large number of *arunda donax versicolor* be required for bedding purposes, cut up the old plants into single crowns, and pot singly into small pots, placing them where they can get a little heat. Plants of this required for vases should be strong plants before being planted out. This an admirable plant for this purpose; in fact it should be grown in large quantities for all forms of outdoor decoration. Look after insects of all kinds, and do not by any means allow them to get ahead. "I often direct the attention of growers of plants to this particular, as upon it depends more success than many of even our best horticulturists apparently think. Thoroughly eradicate insects, and fewer sickly plants will appear in our collections of plants."

Vallota purpurea, an oldfashioned lily—generally called the Scarborough lily—is one of the finest of evergreen bulbs



CLOTH FOLDING MACHINE.—Fig. 2.

for flowering either in the greenhouse or parlor window. It does not require much heat, and can be easily induced to grow under very adverse circumstances, flowering for years in the same pot. Being an evergreen, it should not be dried off during its season of rest. When growing, give abundance of water; and if in the same pot for several years, an occasional watering with liquid manure will benefit it. It sends up its flower spikes from the crown of the bulb during summer and autumn, on the top of which are produced umbels of showy flowers. It is propagated from offsets which are freely produced at the base of the old bulbs.

"*Echeveria retusa floribunda* is a fine flowering plant. In Covent Garden market I observed large quantities of this plant for sale, grown mostly in six inch pots. It is very useful for the winter decoration of the greenhouse and sitting room, and is much used for this purpose around London. The flowers, which individually are very insignificant, have a very attractive appearance upon the spikes, and last for a long time in perfection if kept in a rather dry atmosphere. It is easily propagated by cuttings of the flower spikes and by seeds. If the cuttings are struck now, and grown on until June, then planted out during the summer months, and then lifted in the fall and potted in a rather sandy soil, plants are the best for most purposes, although good bushy plants can be secured by cutting the plant beck to within a few eyes of the pot, and allowing several shoots to grow. Occasionel spongings of the leaves are very beneficial to their welfare.

"They will flower during the winter, and greatly enhance the appearance of the greenhouse." Throughout the towns of Scotland and England the most conspicuous ornamental-leafed plant used for window decorations is *ficus elastica*; and the admirable specimens in some instances which I saw were really very creditable to the persons who bestow the suitable care upon them. The leathery texture of the large green leaves gives to the plant a bold and very attractive appearance; and grown with a single stem, having the leaves entire to the surface of the pot, it makes a fine specimen for the window. It is propagated by cuttings and eyes, and strikes very freely if put into a brisk bottom heat. In order to secure short-jointed, well foliaged plants, be careful to retain a steady moisture at the roots. Thorough dryness will cause the bottom leaves to turn yellow and drop off. Young

Limits of Microscopal Observation.

The annual address delivered on February 2, to the Royal Microscopical Society, by the President, H. C. Sorby, Esq., F.R.S., was the probable limit of microscopical observation, considered in reference to the physical constitution of matter. The author omitted for the purpose of this inquiry the limitation imposed by the residual imperfections of the instruments after the best corrections have been made. Supposing the instruments perfect, light itself was, when compared with the utmost molecules of matter, too coarse a mean to enable us to see them. Referring to the researches of Helmholtz and other physicists, and comparing them with the practical results of microscopists, it appeared that the microscope enables us to obtain distinct vision of objects, such as lines 1·80003″ apart, and that with photography and blue light such objects could be depicted when 1-112000″ apart. Comparing these quantities with the millions of millions of molecules of albumen and other substances probably existing in a cubic 1-1000″, it was shown how far microscopical investigation would be from revealing molecular structure; and as a rough illustration, the highest powers were as much behind the mark as the human eye if it attempts to read a newspaper a quarter of a mile distant. After a variety of illustrations, Mr. Sorby took up the question of Darwin's pangenesis from a microscopical point of view, and showed that, notwithstanding the minuteness of spermatozoa and the essential germinating parts of ova, there was room in them for millions upon millions of the complex molecules the theory required. A sphere of albumen 1-1000″ in diameter probably contained 530 millions of millions of such molecules.—*Academy*.

Gas Lighting in New York City.

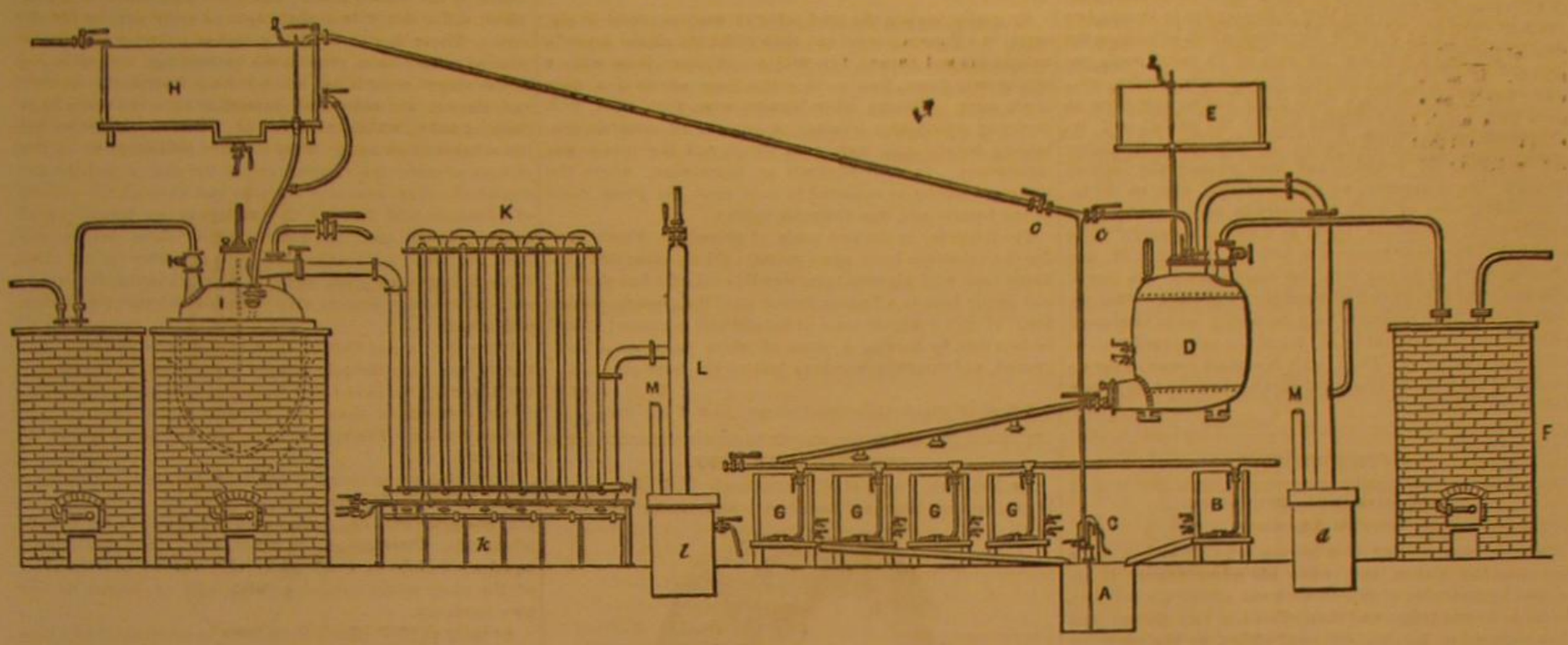
Fifty-one years ago the gas was first lighted in the house of Samuel Leggett, the then president of the New York Gas Light Company, at No. 7 Cherry street, now Franklin square. In honor of that event the company, on February 28, 1876, reduced the price of gas from $2·75 to $2 50 per 1,000 feet, which is the lowest price at which gas has ever been sold on this island. During all these years the fire that was lighted when the company started has never been allowed to expire; and when in 1874 the works were removed from Canal and Center streets, the burning coals were transported to the present location at 21st street, East river.

Treatment of Burns.

In the treatment of burns in the Charity Hospital, New York, when of a superficial character, a preparation consisting of two parts of collodion and one of olive oil has been found to be very efficacious. When the burn is of an extensive character, gasoline proves of decided benefit. The advantage of gasoline is that it is of the right consistence, and does not become rancid.

DISTILLING STEARIN.

As an appropriate supplement to our recent article on the oil resources of Africa, in which we described the immense yield of palm and other oils which might be obtained from sources on that continent now unutilized, we give herewith an engraving of a new apparatus for extracting the stearin from oil, by a new process. Stearin is now extensively used for making candles, and it is extracted from grease of all kinds. Hitherto a costly process of saponification has been employed, which the present device (for the illustration of which we are indebted to the *British Trade Journal*) obviates.



NEW STEARIN-DISTILLING APPARATUS.

The palm oil or tallow, or both combined in certain proportions, are melted in a tank, A, by means of steam; the material is then pumped into a copper vessel, B, to which is connected a steam pipe whereby it is boiled up for a certain period, the steam being superheated in the superheater, F. Sulphuric acid is then run into the acidifier, D, from E, when the process of acidification is perfected. The material is next discharged into an open vat, G, and boiled with free steam for a few hours and allowed to settle; it is then drawn off into a tank below, and pumped into a large open tank, H, lined with lead, which is placed at a sufficient elevation above the still, I, to allow it to run by gravity; this tank has a coil inside which is charged with steam in order to keep the contents in a liquid state. By means of a suitable valve, the material finds its way into the still, which is heated externally by fire to about 240° Fah., while superheated steam is let into the interior. The process of distillation now commences, the temperature being regulated according to the quality of the material that is being operated upon. The vapors pass over to the refrigerator or cooler, K, which consists of a series of vertical copper pipes connected at top and bottom with gun metal bends, the bottom bends having outlets to which are attached spiral copper coils placed in a circular tank, *k*. These tanks are fitted with pipes for the admission of steam and cold water. The product is collected in pails from the outlets or mouths of the copper coils, the greater part being fit for making candles without resorting to the process of passing it through hydraulic presses. L is the essence tank, and M a pipe for conveying gas to be burnt in the flue. That part which is not fit for making candles direct from the still is pressed and redistilled.

As the result of distilling tallow, from every 100 lbs. subjected to this process, 78 to 80 lbs. of stearin are obtained; three fourths of this, or about 60 lbs., is ready for making stearin candles without further treatment; the remaining fourth, namely, 20 lbs., after being submitted to pressing and re-distillation, yields about three fourths of stearin and one fourth of oil, the whole producing only 5 lbs. of the latter. It has been mentioned that 78 lbs. is the product by distillation, but in addition to this there is an amount of material called pitch. This is a hard black substance if it be allowed to get cold, but provision is made for passing it into an iron vessel from the still before it becomes hard. It is operated upon at a great heat in this iron vessel, and the product is similar to that from the distilling process. The pitch, after having undergone the operation in the iron vessel, is a commercial article used in many trades, and is well suited for coating iron in lieu of black japan, an article of a somewhat costly character.

IMPROVED SCROLL OR RECIPROCATING SAW.

In the accompanying engraving is represented a new scroll saw, manufactured by the well known firm of Bentel, Margedant & Co., of Hamilton, Ohio. So far as the general construction of the machine extends, beyond strength and uniform excellence of work there are no special features of novelty which would attract attention. The table and stand are very heavy and are cast in a single piece; or a wooden table may be attached, if preferred. There are the usual crank wheel, pitman, and slide to communicate motive power to the saw, the pin of the slide having a hollow chamber which carries the lubricator. The slide is of steel and the guide slides are adjustable.

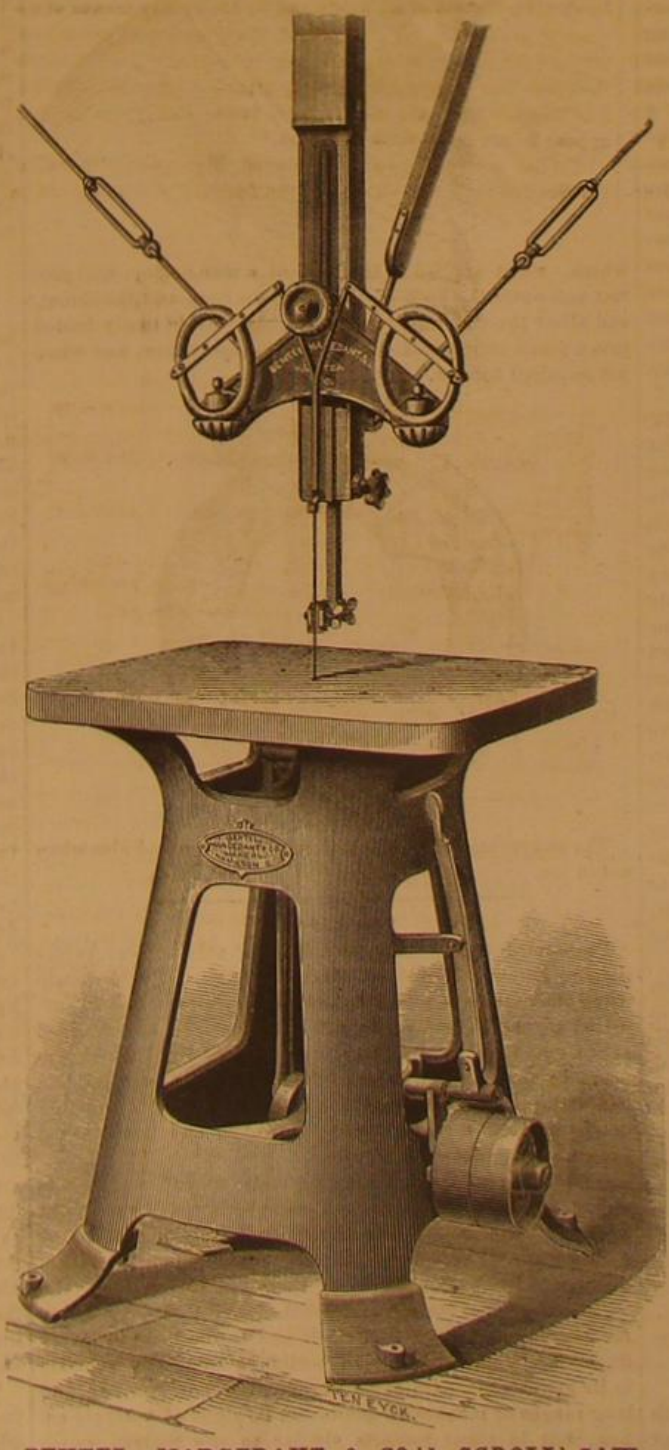
The novel and important point of the apparatus is, however, in the straining device for the saw, which is both simple and effective. It consists of two springs, two levers, and a connecting belt. The springs are each formed of a round steel bar, which is flattened on the ends and bent to an oval in such a manner that the extremities, while nearly meeting, allow a lever to be inserted between them. By depressing this lever one end of the spring acts as a movable fulcrum, while the other end presses with a force of about 820 lbs. on a point almost opposite the fulcrum. In order to compensate for the extra power which, it would appear, would be required to depress the lever to its full sweep, the leverage, or the distance between the ends of the spring, is proportionately reduced, so that the strain is thus equalized.

This device, the manufacturers state, may be adjusted so as to show an actual loss of strain; and as a matter of curiosity they inform us that they have one such apparatus in their possession that loses 3 lbs. during six inches travel or depression.

By raising or lowering the plate which carries the device, and by turning the springs toward or from the center, an increase or reduction of strain is obtained. The saw can be run at a very high speed; and as the two spring levers can be depressed 13 inches, the length of the stroke can be increased in such case to 10 inches, the saw having ordinarily 5 inches stroke.

The further advantages claimed are that the saw runs easier, with less jar, noise, and vibration than does any blade strained by springs, and that the simplicity of the device enables it to be easily manufactured, and reduces its wear and need of repairs.

Patented November 30, 1875. For further information address the manufacturers as above.



BENTEL, MARGEDANT & CO.'S SCROLL SAW.

Pneumatic Dredging.

Dredging has been a disagreeable necessity ever since docks and canals came into use, and up to quite recent times no improvement upon the ordinary elevator seems to have been thought of. Randolph, of Glasgow, tried, some years ago, to pump up mud along with water, much as M. Bazin later has done, but we have not heard that either got beyond the experimental stage. Still more recently a new dredging plant has been designed by Mr. F. E. Duckham—already well known for his hydraulic devices—for the Millwall Dock Company, who are very well satisfied with it, inasmuch as a saving is effected by its use amounting to about $10,000 a year. The working of this system of pneumatic dredging was exhibited to a party of engineers and others interested in the subject, and met with unanimous approval.

The vessel employed is a screw steamer of about 300 tuns burthen, 113 feet long, of 27 feet beam, 12 feet deep under deck, and drawing 8 feet of water when laden. She is driven by a neat compound engine of 25 nominal horse power, having 15 and 30 inch cylinders and 15 inches stroke, and 2 high pressure boilers loaded to 65 lbs. These, as well as the entire plant, reflect great credit on the makers, Messrs. Rait and Lindsay, of Glasgow. The dredger steamed round from the Clyde to the Thames, and behaved admirably. The screw is disconnecting, so that the whole power of the engines can be applied to the air pump, which forms an important part of the apparatus. This is double acting, and able to work up to a pressure of 60 lbs., though 10 lbs. is the usual working pressure. A water chamber round the cylinder, fed by a circulating pump, keeps the air cool. The dredge proper is of the usual elevator kind, fitted in a well in the center of the vessel, on the line of the keel, and adapted to traverse towards the bow, so as to excavate in advance of the vessel if needed. A couple of steam winches aid in raising and lowering the bucket ladder and varying the position of the dredger while at work.

But the distinguishing feature of this dredger is the mode of disposing of the spoil when brought up. Instead of being tipped into open barges or hoppers, it falls through a hopper on deck, into a couple of tanks, one on each side of the well, each 50 feet long by 9 feet 6 inches wide, and having a total capacity of 240 cubic yards. Iron pipes, 15 inches in diameter, one from the bottom of each tank, rise towards the deck, and unite with a breeches junction into one huge discharge pipe of 20 inches diameter, which is led to the side of the ship, and there ends in a large leather hose, with which connection may be made with a similar pipe on shore. This, at Millwall, is carried on underground—crossing roads,

railways and wharfs—for 130 yards, finally coming out into a field, where the spoil is discharged. When the tanks are full, the holes on deck are closed with air tight doors, and the vessel made fast to the discharge pipe as described. Then air is pumped into the tanks from below—and, contrary to our anticipation, at no time during the discharge did the index mark more than 9 lbs. pressure—and the spoil rushes through until the tanks are empty. The tanks can be filled in from two to three hours; it rarely takes more than half an hour to empty them, and they were emptied in twenty-two minutes. Allowing 20 yards for matter which adheres to the sides of the tanks, this is at the rate of 10 cubic yards per minute. It might be supposed that stones, bricks, etc., would hardly pass through these pipes, but we saw some as large as a man's head rushing out of the outfall, and we were informed that much heavier--notably a 20-inch furnace bar, weighing 25 pounds—had been successfully carried through. As to expense, we were told that, even on the intermittent system of work necessary in docks, ten cargoes weekly could be dredged, equal to 2,200 cubic yards. The weekly bill for labor amounts to $66.75; for coal, $ 15; and allowing $100, or 10 per cent, for maintenance, the cost of this would be $184.25, or 8·04 cents per cubic yard. This, we need hardly say, contrasts very favorably with the usual price of 10d. (20 cents) or 1s. (24 cents) per cubic yard; and of itself it proves that Mr. Duckham's invention deserves the attention of all who are interested in what is at best an unprofitable labor.—*Iron*.

Correspondence.

How Strikes are Originated.

To the Editor of the Scientific American:

What is your opinion of a person who advertises for a first class tool maker, and, when his advertisement is answered by a number of skilled workmen, selects the best one, as far as he can judge, and then offers him two dollars and fifty cents a day for his services? This, as the reporters say, "is no fancy sketch," but a stern reality, and happened very recently in this city. Indeed, I learn that a certain powerful corporation, a short distance from this city, will only give this miserable pittance to the men employed in their tool room. Now a tool maker, in the correct sense, is a person who is capable of doing the very finest work, as well as the heavier kinds, in metal. Theoretically, there exists no limit, either way, to the size of tools that may be demanded for various kinds of work. They may be as large as a house or as small as a fine needle; and the skilled tool maker is able to produce either of them, each one perfect in its way, from immense templates used in drilling heavy engine parts down to the marvelous combinations of jewels and hardened steel used in watch factories. He must be able to do a job at the forge that would put many a blacksmith to the blush; he must be very familiar with the working of steel, besides being a competent worker of sheet metals, and have a thorough understanding of solders; he must be able to do a good job in pattern-making and other woodworking; he must have a correct knowledge of drawing and a decent smattering of foundery work: in fine there is nothing, I might almost say, that can be constructed from any known materials on the face of the globe but the first class tool maker is supposed to be, and in fact must be, able to construct. And all this for two dollars and fifty cents *per diem*!

"But," says the fortunate one to whom this offer is made, "I can do any kind of tool-making: I can make gages for you so perfect that the slightest variation in temperature between the parts will make a perceptible difference in their fitting. You surely cannot expect me to work for such wages as you offer!" "Well, sir, you can take my offer or not, as you see fit," answers the advertiser; "I can get plenty of tool makers at that price." This brings me to the main point, one which I have long and earnestly pondered upon. The employers say that the tendency of strikes is to compel the good workman to carry the poor workman on his shoulders; and yet, if they can hire the veriest fool that ever undertook to finish a V thread with a three cornered file (and I have seen this attempted) who chooses to call himself a tool maker, for two dollars and fifty cents a day, they will not give more to the competent workman.

I do not believe in strikes; I never was connected with any but once, and then I saved my employers and fellow workmen each a serious loss by my action in the matter; but as long as there is such a state of affairs as now exists, just so long will the strike disease be either epidemic or sporadic.

The only remedy is, in my opinion, to have the trades legally recognized so far as to have a complete and perfect registry kept of all men who pretend to be skilled workmen, with a rating placed opposite each man's name; and let each have a certificate in his possession, showing his rate in the register. A mixed board, composed of employers and employees, could from time to time fix the ratings and a schedule of wages therefor. The workman's certificate would be his recommendation, and he would get paid according to his ability and skill.

I should like to see a full and free discussion of this subject in the columns of the mechanic's friend, the SCIENTIFIC AMERICAN.

D.

Harlem, N. Y.

A New Test for Boracic Acid.

To the Editor of the Scientific American:

While working with nickel and cobalt in connection with glycerin, a very unexpected result was obtained. A borax bead containing both nickel and cobalt was immersed while hot into glycerin; the bead, then heated gently before the blowpipe, gave at first a faint green coloration, then carbonized, giving off acrolein in abundance. The experiment was repeated, using only a cobalt bead, then a nickel bead; in both cases the result was a beautiful green flame. Thinking it very singular that such difficultly reducible metals as nickel and cobalt should give a coloration, the experiment was repeated, using only a borax bead and without the aid of the blowpipe

By gently heating the bead (after it was immersed in glycerin) in a Bunsen burner and then withdrawing, the glycerin caught fire and burned, first with a faint blue, then with a strong soda flame; finally the entire flame assumed a deep green color. Various other borates were then tried, with perfectly satisfactory results. A number of minerals containing boracic acid were next tested, and the result was satisfactory. In such minerals as tourmaline, where the test could hardly be expected to hold good, the green flame of the boracic acid was distinctly visible.

The following is the best mode of procedure: Finely powder the substance in an agate mortar; fill an elongated platinum loop with glycerin, introduce this into the fine powder, and gently heat in a Bunsen burner until the glycerin catches fire. If only a minute trace of boracic acid is present, it will be best seen by holding a piece of white paper as a background, and carefully watching just as the flame goes out.

M. W. ILES.

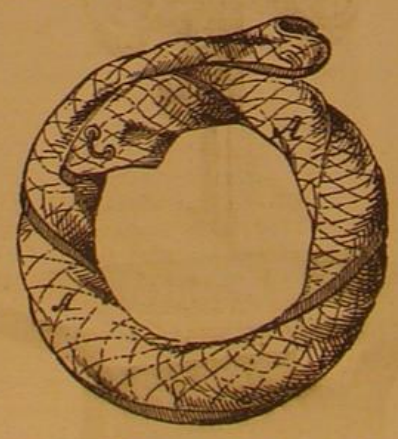
School of Mines, Columbia College, New York city.

IMPROVED HEAD MUFF.

Mr. Heimann Fürst, of Williamsburgh, N. Y., has recently patented an improved neck, ear, and throat protector,



which, when applied to the head of a man or boy, will protect and cover the back of the neck, the ears, and the throat, and allow the free use of a hat or cap. It is easily folded into a small coil for convenience in transportation, and when not required for use.



The engravings show the article while worn and also when not in use.

The Moon.

Professor Soule recently lectured on this subject before the San Francisco School of Mechanic Arts. He said that, in using the immense telescopes of modern times, one is surprised at the exceedingly small area that can be examined at one time, and by the great diminution of light which appears to take place. A careful survey of the surface fills one with astonishment that the placid, silvery moon should be changed in a ragged, gray, wrinkled, and pockmarked heavenly body.

On turning to the brighter portions, we find everywhere mountains, volcanoes, crevasses, and precipices of vast hight or depth. It seems to be a picture of desolation, enthroned upon a pedestal of ashes. Those mountainous parts reflect a brilliant light on account of their volcanic nature, the rocks being often smooth and polished, and their jagged surfaces giving them power to catch and throw light in every direction. The southwestern portion is especially volcanic in its appearance. On close examination, however, we find long ranges of mountains exhibiting no signs of volcanic action, but in many respects similar to the Sierras, much steeper on one side than the other, and apparently formed by similar forces, though as a rule the volcanic element prevails. Many of these mountains are of immense size; thus Clavius is 120 miles in diameter, and has an area of 12,000 square miles, and turrets on its walls shooting to an altitude of 16,000 feet. We next notice the frequent occurrence of ringed mountains, not more than 10 to 15 miles in diameter, and almost perfectly circular in form. They are found alone upon the level country, or in groups, and even upon the ridges of the walled plain. There are also craters and pits, which differ chiefly from the others in their smaller dimensions. There is also another prominent feature which has puzzled astronomers, even in the present day. From many of the ringed mountains, notably from Tycho, Copernicus, and Kepler, are radiations, extending in some cases hundreds of miles, which at the full of the moon glisten with a remarkable brightness. They shine as brilliantly under the oblique as under the vertical rays of the sun—a fact yet unexplained; they pass over the tops and through the craters of volcanoes, and through the valleys in an uninterrupted course. Of the many theories concerning them, perhaps the most reasonable is that they are veins of matter ejected from below during some great volcanic or earthquake disturbances, and in many respects they resemble our own trap dykes and seines.

Since the time of Galileo, astronomers have painfully, patiently, and perseveringly mapped every detail of the moon's surface, until we have lunar topographical charts more accurately constructed than any hitherto constructed of the earth's surface. Photography has recently aided largely in this work.

By careful experiments, it has been proven that the light of the full moon is only $\frac{1}{800000}$ part of that of the sun, and that she gives only one sixth as much light as would a pure white disk; therefore she is nearer black than white. An equal sized globe of fire brick or clay thrown into the orbit of the moon would furnish us with light as bright as our own luminary.

As early as 1700, efforts were made to ascertain if any heat came from the moon, her rays being concentrated by means of a lens upon the bulb of a thermometer, with no effect, however; and other and later trials with improved apparatus gave the same result, or in some cases indicated that the moon was shedding negative heat, or cold. It was only after the invention of the thermopile that evidences of lunar heat were discovered. The amount was excessively small, however. Lord Rosse, with the aid of his three-foot reflecting telescope and Thompson's galvanometer, show that little, if any, of this heat comes from the interior of the moon, or, in other words, that the body of the luminary would be cold but from the heat absorbed from the sun. This borrowed heat has been shown to raise the exterior temperature of our satellite to at least 50° Fah. As the sun's heat and light cease to fall upon her surface and are lost for 15 days at a time; and the remaining heat being radiated into space, the alterations of temperature must be something startling, and the changes in the physical features of the body produced by the enormous expansions and contractions of her outer substance must be great and very destructive.

Intelligence and Labor.

The old delusion that education is unfavorable to labor has almost passed away. We no longer argue that the more a man thinks, the less he is inclined to work, nor fear that the material interests of our country will suffer through intellectual cultivation. We acknowledge that a well educated man may work as well as his neighbor who can hardly sign his name; and we even go a step further, and admit that a certain amount of education is necessary to secure the best kind of labor. Yet we are still far from appreciating the full effect of mental progress upon industrial employments, or estimating the vast debt which the latter owe to the former.

Intellectual culture, so far from unfitting men and women for exertion, actually excites them to it. Ignorance is the chief cause of indolence, and they are rarely separated. Savage tribes know but little of the benefits that industry can secure, and, having scarcely a motive beyond that of appeasing hunger, are proportionately idle. Educate them—show them the superiority of a house to a wigwam, and of a comfortable dress to a blanket—and the industry which can secure these benefits immediately begins to expand. Each fresh accession of civilized life demands a fresh accession of labor; and in proportion as the results of industry become more and more apparent, industry itself will more and more develop.

Education benefits industry, not alone by exciting and increasing it. It has an equally direct and powerful influence upon it in raising and improving its quality. How is the soil made most productive? Not by an unthinking routine of drudgery upon it, but rather by a knowledge of its nature and requirements; a study of the laws which govern vegetation; a thoughtful consideration of the relations which subsist between human needs and the powers of agriculture to supply them. The success of manufactures is due almost wholly to the busy thoughts that are ever planning improvements; making new inventions; constructing machinery; combining and regulating labor, and adapting all the various means within reach to the highest and most productive ends. Commerce, too, owes its very existence to the same source. The more forethought, judgment, discretion, and knowledge the merchant possesses, the more certain we may be of his ultimate success.

The same is true of those occupations which we are accustomed to consider wholly manual. The mechanic or laborer who thinks out the meaning of his work, who enters into its spirit, who devises improved plans for its execution, and

sends a thought with every stroke, has tenfold the value of one who only bestows physical strength upon his work. In the province of domestic service, every housekeeper knows that the great lack is of mental, not bodily, power. There are plenty of girls who have the requisite muscle, but few who can furnish the judgment, care, forethought, and economy which are so needful in the kitchen and the nursery. Each laborer, whatever be his sphere of action, needs to understand the laws which govern his department of labor, and so to adapt his efforts as to conform with them. If he does not, his work must be to that extent unproductive and unsuccessful. These laws, however, are so entwined with those of other branches, and so dependent upon those of life in general, that a thorough education upon a broad basis is the best preparation for any kind of labor, and a continued mental discipline the best safeguard for its success. No industry can afford to slight the intellect; no man or woman who is a mere machine can ever give out his full value to the world, no nation or community can ever emerge from indolence, except in so far as they emerge from ignorance. In this country, where the opportunities of education are so numerous and so widely spread, it would hardly seem necessary to urge their acceptance; yet it is of the highest importance to our national prosperity and personal well-being that we all recognize the intimate connection between the growth of intelligence and the value of labor.—*Philadelphia Ledger.*

PRODUCTION OF LIGHT FROM MECHANICAL FORCE.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY DR. GEORGE F. BARKER, OF THE UNIVERSITY OF PENNSYLVANIA.

Proceeding on the principle that nothing should be taken for granted, the lecturer began by an explanation of the properties of magnets, dwelling particularly upon those which were necessary to a correct understanding of the subject. The name magnet is derived from the name of the ancient town Magnesia, where two important minerals were found, one, white, which is employed in medicine, and the other the black magnetic oxide of iron. This latter has the remarkable property of attracting iron: remarkable because it is not confined to the ore itself but emanates from it in all directions, thus enveloping it as it were with an atmosphere of force. This was illustrated by the familiar experiment of magnetizing a bar of soft iron by bringing the lodestone near it without touching. Upon removing the lodestone, the bar no longer attracted iron. It had lost its magnetism; a steel bar would have retained it permanently. It is of the utmost consequence to understand the manner in which the force emanates from a magnet, and it has been found that it obeys the same law as the force of gravitation, namely, that it diminishes precisely as the square of the distance from the source. If we measure this force at a certain distance from the magnet in one direction, and then find points in other directions where the force is exactly the same, we obtain what is called an equipotential surface; and by repeating this process at various distances, we map out what physicists have named the magnetic field. The direction of the lines of force was beautifully shown by means of an experiment of Professor Mayer's. Iron filings were sprinkled upon a glass plate, and this was placed upon a little bar magnet in the vertical attachment to the magic lantern represented in Fig. 1,

Fig. 1.



in which the light passing through the glass plate was reflected on the screen by a mirror. On slightly tapping the glass plate to give the particles of iron an opportunity of falling back upon the plate in obedience to the attraction of the magnet, they arranged themselves in symmetrical curves about the poles, forming an appearance designated as the magnetic spectrum. The particles in arranging themselves move at right angles to the lines of force. This was shown by means of a small needle suspended by a fine thread and introduced in the lantern. On gradually moving it around the magnet, it constantly changed its inclination so as always to preserve a position perpendicular to the lines of iron filings which represented the lines of attraction of the magnet.

As the earth itself is a great magnet, lines of force are passing out from it in every direction, and we have the means of recognizing them. A piece of soft iron held at a certain inclination, called the magnetic dip, becomes a magnet. This dip is inclined about 73° to the vertical. By placing a magnetic needle in the lantern, it was shown that a bar of soft iron, which before had no magnetic effect on the needle, began to attract it when held near it at the requisite inclination. On holding the other end of the bar up, its polarity was reversed, as its opposite effect on the needle proved.

The similarity of the action of electricity to that of magnetism was long known without suggesting the identity of the two forces to physicists. It was reserved for Professor Oersted to discover, by accident, that a wire, in which an electrical current passed, attracted the magnetic needle. Such accidents are possible only to men of profound insight, whose powers of observation have been trained by long habits of study. It required a Newton to perceive anything extraordinary in the fall of an apple. Professor Oersted's experiment was shown by placing a magnetic needle in the lantern, surrounding it by a coil of wire, and passing a current of electricity through the latter; the needle immediately began to move. On reversing the current, the needle began to swing in the opposite direction. To answer the question whether it was really magnetism which caused the deflection of the needle, and not some other force: in other words, whether the wire carrying the current had become a real magnet: the experiment with the iron filings was repeated, substituting a wire, through which a current passed, for the small bar magnet of the first experiment. The reflection of this wire on the screen was vertical; and when the plate was tapped, the iron filings arranged themselves in horizontal lines. As in the case of the magnet, therefore, they were perpendicular to the lines of force, and it was evident that the copper wire had become a magnet, having its poles along its sides. By making a coil of the wire, we multiply the effect, because we multiply the lines of force; and this is the way to obtain

Fig. 2.



the most powerful magnets. A bar of iron thrust into such a coil, as in Fig. 2, will occupy a position perpendicular to all the lines of force in it, and therefore capable of yielding the maximum effect. A diminutive piece of iron in horseshoe form surrounded by wire was then introduced in the lantern, and it attracted its armature every time a current was sent through the wire. In the next experiment the same little magnet was used with iron filings to show that the magnetic spectrum of these electro-magnets is similar to that of ordinary magnets. The immense electro-magnet of the Stevens Institute, which was mounted upon the stage, formed an amusing contrast to the little bit of iron used in the lantern.

Great as was the discovery that electricity can be converted into magnetism, it must yield in importance to the one that magnetism can be converted into electricity. Arago was the first to observe that, when a copper disk is rapidly rotated under a magnetic needle, from which it is separated by a glass plate, the needle gradually begins to swing with it, following its rotation. His apparatus is represented in

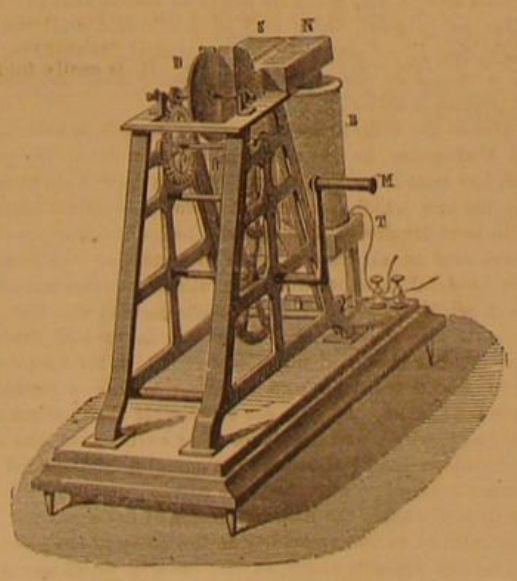
Fig. 3.



Fig. 3. It was left to other physicists, and especially to Faraday, to explain the phenomenon. Their conclusions may be briefly summed up in the statement that, whenever any substance capable of conducting electricity is moved across a magnetic field, a current of electricity is generated in that substance; and this current is the more powerful, the more nearly the motion is perpendicular to the lines of magnetic force. To show this fact, the large electro-magnet of the Institute was used. A wire connected with a galvanometer in the lantern was moved up and down in front of one of the poles of the magnet, so as to cut some of the lines of force proceeding from it in every direction. The effect was that every such motion caused a deflection of the needle, showing that an electrical current was generated.

An interesting experiment to illustrate the same principle was made with the apparatus represented in Fig. 4, which

Fig. 4.



consists essentially of a copper disk rotated between the poles of an electro-magnet, and therefore fulfilling the conditions of maximum effect by cutting the lines of force perpendicularly. This apparatus turned very easily by means of the crank, M, as long as the current did not pass; but the moment the connection was made, it required all the strength of the assistant to manage it. This is explained by the fact that the copper disk is magnetized, and there is a tendency of the unlike poles of the disk and the magnet to attract each other, and hence to offer resistance to further rotation. The magnetization of the disk was shown by connecting it with the needle in the lantern by means of copper wires. If the further rotation of the disk is persisted in, it becomes hot, as was shown by connecting it with a thermo-electric pile and the galvanometer in the lantern. The resistance experienced by the copper disk was excellently shown by means of another experiment of Professor Mayer's, in which a large thin copper disk was made to swing to and fro, like a pendulum, between the two poles of the large electro-magnet. The moment the current passed around the coils of the magnet, the motion of the copper disk was arrested between the poles.

If, then, we are able to obtain an electrical current by cutting the field of a magnet, we ought to be able to do the same by cutting the lines of force of the earth This the lecturer accomplished before the audience, by moving a coil of wire, of large diameter, across the line of dip, and showing the effect on a galvanometer needle connected with the coil; every time the coil moved, an oscillation was imparted to the needle, which was distinctly visible upon the screen. The utilization of this force of the earth, like that of the sunlight for mechanical work, belongs to the future.

We have seen (in Fig. 4) the conversion of the mechanical power of the arm into heat and magnetism, and also the equivalence of magnetism and electricity. There remains the problem to turn these forces into the incomparably more subtle one of light. As in business, so in Science, it is the problem to convert raw material into high-priced products in the most economical way. A pound of cast steel of trifling value is worth thousands of dollars when converted into hair springs for watches. In the production of light, the great difficulty is to utilize our force. Even in the steam engine, only about ten per cent of the fuel is utilized as mechanical force; but when we come to light, that most imponderable of all the forces, we can scarcely utilize two per cent. When a powerful current of electricity is passed through an adequate conductor, it flows along peaceably and without unusual manifestations; but if the conductor is too thin, and it is obliged, as it were, to "crowd and elbow its way through it, it becomes red in the face, and we have the phenomenon of red heat; interrupt the conductor altogether, and make it leap over an empty space, and it becomes white in the face, emitting a brilliant light." The latter is the case in the electric lamp, Fig. 5. One of these lamps was placed upon the

Fig. 5.



stage in connection with the Gramme magneto-electric machine, in which a powerful current of electricity is generated by causing the rapid revolution of one electro-magnet between the poles of several larger ones, by means of steam power derived from an engine in the basement of the Institute. This machine will be explained in the next lecture: suffice it to say, for the present, that the light obtained was equal to about 1,600 candle power. It inundated the hall with a flood of light, and illuminated the fronts of the houses on both sides of the way.

C. F. K.

Useful Recipes for the Shop, the Household, and the Farm.

A simple way of hardening small watch drills: Heat the tools in the flame of a candle and then plunge suddenly in the candle grease. This is done on account of the drills being so small that they will not retain their heat sufficiently long to enable the operator to remove them from the source of heat to a vessel containing water used for hardening.

Jewelers will find the annexed list of silver solders of considerable practical value. Hard solder: Pure silver 16 parts, copper 3½ parts, spelter ½ part. Medium: Fine silver 15 parts copper 4 parts, spelter 1 part. Easy solder: Fine silver 14 parts, copper 4½ parts, spelter, 1½ parts. Common hard solder: Fine silver, 12½ parts, copper 6 parts, spelter 1½ parts. Common easy solder: Fine silver 11½ parts, copper 6½ parts, spelter 2 parts. The fusing points of these solders are as follows: No. 1, 1,866° Fah; No. 2, 1,843°: No. 3, 1818°; No. 4, 1,826°; and No. 5, 1,802°.

The following is an iron cement which is unaffected by red heat; 4 parts by weight iron filings, 2 parts clay, 1 part fragments of Hessian crucible. Reduce to the size of rape seed and mix together, working the whole into a stiff paste with a saturated solution of salt. A piece of firebrick can be used instead of the Hessian crucible.

Böttger suggests the following process for dyeing cotton pure blue: Heat a mixture of 137 grains Paris blue, 137 grains tartaric acid, ½ fluid oz. ammonia water, and 2½ fluid ozs. water, and filter after cooling. Add to the deep blue filtrate a solution of caustic soda, until it is decolorised and after some time assumes a light yellow tint. Impregnate the cotton with this solution and pass it (best after allowing it to dry) through a warm, very dilute solution of sulphuric acid, and it will immediately assume a beautiful blue color and needs only to be washed in water. The sulphuric acid may be so diluted that it has scarcely a perceptibly sour taste.

The best material for hot beds is horse manure well turned and mixed with about one third its bulk of oak leaves. Another excellent mixture is the above with cotton waste, one half waste and leaves, the other half manure. The middle of March is the proper time to start the bed in northern States, and a mild day should be selected for the work. Dig a pit about 3 feet deep in front, 8 inches deeper at the back, and 6 feet wide. This affords an opportunity for adding linings if it be deemed necessary, when the heat in the bed decreases.

The Western tannin plant (*polygonum amphibium*), which grows luxuriantly in the Missouri Valley, seems destined to replace oak bark in tanning. It contains 18 per cent of tannin, while the best bark contains but 12 per cent; and large establishments employing it in Chicago find that one third more leather can be obtained with it than with a like quantity of bark. The process of tanning with it is identical with that with bark, but the leather is tougher, finer, and more durable, and receives a finer finish. The plant is an annual, and can be mowed, dried, and stacked like hay.

To prevent pumps freezing, place a small tack just under one edge of the leather valve which retains the water, sinking the tack into the leather to hold it. This will cause a small leak, and the water will not remain long enough to freeze

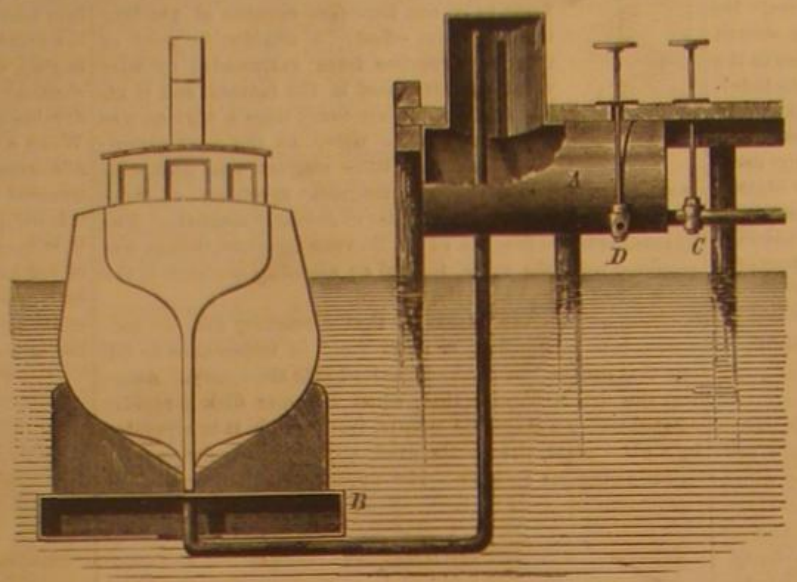
NEW MODE OF DOCKING VESSELS.

The ordinary method of raising vessels, so as to allow of repairs being made upon their bottoms, consists in floating them upon submerged docks. Out of the latter the water is then pumped, and as the dock rises the vessel is simultaneously lifted. The inventor of the new plan for accomplishing the above considers that the pumping out of the water is an expensive process, which may well be replaced by employing compressed air to enter the compartment in order to force the water therefrom, and at the same time render the dock buoyant.

This plan, it is believed, is susceptible of a variety of practical applications. As represented in the engraving, air is compressed into the tank, A, and, passing through the pipe shown, enters the dock, B. In order to effect this compression, the pressure of water in city mains might be used, or suitable storage reservoirs could be arranged to collect rain or surface water and hold it in readiness to exercise the pressure when desired. In such case the water would enter the tank, A, through the valve, C, and, rising therein, would drive the air down through the pipe. After the water had reached a certain level in the upper extension of the tank, the valve, C, would be closed, and the exit valve, D, opened. The tank being emptied would be again filled, and thus the process might continue until the desired end were accomplished.

An engine might be employed, if desired, to compress air into the tank, or any other suitable means used, which would afford a pressure sufficient of course to overcome the resistance of the column of water, depending on the depth of the dock.

The invention, which was patented September 8, 1876, is a simple one. For further particulars address the inventor, Dr. T. J. Wheeden, 107 Sands street, Brooklyn, N.Y.

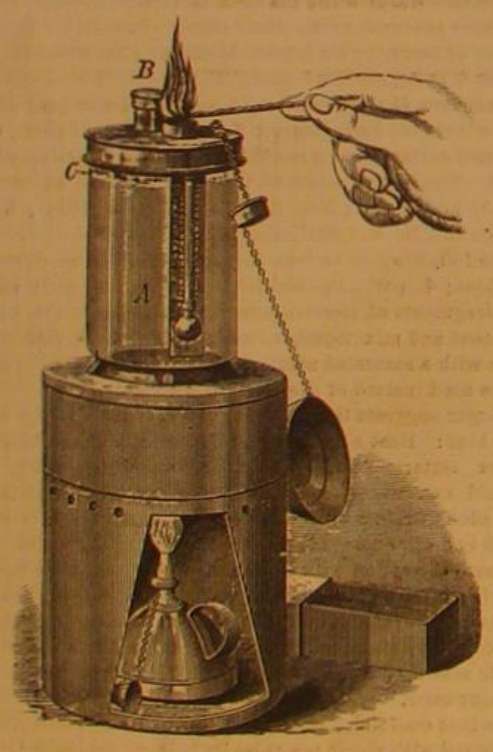


WHEEDEN'S MODE OF DOCKING VESSELS.

IMPROVED APPARATUS FOR TESTING ILLUMINATING OILS.

We have so frequently called the attention of our readers to the dangers attending the use of cheap and inferior kerosene oils that to repeat the warnings is scarcely necessary here. Kerosene accidents, with their disastrous results, need not occur if the retailer or consumer of the oil who will take the trouble can, by a simple test, satisfy himself as to the safety of the same.

Any oil which will evolve inflammable vapor at so low a temperature as 100° Fah. should be as scrupulously avoided as



if it were gunpowder. That temperature may easily occur in a lamp, and the vapor therein forming, mingling with the air, may readily be ignited by a chance draft blowing down the flame above. It is a safe rule not to purchase oil which will flash under 110° Fah., and it should be further understood that the greater the heat the material will endure, above 110°, the greater the proportional increase in its safety and value.

In order to admit of the making of the test above referred to with ease and certainty, Mr. Pethuel Millspaugh, of Kent, Conn., has recently introduced a simple little apparatus which is represented in the accompanying illustration. It consists of a sheet metal chamber which receives a lamp below, and a glass vessel, A, above. The latter is formed with a contracted lower portion, so that the wider part above makes a shoulder, enabling the glass to be firmly set in the orifice over the lamp. The vessel is surmounted by a suitable cover, in which there is a filling aperture, B, and another opening, at which the test is made. To the cover is also attached a small thermometer, as shown.

The method of using the device consists in filling the glass, to the point, C, with the oil to be tested. The lamp is then ignited; and a lighted taper is from time to time applied to the cover orifice, as represented in the engraving, until a flash takes place, when it remains only to note the temperature of the oil as indicated by the thermometer. The tapers are shown in the small box beside the apparatus, and are sold with the latter.

When it is desired to determine the degree of heat at which the fluid actually takes fire and burns, which is commonly called the fire test, the apparatus may be easily adapted therefor by removing the cover (though leaving the thermometer in the fluid) and touching the surface of the oil with the taper.

These tests are very easily done, and are claimed to be accurate. Sufficient oil is held in the glass vessel for a fair and satisfactory trial; and the process of heating is slow and gradual, approximating closely to the manner in which the oil is heated when it is used for domestic purposes.

Mr. Millspaugh (who may be addressed as above for further particulars regarding the device) is also the author of an excellent little work entitled "Kerosene Accidents, and How to Prevent Them," which goes over the whole subject of these casualties in detail, giving a large number of valuable and practical suggestions. It might be read with profit by oil dealers and housekeepers generally.

A Certain Cure for Rheumatism.

Judging from his article in the *Wiener Medizinische Presse*, Dr, Franz Zeller is an enthusiast in the administration of caustic ammonia in rheumatism. For several years he had been a sufferer from severe muscular rheumatism in the right shoulder: he had taken all the anti-rheumatic remedies, with but little alleviation, when he began to reason that in rheumatism, as in gout, there may be a uric acid diathesis; he thought that *liquor ammoniæ*, on account of its rapid volatilization, would be the remedy most readily absorbed and the most prompt in action.

In almost the same moment in which he took one drop, diluted with water, he felt a complete relief from the pain, which had lasted for ten hours; he was now able to move freely the arm which, an instant before, he could scarcely bear to have touched. The remedy, he claims, has proved a positive cure in all recent cases of muscular rheumatism which have fallen under his observation; he cites numerous cases in which relief, as instantaneous as his own, was experienced. He also observed its effects in several cases of acute articular rheumatism, in two of which six drops sufficed to subdue the pain and swelling within a period of twenty-four hours. In one case of chronic rheumatism of a finger joint, which had lasted for over half a year, the simple administration of the ammonia completely dispelled the inflammation and pain in the joint within two days.

He then discusses the mode of action of his remedy. "If we consider an excessive acidity as the cause of the rheumatism, we can scarcely claim, in the cases in which one drop will instantaneously relieve the pain in recent rheumatism, that one drop was sufficient to counteract the effects of the excess of uric or (according to Fuller) lactic acid.

"Nothing remains therefore but for us to seek for the source of rheumatism in a morbid nervous activity induced by disturbances of nutrition, and to believe that the ammonia acts as a nervine directly upon the nerves."

After the cure of one attack of rheumatism, our object should be to put the patient in such a condition as to prevent their recurrence. This, the writer thinks, can be done by building up the general system, and thus diminishing the nervous excitability.—*The Clinic.*

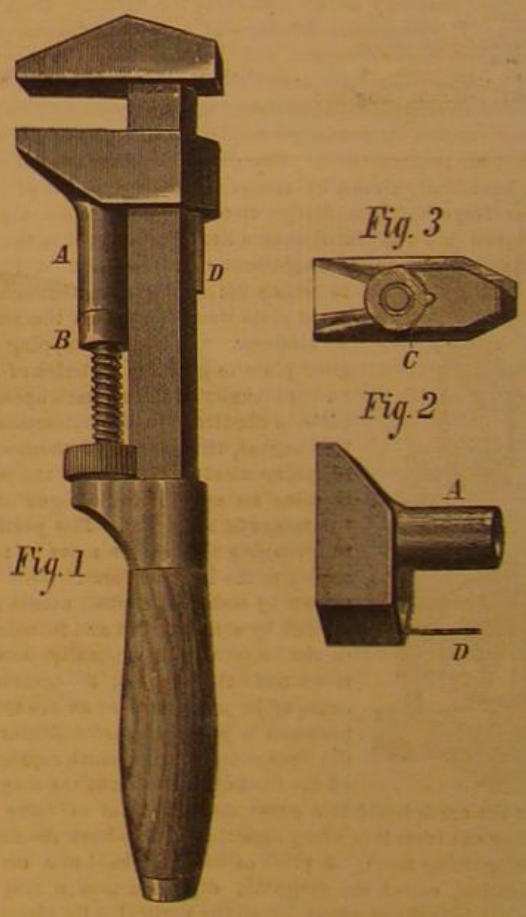
Power for Flouring Mills.

Mr. Henry Cabanes, miller and constructor, of Bordeaux, France, writes to *The Miller* as follows: "The force employed to drive a corn mill depends not only upon the quantity that is required to be ground, but also upon the nature of the wheat and the quality of grinding required; and it cannot be definitely answered without further information. I can nevertheless give you an approximate idea of what can be ground by one horse power of steam, including the necessary machinery for cleaning wheat, and dressing flour. 1. Forty-four pounds of wheat, in a good mill making flour for sale and also for baking, which in one grinding gives the largest possible quantity of fine flour, with broad and well cleaned bran, such as is done by mills around Paris and other neighborhoods, yields from 55 to 60 per cent of first flour from the first grinding; this of course varies with the nature of the wheat. 2. Fifty-five to fifty-seven pounds in mills where it is ground more round or higher, the stones being further apart, and when the millstones are not kept in condition for fine grinding, makes 45 to 55 per cent of first flour, according to quality of the wheat. 3. Sixty-six pounds in mills grinding coarser, with smaller bran more broken and not well cleaned, produces only from 40 to 50 per cent of first flour in the first grinding. Having given these particulars, supposing the grinding you require to be average quality, making fifty-five to fifty-seven lbs. of meal per horse power per hour, it is necessary to reckon 7 horse power for each pair of 4 feet stones or 4 feet 4 English. To work the three pairs with all accessories would require an engine of 21 indicated horse power. Two questions here present themselves, worth more consideration than is frequently given: Speed according to diameter (and in this case 180 revolutions appear to me excessive) and weight of the running stone, which, from all I can gather and from my own practical experience, I consider should be in proportion to the work to be done. Should this answer not be completely satisfactory, I shall be most happy to reply to you further; and perhaps I may be able to prove to you that it is easier than you think to grind 77 to 88 lbs. of meal per horse power, and obtain 55 to 60 per cent of first flour, running the stones at only 125 to 130 revolutions per minute."

BEDELL'S RAPID TRANSIT WRENCH.

An important advantage of this wrench is its capability of immediate adjustment to any size, and the consequent obviation of the slow process of working a screw to set the moving jaw as required. The inventor asserts that no pressure comes on the handle, owing to the movable jaw binding tightly (through said jaw having but one keeper), against the bar, which portion, he claims, is thus rendered about one third stronger. It is further claimed that all the parts are of nearly equal wear. The bevel on the rear portion of the head admits of the use of the wrench in close quarters, and of its turning 45° further than if it were square.

The movable jaw, A, is entirely detached from the screw, which passes loosely into it. Said jaw embraces the bar, as shown, and is provided at the rear with a spring, D, Fig. 2, for holding it against the bar. B is a carriage, screw-threaded



to receive the adjusting screw, which is operated in the usual way by a milled head. The rear portion of the carriage travels in a groove or channel in the bar, as indicated at C, in the horizontal section, Fig. 3.

In order to adjust the wrench it is only necessary to run the movable jaw up by hand until the object is embraced, when the spring holds the jaw in place until the milled screw head is turned sufficiently to bring the carriage against the base of the jaw, so securing the latter tightly.

The absence of a thread on the jaw, which is apt to wear out or bind on the screw, is a point of advantage, as is the absence of nut, ferrule, or any other device for holding the pressure bar in place. The latter receives the strain in a diagonal direction, downward and rearward, and, according to the inventor, will not spring in the back under a stress less than that previously mentioned.

Patented September 28, 1874, and January 12, 1875. Foreign patents now pending through the Scientific American Patent Agency. For information relative to sale of paten or lease on royalty, address the inventor, Otis T. Bedell, care Ely & Wray, 83 Reade street, New York city.

Killed by a Meteor.

An intelligent black boy was trudging along a highway at night in the vicinity of Palestine, Texas. There was a negro woman riding a horse in the direction in which the boy was going. The intelligent black boy re-appeared in Palestine that night out of breath and as pale as he could get. He said he saw a ball of fire come out of the sky and strike the woman and set her ablaze. The horse ran one way with the woman afire on his back, and he ran back to town to tell the people what had happened. The people went to look after further particulars of this curious incident. They found the woman lying on the ground with all her clothing burnt off, but with life enough in her to tell that she had been struck in the breast by a ball of fire. The horse was found with his mane singed, and the woman died the next day. The people think she was hit by a meteor.—*St. Louis Republican.*

Novel Toy.

An ingenious toy, apparently of Japanese origin, has recently been introduced into London. It consists of a small picture, on paper, of an individual pointing a firearm at an object—bird, target, or second person. By the application of the hot end of a match, just blown out, to the end of the gun, the paper commences to smolder toward the object aimed at, and in no other direction. When it is reached, a report is heard, from the explosion of a small quantity of fulminating material.

THE OWL PARROT.

This singular bird, sometimes called the night parrot, belongs to New Zealand, and is called by the natives the kakapo. Dr. Gray describes it as having a high and short bill, grooved on the sides, with acute top, dentated lateral margins, and a base covered with fine, down-like feathers. The wings are short and rounded, and the fifth and sixth quills are equal and the longest; the tail is moderate in size and each feather points out, with the shaft projecting. The *tarsi* are short and robust, and covered with round scales; the claws are long, strong, and slightly curved. In general, the bird has the form of a parrot, but bears a facial aspect resembling that of an owl, of which it also has the nocturnal habits, and the almost noiseless flight. But it is not a bird of prey, as it eats corn and nuts readily when in captivity, its food in a wild state consisting of seeds, roots, and the outer covering of the stalks of New Zealand flax (*phormium tenax*). Its only vocal effort consists in a short croak; it breeds in February, laying two or three eggs; and it becomes gregarious in winter, and in the advent of spring resumes its solitary habits. The flesh is white, and is said to be good eating. The specimens herewith illustrated are domiciled in the unrivaled collection in the gardens of the Royal Zoölogical Society, London, England.

THE OPIUM POPPY.

The opium poppy is a native of Persia, and probably also of the south of Europe and Asia Minor. It is largely cultivated in those countries, and also in Egypt, Arabia, and British India, for the sake of its opium. Dr. Joseph Hooker



THE OPIUM POPPY (*papaver somniferum.*)

thus describes this process: "The capsules are sliced in February and March with a little instrument like a saw, made of three serrated plates tied together. From the incisions made by this instrument, the opium oozes out as a milky juice, which, as it dries, becomes a soft brown sticky paste; each morning this paste is scraped off by means of small shells, and collected into jars, the contents of which are afterwards made into balls of about half a pound weight; these are often coated with the seeds of some species of *rheum* or rhubarb plant. The balls are packed into chests, and exported to other countries."

Opium is produced in large quantities in India for consumption in China, on account of the great sale there, in spite of all prohibitions. Eastern nations generally are very fond of opium, which they smoke with their tobacco, or alone, and take in the form of pills. With us it is much used in medicine as an anodyne, especially in the well known preparation called laudanum; and the delusive habit of taking it to obtain a fleeting repose of the nervous system has recently grown, as our medical men can testify, to alarming proportions.

Poisoned Arrows of the Papuans.

The warlike habits of the Papuans and their implements of warfare are described in a private letter recently addressed to Dr. Hooker. The writer says that no man leaves his dwelling, for his bit of cultivation even, without his powerful bamboo bow and a few deadly poisoned arrows. These poisoned arrows are only a few among a great number not poisoned, the former being distinguished by elaborate carving and painting, probably to prevent accident among themselves. They are each pointed and barbed with human bone brought to almost needle-like sharpness, most carefully and neatly finished; they are poisoned by plunging in a human corpse for several days. Poor Commodore Goodenough and his men suffered from arrows so poisoned. It is a sort of blood poisoning that, like other kinds of inoculation, does not develop itself for several days, the slightest scratch being sufficient to render almost inevitable a horrible death. The symptoms are accompanied by violent spasms like tetanus, with consciousness until the last.—*Nature.*

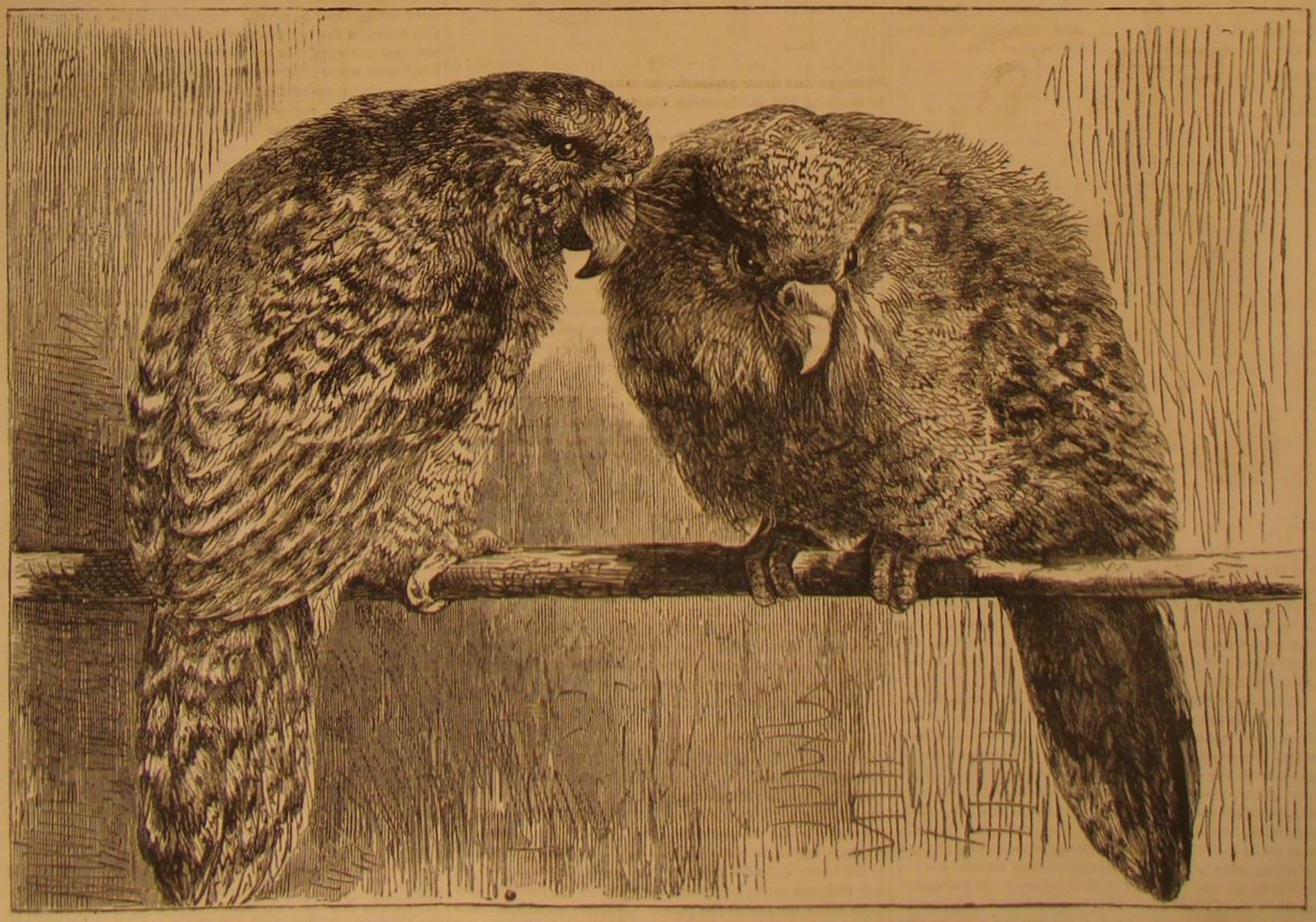
Life in Great Cities.

The relative healthfulness of some of the great cities is shown in the following table, which exhibits the annual mortality for each 1,000 inhabitants:

Madrid	65·0	Turin	24·8
Vienna	32·7	Brussels	24·8
Berlin	30·6	Paris	23·2
Rome	29·3	London	22·2
New York	27·9	Philadelphia	20·3

The above estimate for Madrid is from a recent compilation given in *La Gaceta Industrial* in that city. The capital of Spain is thus made to rank as one of the most unhealthy places in the world

A GOOD cement for covering the joints of ovens, which becomes very hard and does not crack, is made by mixing equal quantities of finely sifted wood ashes and clay. Some salt is added and then sufficient water to form a dough. The cracks should be covered while the oven is cold.



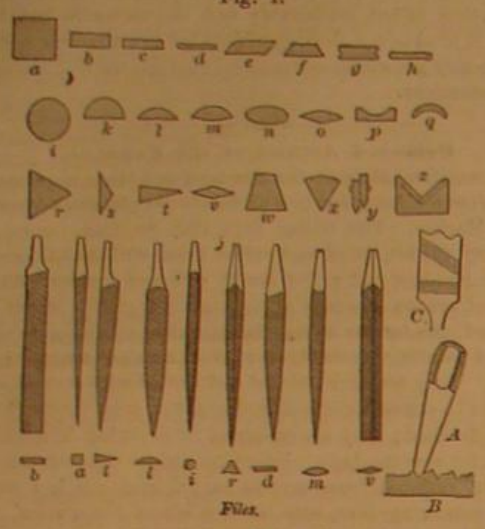
THE OWL PARROT.—(STRIGOPS HABROPTILUS.)

FILES, FUSES, AND LOW WATER ALARMS.

Our extracts from Knight's "Mechanical Dictionary,"* this week, include illustrations of all the different forms of files, of a variety of fuses, electric and otherwise, and of a number of ingenious low water alarms.

Files are graded by shape, size, and fineness of cut; and also are known by their purpose. As to shape, the series of sections given in Fig. 1 will be readily understood. *a*, *b*, *c*,

Fig. 1.



Files.

d, *e*, *f*, *g*, *h* are sections derived from the square; *i*, *k*, *l*, *m*, *n*, *o*, *p*, *q* are derived from the circle, and *r*, *s*, *t*, *v*, *w*, *x*, *y*, *z* from the triangle. The files represented in the succeeding engravings are known as follows: *a* is a square file, parallel or taper, sometimes with a safe side; *b*, when large, is a cotter file, when small, a verge or pivot file. *c* is a flat file; when small, a pottance file; when narrow, a pillar file. *d*, when parallel, is an equaling, clock pinion, or endless screw file; when taper, a slitting, entering, warding, or barrel hole file. *e f* is a French pivot or shouldering file; when parallel, a V file. *g* is a nail file for the finger nails; *h*, a pointing mill saw and round edge file; *i*, round, gulleting, or rat edge file; *k*, frame saw file; *l*, half round, nicking, piercing, or round-off file; *m*, cross file, double half-round file; *n*, oval file; *o*, balance wheel or swing wheel file, the convex side only being cut. *p* is a swaged file for finishing brass moldings; *q*, a curvilinear file; *r*, triangular, three square, or saw file: *s*, cant file, for filing inside angles of 120°; *t*, when parallel, is a banking or watch pinion file, when taper, a knife edge file. *v* is a screw head, feather edge, or slitting file; *w*, a valve file; *x*, triangular-and-half-round file; *y*, double or checkering file for gunsmiths; *z*, double or pencil-sharpening file.

As to character of teeth, the classes are: Double cut, having two sets of teeth crossing obliquely; single cut or float, having but one row of teeth; rasp, having detached teeth made by a punch instead of a chisel. At A is shown the position and action of the file chisel on the blank. C shows the appearance of the rows of teeth. The following table gives the approximate number of cuts in an inch of file:

Length of file in inches	4	6	8	12	16	20
Rough	56	52	44	40	28	21
Bastard	76	64	56	48	44	34
Smooth	112	83	72	72	64	56
Superfine	216	144	112	88	76	64

Figs. 2 and 3 represent a

FILE CARRIER AND FILING BLOCK.

Fig. 2.



File-Carrier.

The first is a tool holder like the stock of a frame saw, and

Fig. 3.



Filing-Block.

is used to mount a file in a similar manner. The file block is of suitable wood, and is gripped in the jaws of a vise. It has grooves of varying depth, in which small rods, bars, or wires may be laid, to be filed conveniently.

Fig. 4 represents different kinds of

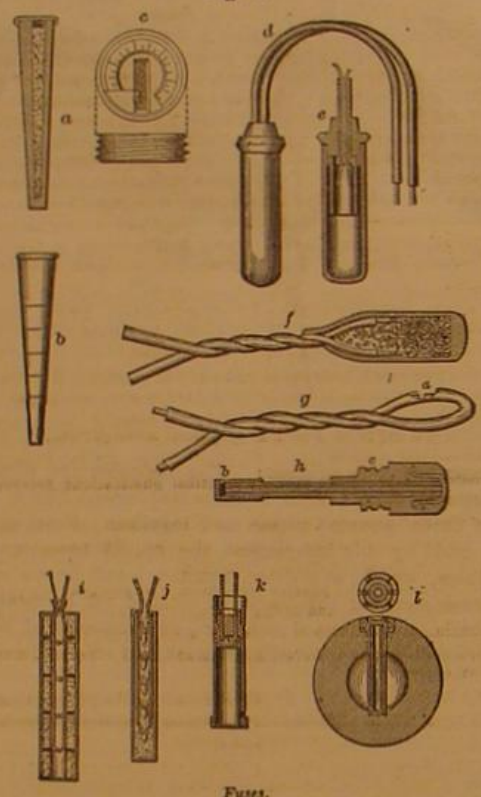
FUSES.

a b is the common wooden fuse for shells. It is filled with a slow burning composition, and for use a part is cut off at the smaller end, the amount removed regulating the length of time which the fuse burns, and consequently the duration of the period prior to the bursting of the shell to which it is attached. *c* is the Bormann fuse, which consists of a disk of an alloy of tin and lead, in which a deep channel is made to receive the composition. At the end of the channel is an aperture communicating with the exploding charge. A cap covers the disk, and is marked to indicate seconds and fractions of the same. To use the fuse, the outer covering is perforated at any desired mark, when the composition ignites by the flame from the gun passing through the aperture made, and burns until the magazine inside is reached. Bishop's electric fuse, *d*, *e*, comprises an inner and outer cylinder, protected by a perforated cap, through which the insulated conducting wires pass. *f* illustrates another form of electric fuse, in which the ends of the conducting wires are united by a fine wire of platinum. This last becomes highly heated when the current passes, and so ignites the powder. The operation of Statham's fuse, *g*, depends on the fact that a copper wire, covered for some time with vulcanized rubber, becomes coated with a layer of sulphide of copper, which is a moderately good electric conductor. This is utilized by twisting a piece of rubber-covered wire into a loop, when part of the covering is removed (at *a*) and the wire severed. Consequently, when a spark is passed along the wire, on reaching this spot it must follow the film of sulphide adhering to the rubber; and the resistance which it has to overcome causes the sulphide to ignite.

i j k illustrates Shaffner's blasting fuses and cartridges. *i* is a hollow cartridge provided with central and diverging spaces, occupied by a series of fuses and loose nitro-cotton, the whole covered with a waterproof casing, into which the ends of the conducting wires pass. In *j*, the main wires pass to the mine or cartridge, and are connected by smaller wires to the fuses, a number of which are placed in a single charge of explosive material. *k* is provided with a wooden head enclosed in an indented cylinder, closed by a cap; the head has a recess for the composition, and another for cement for the conducting wires. The Abel fuse, *h*, consists of a wooden head, into which the insulated conducting wires enter, and are covered with a tin foil cap containing the priming.

Powel's fuse, *l*, admits of being turned within the plug, which is screwed into the shell so as to bring corresponding apertures in the fuse and the plug into communication.

Fig. 4.



Fuses.

These are so adjusted to each other that the composition may be made to fire the bursting charge at the expiration of a given time.

LOW WATER ALARMS

may be classed under four heads, as follows:

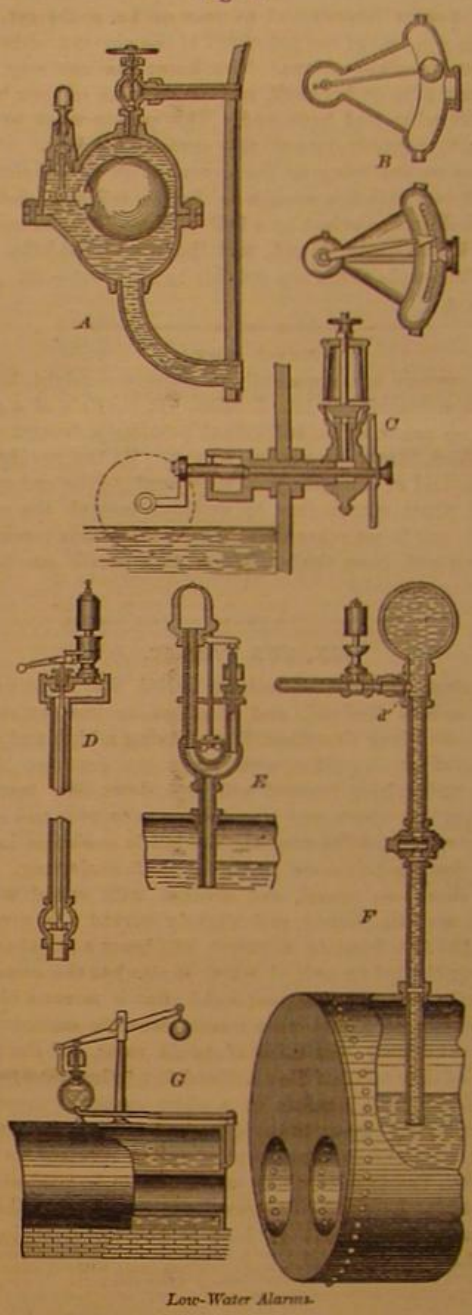
1. The float movement: A. The float is attached to an arm, and is immersed in water in the chamber which communicates by pipes with the boiler. Should the end of the lower pipe be uncovered by the subsidence of the water to that level, the water leaves the chamber and the float falls, depressing the valve and admitting steam to the whistle. When the water rises again, the upper valve is moved to allow steam to depart, and the normal condition is re-established. B. The hollow steamtight case has a central hub and a sector space, occupied by the arm of a float, which rises and falls with the changes of level of the water in the boiler. An indicator on the same axis moves with the float. C. A float is placed on the crank arm of the valve stem, and rises and falls with the changes of the water level, bringing a stud on the stem against an inclined socket, and raising the valve from its seat. This allows steam to pass to the whistle.

2. The thermostat movement: D. When the water subsides below the end of the vertical pipe, which extends downward into the boiler, the water contained therein is discharged and steam substituted. The increased heat, due to the presence of steam, elongates the thermostatic rod in the tube, and acts upon the lever to lift the valve from its seat; the steam rushes out and sounds the whistle. E This acts similarly to the foregoing, except that the effect is due to the expansion of the steampipes when the water is emptied and steam admitted. The lever has its fulcrum on a post between the pipes; the expansion of one of the latter depresses the valve stem and withdraws the valve from its seat; the expansion of the other pipe withdraws the seat from the valve. The action of the two is cumulative. The passage of steam sounds the whistle, as in other devices for the same purpose.

3. The fusible plug action. F. After the boiler has been filled to the water line and put in operation, the pressure of the steam forces the water into the pipe and air chamber, *e*. As there can be no circulation of water in the pipe as long as the lower end of it is under the water line, the disk, *d*, will continue solid; but when the water in the boiler evaporates below the end of the pipe to the alarm water line, then the water in it falls of its own weight into the boiler, and steam at once takes its place, melts the plug, and notice of low water is given by the sounding of the whistle.

4. The gravity movement: G. A vertical pipe passes into the boiler, and its open end is at the level at which it is desired notice shall be given. This pipe forms a communication between the boiler and a reservoir on the end of a hollow arm and axis. In the normal condition this reservoir is filled with water; but when the end of the pipe is uncovered by the subsidence of the water level in the boiler, the water runs out of the reservoir and steam takes its place. The change of weight in the reservoir, due to the substitution of steam for water, causes the arm to be lifted by the weighted lever, and raise the valve which admits steam to the whistle.

Fig. 5.



Low-Water Alarms.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

BOILER PLASTERING.—THE UNITED STATES AND FOREIGN SALAMANDER FELTING COMPANY *vs.* THE MERRIMACK MANUFACTURING COMPANY.—THE SAME *vs.* THE LAWRENCE MANUFACTURING COMPANY.

[In equity.—Before SHEPLEY, J.—Decided October, 1875.]

The first claim of plaintiffs is for a composition for coating the exterior of steam boilers, pipes, or other heated surfaces, composed of asbestos and lime putty, charcoal, and pumicestone, or their equivalents, and is infringed upon by the defendants in their use of an inner coating of a mixture of clay and asbestos, crushed or ground, with the addition of a little hair and some other fibrous substance, with a coating composed of a mixture of clay and charred fiber, or cocoanut, or cane sawdust ground, wool, or shoddy.

The second claim is for a composition, for the same purpose, of asbestos and lime putty.

This claim is infringed by defendants in their use of asbestos and whitewash (which is the same as lime putty in this composition) and clay, which is also proved in this composition of matter to be a well known equivalent for the lime putty.

SHEPLEY, J.:

These are actions at law against the defendants for alleged infringements of letters patent No. 4,134, dated September 27, 1870, reissued to the complainants as assignees of John Riley and Charles W. Bissell for an improvement in compositions for covering steam boilers, steam pipes, etc., and also for alleged infringement of letters patent No. 114,711, dated May 9, 1871, and letters patent No. 108,055, dated October 4, 1870, both to John Riley, of Troy, N. Y., assignor to the complainants, for an improvement in compositions for covering steam boilers, etc.

The reissue No. 4,134 described the essential part of the invention as consisting in the employment of lime putty, or lime mixed with water, so as to be of the consistence of glazier's putty, with some non-conducting fibrous material, such as paper pulp, and with pulverized earthy materials, which are light, porous, and are non-conductors of heat, such as plaster of Paris, water lime, cement, sand, soapstone, or black lead.

The invention described in letters patent No. 114,711 consisted in the employment of a combination of asbestos and lime putty, either with or without the other ingredients hereinafter named, as a coating for steam boilers and pipes. The other ingredients named were charcoal and pumicestone, or their equivalents.

The invention described in letters patent No. 108,055 consisted, so far as the invention related to the covering of steam boilers, in the addition of ground gypsum, or plaster, or pumicestone to the composition described in the reissued patent No. 4,134.

The defendants coat their pipes with an inner coating of a mixture of clay and asbestos, crushed or ground, with the addition of a little hair and some other fibrous substance. The next coat is a mixture of clay and charred fiber of cocoanut or cane sawdust ground, wool, or shoddy. Outside of this is a thin wash of lime with a slight mixture of hair. Outside of the second coat, in some instances, is a mass of fiber wound around the second coating. This covering of cord or fiber is covered with lime.

This coating is an infringement of the first and second claims of letters patent No. 114,711, the first claim being for a composition for coating the exterior of steam boilers, pipes, or other heated surfaces, composed of asbestos and lime putty, charcoal, and pumicestone, or their equivalents, and the second claim for a composition for the same purposes composed of asbestos and lime putty.

Defendants use the asbestos and whitewash, which is the same as lime putty in this composition, and clay, which is also proved in this composition of matter to be a well known equivalent for the lime putty. They also use the combination of asbestos, lime putty, and charcoal.

A large number of American and English patents are introduced in evidence as tending to show want of novelty. A careful examination of all these patents fails to afford any satisfactory proof that the patent No. 114,711 is void for want of novelty. The nearest approach to the composition of matter patented to the plaintiffs is to be found in the felt rags or sheets of asbestos and lime, which were not plastic like the compositions of matter in the Riley patents, but were wrapped or fastened around the pipes

*Published in numbers by Messrs. Hurd & Houghton, New York city.

to boilers. These, although most nearly approximating the invention of Riley, do not anticipate it.

Judgment is to be rendered for the plaintiffs against the Merrimack Manufacturing Company, for infringement of the first and second claims of patent No. 114,711, for three hundred and fifty dollars, and against the Lawrence Manufacturing Company for seventy and forty-one hundredths dollars damages, with interest from the date of the respective writs.

[*G. E. Betton*, for complainant.
G. L. Roberts, for defendant.]

United States Circuit Court---Southern District of New York.

PATENT JEWELRY.—LEWIS J. MULFORD *et al. vs.* THOMAS D. PEARCE *et al.* [In equity.—Before SHIPMAN, J.—Decided November 3, 1875.]

The first claim to "an ornamental chain for necklaces, etc., formed of alternate closed links, A, and open spiral links, B, substantially as shown and described," is not a claim for an ornamental chain, composed of alternate closed links, without reference to the material of which the spiral link is made; but it is a claim for a chain composed of alternate closed links and open spiral links, formed of one or more coils of gold tubing, as shown and described.

The manner in which gold tubing is manufactured is well known to all persons skilled in the art, and the process thoroughly understood by the manufacturing jeweler. It would have been a waste of words to explain the method of manufacturing to a class of persons who are sufficiently informed when they are told that the link is "formed of one or more coils of tubing of the proper length, so as to form a double spring link."

SHIPMAN, J.:

This is a bill in equity, alleging an infringement by the defendants of reissued letters patent, which were issued to the complainants on February 24, 1874, for an "improvement in chains and chain links for necklaces," etc., and praying for an injunction and an account. The defendants, admitting in their answer the manufacture and sale of the patented article, deny the novelty or patentability of the alleged invention, and further insist that the patent is invalid by reason of the vagueness of the specification. The specification states that—

"The invention has for its object to furnish an improved chain for necklaces, etc., having links of peculiar construction, which enable all the links to be finished separate and then put together to form the chain. The invention consists in an ornamental chain, whereof the links are connected together by open spiral links, B, finished before being connected together, the connection being made by springing the finished links into each other in the manner described. A and B represent the links of the chain. The links A are round and closed, and are made and polished, or colored, separately from the other links. The links, B, which constitute the peculiar feature of my invention, are formed of one or more coils of tubing of the proper length, so as to form a double springlink. Into each end of the tube forming the link, B, is soldered a small shot, as shown in the drawing, which shot gives a finish to the link. The links, B, may then be colored or polished, and the chain is formed by springing the links into each other. * * * * * By this construction the links may be made and finished in quantities, and the chain formed from the finished links, by springing them into each other to produce any desired combinations of the links of the same or different kinds. Finishing the separate links in this way enables them to be more perfectly polished or colored, and with a greatly diminished expenditure of labor and time, and enables the links to be put together without injuring them in the least, however highly they may be polished or colored."

The claims of the inventor are:

1. An ornamental chain for necklaces, etc., formed of alternate closed links, A, and open spiral links, B, substantially as shown and described.

2. The open spiral links B, formed of coils of tubing, substantially as shown and described.

Ornamental gold chains, formed of alternate closed links or spiral links, or of spiral links alone, have long been known. Chains composed of split rings which are sprung into each other, or into a solid link, are familiar articles, and there can be no novelty in the mere shape or form of the chain, or of the link, which is shown in the drawings of the patent. The distinctive feature of the invention does not consist in the fact that the link is spiral, but does consist in the construction of the open spiral link from a specified material, namely, gold tubing. The article which is called tubing in the jeweler's art is made by drawing a strip of gold through a drawplate, the gold strip having been placed around a copper wire in such a manner as to incase the wire. The copper wire, with the strip of gold wire around it, is then wound upon a mandrel and cut into proper lengths. The copper is destroyed by acid, leaving a hollow spiral link which is bound with wire and annealed. The wire is then unfastened, and the link, which is thus made, possesses a peculiar elasticity not affected by the annealing, is easily separated and united to another link without any injury to itself or to the solid link into which it is sprung, and constantly preserves its elasticity and shape.

The discovery which led to the invention consisted in the discovery of the fact that links made of tubing possessed a peculiar elasticity which was unaffected by annealing. The invention was the application of this discovery to the production of a new and useful result, namely, the manufacture from tubing of ornamental chains, which possess the following elements of novelty and utility:

First, all the links can be completely finished and then put together without injury to the chain, and thereby the article can be produced at a much less expense than had previously been necessary. Gold chains which are constructed in any other manner must be finished or polished or colored after the chain is completely formed, which is a difficult and somewhat expensive part of the manufacture, while, inasmuch as these links are sufficiently elastic to be united together or sprung upon a solid link without injury to any part of the chain, the separate links can be made in quantities, and completely finished and polished before being united.

Second, the elasticity of the special links is such that the chain can easily be separated by the fingers of the owner, and united in different forms and for different purposes, and reunited in the original chain without detriment to the polish of the links, and with no loss of their elasticity. As has already been suggested, their features of novelty and utility do not result from the fact that the chain is made in part from a spiral link, but from the fact that the spiral link is manufactured from a material which possesses a peculiar quality of permanent elasticity. The invention consists in the fact that, whether the inventor was or was not the first person to discover the peculiarity, he first utilized the discovery, and applied the peculiar property of the material to a useful result in the manufacture of chains.

It being self-evident that chains composed of spiral links have been well known, it was insisted by the defendants that the chains heretofore in use possessed substantially the same qualities which are attributed to the patented article; and that the patented article had no advantage over the chains which were introduced as exhibits, and which were made of gold split rings, or split links in various forms. But it was satisfactorily proved that the split rings, which are manufactured from solid gold wire compressed in dies, and made elastic by hammering, are not sufficiently elastic to permit the chain to be joined without injury to the material into which the split link is sprung, and thus injury renders necessary a repolishing or finishing of the completed article. Again, if the chain of split gold links is taken apart, this act of separation causes the coil to spring asunder, so that it loses its shape and its beauty; and if a necessity of annealing arises, the process of annealing destroys its elasticity. The difference between the patented article and a chain made of split gold rings is clearly marked. It is a difference in kind and not merely in degree.

Testimony was also offered by the defendants to prove that chains of spiral links made of tubing had been in use prior to the date of the invention, but the evidence failed to satisfy me that chains of open and unsoldered spiral links made of tubing had been manufactured prior to the date of the patent. Links have been made of tubing, which, after being united in a chain, were soldered together, and thus a chain was made which could not be taken apart, and which required finishing and polishing after it was soldered together. The testimony did not show that the plaintiff's invention of the open spiral link form tubing had been practically anticipated by others.

A large serpentine bracelet made of a coil of gold tubing, to be worn upon the fore arm, and to be kept in its place by pressure, was also introduced as an anticipating device. It manifestly is a very different article from a chain, and the fact that a gold tubing was known and used in the manufacture of jewelry was conceded by the plaintiffs.

It was also suggested by the defendants that the specification does not describe the process of manufacture of the spiral link with the exactness which is requisite. The manner in which gold tubing is manufactured is well known to all persons skilled in the art. After having been compressed around copper wire, it is wound upon a mandrel; the wire is then removed by acid, and the coil of tubing, having been secured with wire, is annealed into the proper shape. This process is thoroughly understood by the manufacturing jeweler. It would have been a waste of words to explain the method of manufacture to a class of persons who are sufficiently informed when they are told that the link is "formed of one or more coils of tubing of the proper length, so as to form a double spring link."

The first claim is not a claim for an ornamental chain composed of alternate closed links, and open spiral links, without reference to the material of which the spiral link is made, but it is a claim for a chain composed of alternate closed links and open spiral links formed of one or more coils of gold tubing, as shown and described. The finish, as given to the chain by the shot at the end of the open link, is not a material part of the invention.

There should be a decree for an injunction, and a reference to a master to take and state the account.

[*B. F. Lee* and *A. A. Alcord*, for complainants.
Jos. C. Fraley and *Henry Baldwin, Jr.*, for defendants.]

NEW BOOKS AND PUBLICATIONS.

THE INTERNATIONAL REVIEW, March—April, 1876. Published Six times a year. Subscription price, $5. New York city, Chicago, and New Orleans: A. S. Barnes & Co.

To the scientific reader, the most interesting paper in this number of the above periodical is Professor Vogel's "Chemical Action of Plants," in which the invaluable assistance of plant life to mankind, in the accomplishment of many purposes which human skill and scientific industry do not, and perhaps never will, enable us to perform, is demonstrated by a variety of illustrative instances. Professor Proctor's "Essay on the Structure of the Universe" reveals no new thought, and is characterized by the same peculiarity of that astronomer which obtrudes itself in many other of his recent productions, namely, of saying little and writing much. For a scientist whose ideas have undergone such radical changes, amounting to the abandonment of previous convictions, and whose present notions may undergo like revolution in the future, it would appear safer to speculate less, or, at least, not to extentuate his thoughts through a multiplicity of books and essays. A careful memoir of Professor Cairnes, the great English political economist, is contributed by Mr. George Walker. There is an instructive article on "Bardism," and a useful paper on "The Old and the New South," beside a valuable series of reviews of recent foreign publications

THE NEW GUIDE TO ROSE CULTURE. Published Annually by the Dingee and Conard Company, Rose Growers, West Grove, Chester county, Pa. Price 10 cents.

The successful cultivators of roses who publish this interesting pamphlet have introduced a new system of supplying their numerous customers with rose trees. They send them by mail, and guarantee their delivery in good order. Thus amateurs of roses can obtain specimens of all the choicest varieties of this most beautiful flower, merely by sending a letter and post office order to the growers, as above. The New Guide is published to aid purchasers in making a selection; and it contains a complete list of all the roses now in demand, with detailed particulars. Illustrations and descriptions of other plants and flowering shrubs are added, together with other valuable information on floriculture. See a further announcement in our advertising pages.

THE EDEN OF LABOR, OR THE CHRISTIAN UTOPIA. By T. Wharton Collens, Author of "Humanics," etc. Price $1.25. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

Mr. Collens announces, in his preface, that his design is to develop a practical plan for the application of the fundamental principle, "admitted by all political economists," that "labor is the real measure of the exchangeable value of all commodities and services," and to show that the principle and its application rest upon the duty of Christians towards God and each other. Such of our readers as may read the book will be surprised at many of its statements, and at the autocratic manner in which the author lays down his opinions; and the strange commingling of the holiest names and the most solemn subjects with inflation theories and the advocacy of paper as a source of wealth would be amusing but for its irreverence. We do not think that the currency question is to be settled by such publications as this.

THE TEXTILE COLORIST, a Journal of Bleaching, Printing, Dyeing, and Finishing Textile Fabrics, and the Manufacture and Application of Coloring Matters. Edited by Charles O'Neill, F.C.S., Author of "The Chemistry of Calico Printing, Bleaching, Dyeing, etc." Nos. 1 and 2. January and February, 1876. Subscription price $12 a year, payable in advance. New York city: John Wiley & Sons, 15 Astor Place.

This monthly publication gives promise of being a technical journal of the highest order. Its subject has long been the most interesting and progressive branch of industrial chemistry; and the rapidly extending use of chemical dyes gives additional value to such thoroughly digested and trustworthy information as this serial contains. The following articles are found in the pages of the first number: "Lime Juice, Argols, Citric and Tartaric Acids," "Methylaniline Purple on Cotton," "Straining Colors by Atmospheric Pressure," and "Sulphur as a Mordant for Aniline Green." Contemporary news as to new discoveries, patents, reviews, etc., is added; and an extended treatise (by the editor) on "The Practice and Principles of Calico Printing, Bleaching, Dyeing," etc., is commenced in this issue. The publication is illustrated with diagrams, etc., and each number contains 96 pages.

SPECIFICATION AND WORKING DRAWINGS OF A SWISS GOTHIC FRAME COTTAGE. By D. T. Atwood, Architect. New York city: A. J. Bicknell & Co., 27 Warren street.

This publication would be useful to many of our readers in the West and South, and to any one who desires to build a serviceable and elegant cottage without the assistance of an architect. The design of the structure is commendable, and the interior is especially arranged with a view to convenience; and the specification lays down the requirements for a well built and commodious house. Such usefully practical publications deserve the highest recommendation.

BURLEY'S UNITED STATES CENTENNIAL GAZETTEER AND GUIDE FOR 1876. Edited by Charles Holland Kidder. Philadelphia, Pa.: S. W. Burley, Proprietor and Publisher.

This handsome volume is a general cyclopædia, historical and statistic, of the United States, both now and during the past century. The information as to the Centennial Exposition is extensive, and apparently accurate; and the industrial statistics are elaborate and well arranged. The book is likely to have an extensive sale.

DESIGNING BELT GEARING. By E. J. Cowling Welch, Author of "Designing Valve Gearing," etc. Price 20 cents. New York city: E. & F. N. Spon, 446 Broome street.

This is a very elaborate treatise on a simple yet important subject, and will be useful to such of our readers as understand the higher mathematics.

THE CREED OF FREE TRADE. By David A. Wells. New York city: Hurd & Houghton, 13 Astor Place.

Mr. Wells commences his text with the indisputable axiom that the highest right of property is to *freely* exchange it for other property; and the truths that he deduces from this maxim are as self-evident as their source.

THE ECLECTIC MAGAZINE for March has a remarkably good table of contents. We can cordially recommend this magazine to our readers as one of the most instructive and useful of our monthly periodicals. It contains the best short papers which appear in the English monthlies, selected with great discrimination and judgment, besides one or two good continued serials. The present number has Mr. Gladstone's address on "Science and Art," Dr. Bastian's essay on "Why Animals have a Nervous System," "Her Dearest Foe" and "Jonathan" (continued), besides articles on "Montenegro," "Richelieu," "German Home Life," "The Unseen Universe," etc. The only objection to the magazine we can find is its embellishments. This month, there is a steel engraving of President Barnard, which, as a likeness, is almost as bad as a bust for which the learned and amiable scientist patiently sat during a recent American Institute Fair, to the delectation of a gaping crowd and to the furtherance of the reputation of the aspiring sculptress. If somebody would buy both plate and bust, and scrupulously destroy them, it would be a service both to Dr. Barnard and to posterity.

HARPER'S MAGAZINE for March contains an illustrated article on the Danube Principalities, which is of timely interest with reference to the recent Herzegovinian outbreak. Professor Samuel Lockwood contributes a paper on the "Microscope," written in plain and simple style and copiously embellished with engravings. George Eliot's "Daniel Deronda," the reigning sensation of the literary world, is continued; another instalment of the "First Century of the Republic" series treats of the progress of literature in this country; and there is the usual good selection of short stories, beside the summaries, scientific and otherwise, of recent events. Harper & Brothers, New York. $4 a year.

THE SANITARIAN for March opens with a lengthy paper, forming, as a lawyer would say, a "case" in favor of the use of salt for the removal of snow from the streets. All the evidence in the shape of professional opinions, *pro* and *con*, is adduced, and a preponderance appears to exist in favor of salt, a committee of the College of Physicians, among other authorities, certifying to its non-deleterious influence as regards public health. Dr. Bailey has a sensible article on "Ventilation of Churches," Mr. A. H. Dana tells of the "Uses and Abuses of Life Insurance" in a clear and concise essay, and there is an address, recently delivered by Dr. Doremus, on "Milk in its Medico-Legal Aspects." $3.00 a year. McDivett, Campbell & Co., Publishers, 79 Nassau street, New York.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED FRUIT DRYER.

Samuel W. Hope, Dover, Del.—This device includes a flue-shaped chamber having a heater at the bottom and a system of small tubes at the sides, for taking some of the air up around or by the trays, and discharging it into the drying flue again, between the trays, and also another system for drawing out the air from the spaces between the trays as it becomes charged with moisture by evaporation of the moisture of the fruit.

IMPROVED PAPER FILE FASTENER.

Charles D. Lindsey, Cincinnati, Ohio.—This fastener is made of a single piece of metal split for a certain distance at each end. The strip is then folded lengthwise. The split portion at one end has each extremity bent at right angles, while the ends of the other split part are sharpened. The latter are inserted through the paper and bent flat.

IMPROVED INVALID CHAIR.

Cevedra B. Sheldon, 7 State street, New York city.—Mr. Sheldon now offers another ingenious device, in the shape of an easy chair suitable for physicians' or invalids' uses. It has an adjustable foot rest arranged to be raised upon its pivots to a horizontal position, and a back to fall down on a level with the seat, to form a bed or lounge. It also folds up for storing away compactly. There is an improved contrivance of the adjusting back support, a new arrangement of the adjusting foot support, and a cane bottom for the latter. The entire chair is of very light but strong construction. Mr. Sheldon is one of the most persistent inventors we have ever known. His patents must now number in the neighborhood of fifty; and as he is yet a young man, we have no doubt but that his "centennial" invention is a future possibility.

IMPROVED BACK STRAP BUCKLE AND TRACE CARRIER

James W. Weed, Clarinda, Iowa.—This is a simple fastening device for the back and hip straps of harness, by which the cutting and stitching of the same is obviated, and a stronger and more durable connection of the straps obtained, while it furnishes also a hook support for the traces when the animals are detached from the vehicle. It consists of an oblong device with loops at all sides, and a central vertical pin for the fastening of the crossing straps. The side loops of the hip straps are furthermore provided with T-shaped hooks or carriers for the traces.

IMPROVED LAMP TRIMMER.

Philip Sidney Lyman, Chicago, Ill.—The invention relates to the construction of lamp trimmers, so that the wick may be cleanly cut and with perfect evenness, and consists in making it with handles angled at their ends, working upon the same fulcrum, one moving in a vertical, while the other moves in a horizontal plane, and provided with cutting blades, kept in continual close contact by guides that project from one of them.

IMPROVED TRUSSED STANDARDS FOR PIANOS.

Edwin Oakley, Lerrika, Ovalan, Fiji Islands.—The object of this invention is to provide a standard which shall counteract the overhanging strain of wires and prevent curving or bending in the back of upright pianofortes. It consists in the combination with upright pieces having obtuse angular grooves, and a tapering mortise, of trusses fitting in said grooves, and a wedge fitting in said mortise, and the whole so arranged as to form a rigid and secure brace for the standards, for the purpose of resisting the tension of the wires

IMPROVED TOY PISTOL

O. C. Butterweck, St. Louis, Mo.—The invention relates to a pistol whereby a marble may be ejected from the barrel with considerable striking force, by a rear-impelling spring that drives the piston rod forward as soon as the latter is lifted by the trigger. By the peculiar mode of combining the trigger and piston rod with the spring, the impulse is given with great facility, and without any liability of deranging the aim.

IMPROVED LIGHTNING ROD.

Isaac Johnson and David A. Price, Chicago, Ill.—The invention relates to that class of lightning rods made of tubular form and in several parts joined together. It consists in reinforcing and stiffening the tube sections with a metallic rod that does not fit up to the inside of the tube, but is maintained in a rigid and immovable position on the axial line of the outer cylinder by attachment at each end to a coupler; also in combining with each section a pair of peculiarly constructed couplers, one having a threaded socket and the other a screw, while each is provided with an opposite central recess for receiving the strengthening rod, and a conical cavity at the outer end of the recess for directing and guiding the end of the rod to its rest in the recess.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PORTABLE FENCE.

Urias Crayton, Davidson College, N. C.—The invention relates to portable fences which may be employed for different cross lines at different times, and consists in causing a tapered edge of one panel to fit into a corresponding groove of the next adjacent one, thus preventing one panel from ever being forced past another by an ordinary pushing force or by a wind.

BAND CUTTER AND FEEDER FOR THRASHING MACHINES.

Godfroy L. Gearhart and Nicholas W. Hoffman, Lebanon, N. J.—This is an automatic feeding apparatus for thrashing machines, by which the sheaves are readily and evenly cut, spread, and conveyed to the thrasher without an attendant. The invention consists, mainly, of a reciprocating shaker with a side shelf, from which the sheaves are pushed on stationary fingers, arranged concavely with cutting knives to cut the bands. The stalks are dropped through the fingers and pushed forward by lateral strips of the shaker, to be then evenly distributed by vibrating rakes, and conveyed to the thrasher.

IMPROVED HAY STACKER.

Moses Amidon, Lathrop, Mo.—In using this device, a rake is drawn over the field by horses until loaded. The loaded rake is then drawn upon and then from the platform, leaving the rake load of hay within the hopper. As the rake passes from the platform the horses are stopped, and suitable arrangements are made whereby the hopper is caused to carry the hay over and discharge it upon the stack.

IMPROVED SWARM BOX.

Andrew Harbison, Newcastle, Pa.—The object of this invention is to catch swarms of bees as they issue from the parent hive, and keep them confined until at leisure to introduce them into new habitations, thereby saving much time of the attendant, risk of several swarms mingling together, and the consequent destruction of their queens, as well as the danger of leaving for the woods. The swarm box is constructed of thin light lumber, except the top, which is of wire cloth. The swarm is caused to pass through a tube extending inward and upward, at an angle of about 45°. The edges around this tube are armed with wire pickets, the object being to prevent the bees from again returning to the parent hive, as they cannot successfully pass over the wire pickets. On the sides, in the interior, there are shelves on each side for the swarm to cluster on, as a support is necessary when a swarm is to remain in the box for some time before hiving.

IMPROVED BUTTER PACKAGE.

Andrew J. Dibble, Franklin, assignor to himself and David G. Landon, Delhi, N. Y.—This inventor proposes a new butter form, constructed of a single block of wood, having conical cavity, in which the butter is packed. These forms may be packed together and transported. The inventor states that they will cost about one cent a piece; and after the butter is once packed in them it need not be disturbed until each reaches the consumer. Each form is made to receive a given weight of butter.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The "Catechism of the Locomotive," 625 pages, 250 engravings. The theory, construction, and management of American Locomotives. Sent post paid, on receipt of $3. R. P. Stein, RR. Gazette, 73 Broadway, N. Y.

Wanted—Locomotive, 6 to 10 tons, 3 ft. gauge, for wood rail. Send photo. Barner Bros., Longview, Texas.

"Wrinkles and Recipes" is the best practical Handbook for Mechanics and Engineers. Hundreds of valuable trade suggestions, prepared expressly by celebrated experts and by correspondents of the "Scientific American." 280 pages. Elegantly bound and illustrated. A splendid Christmas gift for workmen and apprentices. Mailed, post paid, for $1.50. Address H. N. Munn, Publisher, P. O. Box 772, New York city.

For Sale—An established business, manufacturing metal goods. Patented. Box 729, Providence, R. I.

For Sale—Two Valuable Patents: Automatic Grinding Machine, for grinding Planer Knives, Leather-Splitting Knives, Cloth Shears, &c. Also Friction Clutch, the best in the market. For particulars, address E. S. Fernald, Saco, Me.

Manufacturers desiring a full description and statement of the mechanical construction and working, and of the merits of the lately patented adjustable calendar and almanac, illustrated in the "Scientific American" of February 12 last, may obtain the same by addressing the Inventor and Patentee, David J. Miller, at Santa Fé, New Mexico.

Waggener's Improved Trial-Balance Book—Invaluable to Book-Keepers. Saves time: systematizes the work: prevents errors. Now in general use. 12 mo's form—No. 1, 500 acc'ts, $1.80: No. 2, 1,000 acc'ts, $2.70: No. 3, 2,000 acc'ts, $4.50. 6 mo's form—No. 4, 500 acc'ts, two periods of 6 mo's, $2.25: No. 5, 1,000 acc'ts, two periods of 6 mo's, $3.15. Sent postpaid. Catalogue free. D. B. Waggener & Co., Publishers, 420 Walnut St., Phila

Yacht & Stationary Engines, Sizes 2, 4, 6 & 8 H.P. Best for Price. N. W. Twiss, New Haven, Conn.

Patented articles manufactured at lowest prices, by the Allen Fire Supply Co., Providence, R. I.

Wanted—Manufacturer of Iron Tools or Steam Engines, to take part of a Salesroom in this city. Address B., P. O. Box 4779, New York city.

Manufacturers of Wagon Hub Machinery, send address to P. O. Box 58, Detroit, Minn.

Round Thread Hose Couplings and "Controlling Nozzles" are the best in use. E. M. Waldron, Prov., R. I.

Inlaying and Fret Sawing in Wood, Shell, Metal, &c. See Fleetwood Scroll Saw, page 188.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

Amoskeag Steam Fire Engine, first class, for Sale. Is in excellent order throughout. Has two 8x10 cylinders, rotary pump (wholly composition), steel waist boiler with copper tubes, 6 in. suction, and plays four 2⅛ in. streams. Price $1,200, warranted. Address S. C. Forsaith & Co., Manchester, N. H.

Situation Wanted at Centennial, to Exhibit or Tend Machinery. F. N. B., Box 349, Flushing, L. I., N. Y.

Hearing Restored—A great invention by one who was deaf for 20 years. Send stamp for particulars to Jno. Garmore, Lock-box 80, Madison, Ind.

$1,000 for any Churn ahead of "The Prize." A. B. Cohu, 197 Water Street, New York.

A Clear Field—Small capital ensures heavy percent. Territory, etc. Liquid Vent Co., Kansas City, Mo.

For Sale—36 in. x 16½ ft. Lathe, $400; 28 in. x 8 ft. Lathe, $200; 18½ in. x 12 ft. Lathe, $250; 15 in. x 8 ft. Lathe, $175; 6 ft. Planer, $350; 3 ft. Planer, $200; 36 in. Drill, $125. Shearman, 45 Cortlandt St., New York.

Wanted—Universal Milling Machine, Brown & Sharp M'f'g Co., Providence, R. I., make preferred. Address, giving price, cash, Wm. E. Lewis, Cleveland, O.

Sash and Door Factory, Planing Mill, &c., for Sale. See advertisement on page 172.

Painters & Grainers—Send for descriptive Catalogue, & Sample of first class & quick Graining. Executed with my new perforated Metallic Graining Tools. 40,000 in daily use. J. J. Callow, Cleveland, Ohio.

Wanted—Every Machine Shop to send for one of Gardiner's pat. centering and squaring attachments for Lathes. On five days' trial, to be returned at our expense if not satisfactory. 700 one inch shafts centered and squared up per day. Price $35. R. E. State & Co., Springfield, Ohio.

Family Dish Drainer—Shop right deed and patterns, $10 per year. J. R. Abbe, Lawrence, Mass.

Yocom's Split-Collars and Split-Pulleys are same appearance, strength, and price, as Whole-Collars, and Whole-Pulleys. Shafting Works, Drinker St., below 147 North Second Street, Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings, from one lb. to five thousand lbs. Invaluable where great strength and durability are required. Send for Circular. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

$1,000 for any Hand Saw Mill equal to A. B. Cohu's, 197 Water St., New York.

A Valuable Patent for Sale to the highest bidder. Smith's Improved Awl, for sewing leather without bristles. For Cut and description, see Scientific American of July 31, 1875. Address Sylvester A. Smith, Letts, Louisa Co., Iowa.

Best Line Shaft, Pulleys, Dead Pulleys, Couplings, etc., in the country. Catalogue free. A. B. Cook & Co., Erie, Pa.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Water, Gas and Steam Goods—Send eight stamps for Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co., Pittsburgh, Pa.

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

American Metaline Co., 61 Warren St., N. Y. City.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

For 6 1st class Shapers and other tools, new and 2nd hand, address E. F. Bullard, 48 Beekman St., N. Y.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'k's, Bridgeton, N. J.

Notes & Queries

A. P. will find an answer to his query as to a ball dropped through the earth, a vacuum being maintained in the hole, on pp. 138, 250, vol. 31.—D. O. F. will find the description of a method of putting a black enameled finish on cast iron on p. 238, vol. 28.—H. L. M. will find directions for polishing handles, etc., in the lathe on p. 138, vol. 24.—C. H. S. will find directions for preparing corn cobs for kindling on p. 325, vol. 26.—C. W. B. can mend his rubber boots by the method described on p. 203, vol. 30.—J. M. will find directions for making friction matches on p. 75, vol. 29.—S. T. is informed that there is no safe way of tampering with the natural change of color in the hair.—J. P. C. will find that the proper speed for a circular saw is given on p. 163, vol. 34.—C. B. R. will find directions for producing white enamel on iron on p. 382, vol. 32. This also answers H. W. P.—F. D. can remove rust from his steel tools by following the directions given on p. 56, vol. 33.—M. J. M. is informed that we cannot recommend a boiler scale preventive, as we do not know what is the injurious element in his water.—A. J. P. will find a solution of the wheel difficulty on p. 298, vol. 31.—D. C. can clean his tarnished plated goods by the method described on p. 251, vol. 33.—W. A. will find directions for making corn starch on p. 154, vol. 30.—H. B. L. will find full directions for soldering cast iron on p. 251, vol. 28.—H. B. C. will find full directions for bronzing cast iron on p. 11, vol. 33.—F. H. L. will find an article on the strength of cast and wrought iron at different temperatures on p. 43, vol. 30.—W. T. R. will find directions for cleansing mercury on p. 131, vol. 30.—F. W. D. will find directions for making a silver-plating solution, for use with a battery, on p. 362, vol. 31.—I. B. & S. should apply to a toy manufacturer.—A. J. G. should read our article on the horse power of engines, published on p. 33, vol. 33.—C. D. F. is informed that we are unable to calculate the horse power of boilers from the dimensions and pressure. No trustworthy formula for such a calculation has ever been laid down.—J. McE. will find directions for building a refrigerating room on p. 251, vol. 31.—B. H. Jr. is wrong in trying to remove hair from his face.—J. V. B. will find directions for producing a green bronze on brass on p. 51, vol. 33.—J. V. B. will find directions for polishing meerschaum on p. 155, vol. 31.—H. M. H. will find directions for making rubber cement on p. 119, vol. 28. The construction of an aquarium is described on p. 80, vol 31.—F. J. will find directions for transferring engravings to wood on p. 138, vol. 30.—W. K. P. must use olive oil and white phosphorus for his phosphorus and oil lamp.—A. M. G. will find the required tables as to temperature and pressure of steam in Box's "Treatise on Heat."—W. R. M., H. G., H. H., E. H, G. A. B., W. & S., and many other correspondents who ask us to recommend books on industrial and scientific subjects should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) E. W. H. says: In a recent number of the SCIENTIFIC AMERICAN appears an article under the head of "The New Phase of Electric Force." I tried the experiment, using a telegraph sounder. I arranged the wires so that the armature vibrated. I now fastened a wire to the armature, but could obtain no sparks. I used three cups of Bunsen battery. What is the matter? A. Try again.

(2) C. S. says: Please give me a formula for preparing a solution to electroplate zinc with copper. I have tried the usual cyanide of copper solution, with the peculiar result of first throwing down copper, which in a few moments turns to a bright yellow, like brass. What is my trouble? A. Dissolve ¼ oz. sulphate of copper for every pint of water; add ammonia till all precipitate is re-dissolved, forming a deep blue solution, then add solution of cyanide of potassium till this color quite disappears. Add ammonia and cyanide whenever required. When these are deficient the anode becomes coated with a blue powder. About two Grove or Bunsen cells will be required.

(3) E. B. asks: Can steel knives be silver plated without putting some other metal on first? A. No, not so that the coating will adhere properly.

(4) J. G. asks: 1. What size of wire is fine enough to wrap the electro-magnet of a Morse sounder? A. No. 18 will be found a convenient size. 2. How many feet will it take? A. Use 20 or 25 feet. 3. Is it necessary to cover the silver plate of a Smee battery with platinum? A. Yes, to get the best effect. 4. How is the Leclanché battery arranged? A. Manganese and carbon in the porous cell, the latter closed with pitch, and a zinc rod in the outer cell. Use a solution of sal ammoniac for the excitant.

I made a marine telescope for use in water, but I cannot see much, as the water is muddy. Can I arrange a lamp inside it, and how? A. Some form of electric light might be used.

I made a phosphorus lamp, according to your directions, but it will not work. I boiled sweet oil, and poured it in the bottle on a small piece of white phosphorus. What was the trouble? A. Warm the bottle slightly by holding it in the hands or by placing it in a warm place, away from the fire, for a short time: then expose the oil to the air by opening the bottle.

(5) S. G. says: If oxygen and nitrogen are properly compounded, will they form an atmosphere that will sustain life? If so, why cannot they be used in sea diving? A. You propose merely to supply artificial air. There is no advantage in this, as common air may be pumped into the bell from above, or already stored there under pressure.

(6) A. S. G. says: I have observed some points in experimenting with a small induction coil which seem peculiar, and I shall be glad if you can assist me to an explanation of them. With the current from a quart Grenet, the secondary sparks will leap nearly ⅜ inch when the battery is in its best condition. Of course, sparks pass freely between wires from the secondary poles, when brought within striking distance; a point which troubles me is that sparks are freely given off from one secondary pole when no circuit is made. A. The case is one of inductive action, and is observable with all high tension electrical apparatus. 2. Another peculiar phenomenon is that the primary current gives quite severe shocks. When the circuit-breaker (magnetic) is operating (no connection between the secondary poles) upon pressing a moistened finger on the thumb screw which governs the distance of the platinum point from the vibrator, and another on either of the thumb screws of the battery, a current is felt, very similar to that from a medical coil, when the bundle of wires is pushed about half in. A. The shock is occasioned by the extra current. This is produced by the induction of the battery current upon itself, hightened, also, by the reaction of the magnetism in the core.

(7) C. I. H. asks: What is the matter with my battery? I have 4 cups (bichromate of potash) and I get a stronger shock with 2 cups than with 4. I use an induction coil; the wires are No. 36 and No. 20. Are these sizes right? A. If the wire of your primary coil were a little larger, we think you would obtain somewhat better results. It is quite likely that bad connections cause most of your troubles.

(8) D. G. asks: 1. What is meant by a drop forging? Is there any way of driving hot iron (wrought) into molds to produce given forms, such as are difficult to forge? A. Yes. Drop forgings are forgings driven into a mold or form by a drop hammer. 2. What is cast cast steel? Has it greater strength than iron, or is it simply harder? A. Cast cast steel is a casting made of cast steel. It is much stronger than wrought iron, and is soft. 3. How does it compare with cast steel? A. It is cast steel of fair quality. 3. Is malleable iron strong enough to do good service with a thread and nut, or will it pull in two too easily? A. It is strong enough if sound.

(9) N. L. C. asks: Why does cider made from sound apples in a hand press, and carefully bottled in clean bottles, have, year after year, a bitter taste? A. If it is as you say, we can give no reason.

(10) L. B. says: I am framing a barn, and I want to raise it with a pair of pulley blocks with 1¼ inch Manilla rope and a gin pole. The bents will consist of one beam 36 feet long, 9 x 9 inches, 2 posts 20 feet long, 9 x 9 inches, 2 posts under the beam 16 feet long dividing the 36 feet into three equal spaces, and three girths 5 feet 6 inches in each space. 1. Will a pair of pulley blocks that will carry that size of rope be strong enough? A. Yes. 2. How large will I want the guy ropes to steady the pole, and how many are necessary? The blocks are what they call four fall. A. Provide four guy ropes, placed at equal distances around the pole, and so placed that the strain when the load is on will be borne by two at once; 1¼ inch ropes will do for these. 3. Could I raise a barn that way by using a span of horses to pull with? A. Yes; but if you are shorthanded you had better raise your frame by single stick, which is now quite frequently practised. Set up a corner post and brace it both ways in its proper position; then set up the next post and brace it, putting the girt in its place at the same time; so proceed with the third post and girt; then put in your 36 feet beam and last girt, and set the remaining corner post. You will probably find this plan attended with less labor, and with less danger from accidents, than that of raising by bents. The heavy sticks may be raised by a pole and single pulley, if required.

(11) W. H. K. asks: Can a person's beard be permanently destroyed without injury to the skin? A. Try the following: Make a strong solution of sulphuret of barium in warm water; and when required for use, mix it into a paste with powdered starch and apply immediately. In about 10 or 15 minutes, or sooner if much smarting occurs, the paste should be removed by means of warm water.

(12) S. D. asks: Please inform me what will cleanse brass shells, used in breech-loading guns. A. We suppose you refer to the blackish carbonaceous crust formed on the surface of the shells, often to a considerable thickness. Try benzine or benzole, and finish with dilute nitric acid applied with a piece of cloth.

What will clarify or bleach chicken oil? A. There is no chicken oil sold in the New York market. Send a sample of what you wish clarified or bleached.

(13) A. P. D. asks: Will hard water do to use in an aquarium? A. Yes.

(14) H. S. asks: 1. I have been trying for some time to obtain flowers of any desired color. Where can I find the explanation of the meaning of color, and the conditions under which a given color is present? A. The information asked for is to be partly found in a *resume*, published in the "Quarterly Journal of Science" (Vol. XI., 1873, p. 451), of an investigation by H. C. Sorby on this subject. He found that the most important coloring substances met with in plants are insoluble in water, but soluble in bisulphide of carbon. He also made a series of determinations of the amount of coloring substances by obtaining solutions of the same tint, but of different depth. The total number of the fundamental coloring substances of plants isolated in this manner is about 12; for their names and properties see "Proceedings of the Royal Society," Vol. XXI, p. 442. 2. If I mix two different colors or paints I get a color different from the two. Now if I, by some means, extract one of the colors, would I not get the two colors separately again? A. Yes. 3. Can I not extract something from any color so as to change the original colors? A. Yes. 4. I have the impression that black is no color and white is all colors. Is this so? A. Black is the absence of color, and white is the mixture of all the spectrum colors. 5. I have been trying to make a plant digest certain substances through the aid of a galvanic battery. Has this ever been tried? I know it to be possible, for I have obtained such results. A. What are the results spoken of?

(15) F. C. B. asks: How can I make an ink for stamping buckskin and chamois leather, that will not smear? A. From the nature of the material it is a somewhat difficult matter to get a perfectly clear and legible impression from any hand stamp of ordinary description, no matter what kind of ink is employed. If a ribbon stamp, however, be employed, and an ink of sufficient fluidity, a clear imprint may be obtained without difficulty. It is requisite that the print should not be handled until the ink has sufficient time to dry. This drying, it is hardly necessary to add, will be much accelerated by a moderate warmth.

(16) G. C. says: I tried the following for nickel plating: "Take 4 parts nitrate of nickel, 4 parts liquid ammonia, 150 parts water, and 50 parts sulphate of soda." I could not get the nitrate o nickel, but was told that sulphate of nickel was the same thing, and I used it. It quickly made a thin coating of nickel, but I could not get it any thicker, as the solution crystalized and covered the articles and the anode all over with crystals ¼ of an inch thick. The anode was granular nickel in a cotton bag. Can you tell me the reason of that? A. The following is recommended highly: 2½ parts sulphate of nickel and 1 part sulphate of ammonia, dissolved in enough water to keep the solution just below the point of saturation. This will diminish the tendency to crystallize. Use two or three Bunsen cells to start with; a single Smee cell will answer for the main deposit.

(17) J. E. B. asks: What are the solvents of pure asphalt? A. Asphalt is the term given to solid bitumen. The bitumens differ in the facility with which they are attacked by solvents. Most of them are in great part dissolved by ether, mixtures of ether and alcohol, turpentine, the essential oils, benzole, naphtha, etc.

(18) C. F. L. says: Our town authorities are talking of supplying the town with water by a pump or water ram, from a stream 1,000 feet distant to a hill 115 feet high, thence from a reservoir by pipe, 800 feet, to the streets, and up and down the streets, 2,000 feet more or less. The town is from 80 to 100 feet below the hill. Will pipes from the reservoir under that head be sufficient to put out fire, or would it be better to attach a large force pump to one of the water wheels and force the water through pipes to different parts of the town? A. The town of Rahway, N. J., and several other places are provided with what is said to be a very economical and effective system of water supply. It consists of a stationary engine supplying a certain number of millions of gallons of well water per day, at a certain pressure agreed upon, and which is at all times sufficient to force the water to the upper stories of the houses in the most elevated sections of the town. This is known as the Holly system, and would probably suit you better than any other. In case of fire the pressure is maintained at its maximum by means of the control obtained through the stationary engine. Write to Holly Manufacturing Company, Lockport, N. Y.

(19) M. O. R. says: I am about to build an engine 6 x 8 inches. I intend to have the steam ports ⅝ inch wide and 2 inches long, and the exhaust port 2 inches wide and 2 long. Will the ports be long enough for the engine? A. Make your steam ports ⅝ wide and 3 inches long, and the exhaust port 1¼ wide by 3 inches long.

(20) J. W. Jr. says: In one of your back numbers you say that the scent of the hay flower can be made of the bark of the marie. Please give me the directions. A. The plant is one newly discovered, and we have no description of it at hand. The statement that it may be employed as a source of the perfume "new mown hay" is made by a French perfumer.

1. What preparation is put on the sensitive plate for an instantaneous photograph? A. No photograph is actually instantaneous, although the time of exposure may be reduced to a very small fraction of a second. There must be a slide attached to the camera front, so arranged as to give a very brief exposure. Use a neutral new 30 grains bath, a bromo-iodized collodion just old enough to work, a plain iron developer, and a lens giving a strong bright image. Give a very brief development and see that the image is strongly and evenly illuminated. A collodion containing 5 grains ammonium iodide and 3 grains ammonium bromide to the ounce works well. 2. What substance is put on the sensitive plate after it comes out of the came

ra to bring the picture out? A. A good developer s composed of 2 ozs. protosulphate of iron, and 4 ›zs. acetic acid to 16 ozs. water.

(21) A. D. T. says: I have a porcelain slate which has become so smooth that a pencil will not make a good mark on it. What can I use to give it a good surface to mark on? A. If the slate is really porcelain, try a little dilute sulphuric acid, which allow to remain in contact with the surface a short time. Then wash carefully with clean cold water and flow over it a little strong potash lye. Allow this latter to remain in contact with the porcelain for about half an hour, and then wash clean with water.

(22) J. D. M. & Co. say: There is an article of vegetable origin used in Germany for cleaning kid gloves, and as a substitute for white of eggs in icing cakes. Can you tell us what it is? A. When the water that has been used to wash starch from wheat flour or scraped potatoes is allowed to stand until it becomes clear, and is then boiled, it assumes a turbid appearance, and deposits a flaky white substance, which has the same character as the white of egg, and is known as vegetable albumen. When dried, it forms a brittle, yellow, gummy mass, which dissolves in cold water; but when coagulated it will not dissolve in water, either hot or cold. The change of coagulation does not alter its composition. The temperature at which it takes place varies. A strong solution of the albumen in water becomes completely insoluble at 145° Fah., and separates in flakes at 167°. The more it is di-.uted with water, the higher the temperature of coagulation.

(23) H.O.R. says: I have a well 10 feet deep. About 3 gallons of paraffin oil has leaked through the clay floor, 12 feet from it. Can you tell me how to clean it, and destroy the oil? A. The ordinary means of destroying or absorbing the oil would not answer in this case, and we know of no means of cleaning the wel. better than those usually employed. If you have at hand some absorbent clay or earth, it would assist you.

(24) P. S. says: 1. I have made a Daniell's battery, and am trying to make a Neef's hammer for producing shocks. Please explain the easiest method for making it, and how to make the connections of the wires from the battery and to the handles. A. If you wish to produce shocks from a single coil in which there is an iron core, arrange the coil horizontally on a wooden base, fix a short round piece of soft iron to a spring, and fasten the latter to the base in such a position that the iron piece is within the attractive influence of the core. An upright with an adjustable screw, against which the spring rests when the battery is not in circuit, is also attached to the base back of the spring. Connect one pole of the battery to the upright carrying the adjustable screw, the other pole to one end of the coil, and the opposite end of the coil to the spring. By properly regulating the adjusting screw, the iron piece will vibrate rapidly; and if the hands grasp conductors in communication with the upright and spring respectively, more or less intense shocks will be felt. 2. What form of battery is best adapted for producing shocks? A. Two or three Grove cells will answer. 3. Will silver answer the same purpose as platinum for the connections on the spring platinum point for breaking and making the circuit? A. No.

(25) A. R. M. says: How can I make a cement for sealing glass bottles that will not soften at a temperature of less than 250° Fah.? The stopper of the bottle is made of tin. A. Cut 3 parts of good india rubber into small shreds; dissolve it by heat and agitation in 34 parts of cold naphtha. Add to this 64 parts of shellac in fine powder, and heat the whole, with constant stirring, until the shellac is dissolved. Then pour it while hot on metal plates, to form sheets. When required for use, heat to 250° Fah. and apply quickly.

(26) B. & F. say: 1. We are fitting up a line shaft to make 220 to 240 revolutions per minute. We think of putting in an engine of 10 or 12 inches bore by 24 inches stroke, running at 100 or 110 revolutions per minute, with an 8 feet fly band wheel, requiring about a 40 inch pulley on line shaft. Some of our friends say a shorter stroke engine will be more economical. If so, how much? And where is the economy? A. A shorter stroke will be more economical if you run your engine proportionally faster, so as to have the same speed of piston per minute, the economy being because the temperature of the cylinder will be maintained more equally, and nearly equal to that of the initial steam. 2. Would it be more economical to put on a smaller band wheel, with ndependent fly wheel? A. Yes, if the bearing surface of the working parts will stand the necessary increase of speed.

(27) A. B. asks: What is the property or substance in the human body that gives lead, inhaled or otherwise absorbed into the system, its remarkable noxiousness? A. The subtlety of the poison in the fluids of the body is brought about by the presence there of carbonic acid. The amount of lead which may be received into the body, and the length of time which must be consumed in its reception before symptoms of poisoning can be developed, is uncertain. These factors depend upon the peculiarities of the patient, the form under which the metal is introduced into the system, and the channel through which it makes its way. Sometimes a single dose (so to speak) will be sufficient to produce severe symptoms of poisoning, and again months and years may elapse before a man who is constantly at work will be at all affected by it. The excretion of lead after it has been received into the body is performed very slowly. In bad cases of lead poisoning, the metal can be detected in the urine a long time after the patient has been removed from the source of contamination. Parks mentions a case where a patient was exposed for the last time to the influence of lead on December 20, 1852, and lead was found in the urine on June 16, 1853, before treatment had been commenced.

(28) C. Y. asks: In $Na_2\ CO_3+10H_2O$, how can I cheaply and expeditiously get rid of several equivalents of H_2O so as to get a dry, white, almost anhydrous powder? I wish to gain the same result (in large quantities) as by letting it effloresce in dry air. A. Crystallized carbonate of soda contains 62¾ per cent of water. The crystals readily effloresce in the air, and melt in their own water of crystallization. On decanting the liquid from the fused mass, it is found that one part of the salt has given up its water of crystallization to an other. By evaporation of this liquid, crystals containing one fifth less water than common carbonate of soda are obtained. These do not effloresce in air. The same result may be obtained by heating the carbonate in a current of dry air for a short time.

(29) W. T. S. asks: How can I produce a crystallized surface on tinned plate? A. Use a mixture of 1 part nitric acid, 3 parts hydrochloric acid, and 50 parts water. First clean the plate with a strong solution of potash in water. When the crystalline structure has become fully developed, remove the acid and wash in clean water.

(30) J. G. says: I have a paint mordant, which I cannot make work. This is the formula Mix 15 gallons water, 6 ozs. borax, and 3 lbs. silicate of soda. Heat until dissolved, then add 10 lbs. rosin, boil until dissolved. To this I wish to add rubber, but cannot dissolve the kind I have with benzine. It is old billiard cushions. How can I do it, and will rubber replace linseed oil and make durable paint? A. The rubber you mention is not suitable for the purpose. Use a purer rubber, and dissolve in the benzine by heat and agitation. This solution is not miscible with the solution of borax, water glass, etc., and will not replace linseed oil. 2. Would more water glass be of use? A. No. Shellac might replace part of the rosin.

(31) A. F. O. asks: 1. What is the process for enameling on zinc in making faces for common clocks? A. The zinc disks are simply painted with white lead, containing sufficient zinc-white to maintain the requisite intensity. 2 How are the the figures put on? A. The figures are worked on with stencil plates and afterwards finished with a brush; and finally the whole is finished with a coating of good picture varnish.

(32) E. C. N. asks: Why does paint which is made of pure linseed oil and lead affect young children and even some adults? A. There is no doubt that lead finds its way into the human body, under certain conditions, and there produces a variety of morbid changes, which may in some instances terminate in death; for the metal has often been found after death in the muscles, liver, brain, and other organs. White lead paint is introduced into the body in three ways: First, by the lungs. This takes place chiefly among house painters, when the lead is mixed with turpentine in large quantities. In the evaporation of the latter, a small amount of lead is carried off, and is breathed into the lungs. Lead dust may be taken in the same way. The second way is by direct absorption through the skin. The third method is by the mouth. When the painter is careless about his personal cleanliness, and neglects to change his clothing at meal time, a considerable quantity of paint may be taken into the body with his food and drink. This is especially true of his midday meal, which in many cases is eaten on the spot where his work is going on.

(33) J. H. L. asks: In the process of making malleable cast iron, is soft or hard cast iron employed? A. A mixture of two good sorts of No. 2 pig iron and old scrap is used, the latter in the proportion of ½.

(34) J. S. G. says: In reply to a correspondent who asked for the method of calculating logarithms, you give the following: Let a=any number. Then $log.\left(\frac{a}{a-1}\right)=0{\cdot}868589\times\frac{1}{2a-1}+$, etc. Why do you not tell us how you came by that number 0·868589? A. In the answer referred to, our correspondent only asked for a formula by which he could calculate the logarithm of a number. The demonstration of the formula would require considerable analysis, quite out of place in our columns, as the matter may be found clearly treated in a number of works, among which we may mention "Rudimentary Treatise on Logarithms," Weale's series, introductory to Law's "Tables," Hutton's "Mathematical Tables," Davies' Bourdon's "Algebra," and Todhunter's "Algebra."

(35) B. & H. say: Please tell us whether there will be any difference in the drawing power of two locomotives, of equal weights, etc., one of which has drivers of a larger diameter than the other. A. The smaller the driving wheel, the greater the leverage at which the power is working to the load, and hence the greater the tractive power.

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

E. M.—It is red ocher.—H. W.—No. 1 is red oxide of iron or hematite. No. 2 is iron pyrites.—J. M. M.'s specimen is under examination, but no one has been able as yet to identify it.—Specimen from Noblesville, Ind., is iron pyrites.—Specimen marked "Eberhart" is sulphide of antimony. One marked "Cannon" is green quartz marked on surface by oxide of manganese.

R. C. C. asks: What was the Egyptian mode of incubation?—F. N. asks: How can I calculate the quantity of air that and the velocity with which it will pass through a given aperture at a given pressure?

COMMUNICATIONS RECEIVED.

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

On Storm and Flood Signals. By A. W.
On Cotton Factories in the South. By E. H.
On Timber Waste. By H. C. B.
On Bank Vaults. By J. K.
On a Patent Pirate. By C. F. J., Jr.
On a Mathematical Problem. By A. B.
On Boiler Explosions. By A. C.
On Centennial Circulars. By T. A. R.
On Mohair Goods. By O. C. K.

Also inquiries and answers from the following:

J. G. W.—F. W.—T. D. T.—E. H.—J. S. W.—S. H. W. —J. L.—C. P.—R. F. J.—B. L.—C. K —T. C.—J. T.— T. H.—W. E. G.—B. D.—J. H. T.—G. C.—C. J. F.— W. T.—R. H.—S. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Whose steam boiler is the safest? Who sells ready made iron fences, posts and all? Who sells egg-hatching machinery? Who sells bookbinders' cloth, dyed with permanent colors? Who makes machinery for cleaning moss for upholstery? Who sells the officinal preparations of boldo? Who sells penholders which teach the proper position for holding the pen?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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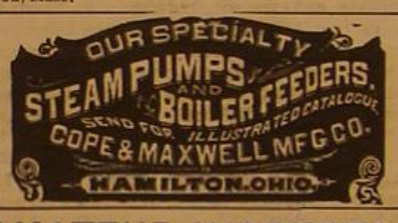
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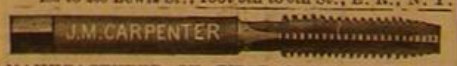
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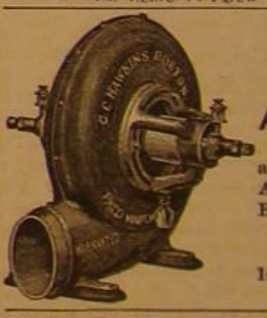


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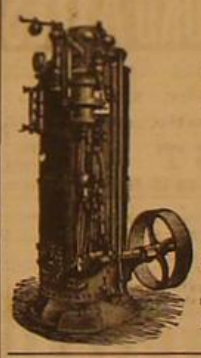
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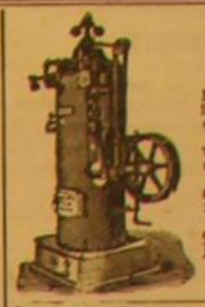
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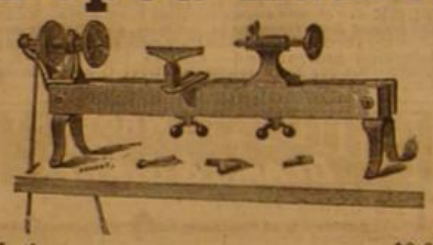
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