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APPARATUS FOR EMPTYING CESSPOOLS.

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

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

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

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

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

In other cases exhaustion has been effected by injecting steam or heated air into the tank and subsequently condensing or cooling it, or by filling the tank with water and discharging it through a tube, having its outlet some 35 or 40 feet below. All of these systems, though excellent in theory, have encountered many practical difficulties. What is needed is a pump so constructed as to raise and force, by direct action and without obstruction to its working parts, the contents of sinks and cesspools, just as they occur. To this must be added the requirement that, in discharging the matter into the airtight receptacle, no offense be created by the escape of noxious gases.

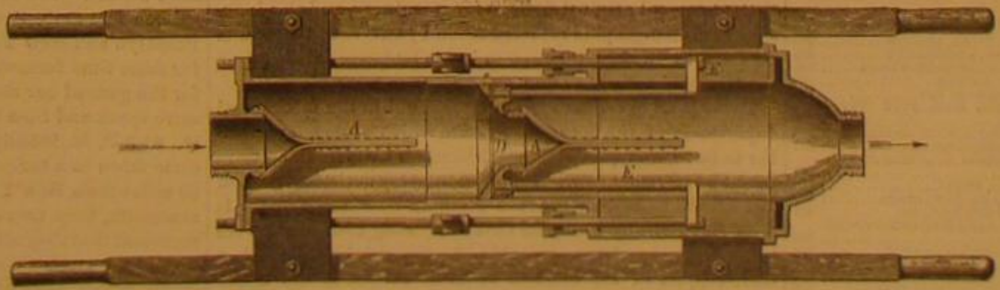
Fig. 3.

Fig. 4.

Such an efficient direct-acting pump, an airtight tank, and a deodorizing attachment are claimed to constitute the prominent features of the system of the "Odorless Excavating Apparatus Company," about to be described. By this plan, we are informed, the operation is performed during the working hours of the day, not only without offense but with the greatest efficiency and dispatch.

The chief point of novelty in the pump employed lies in the valves. Virtually, these appliances, by their construction and positions in the pump, form a continuation of the connecting hose leading from the vault to the tank, and, being in direct line with each other, offer little resistance to the passage of the material. The valve shown in the sectional view of the pump, Fig. 2, and in the smaller engravings, Figs. 3 and 4, is made of soft, elastic, vulcanized rubber, A, tubular in form; and being composed of two flat pieces placed face to face and riveted together at their edges, is, in its normal condition, collapsed. Its length is equal to some three diameters when open. One end is distended, and, embracing a collar, B, that surrounds the port, is securely fastened thereto by clamps and bolts. There is, therefore, a collapsible tube, one end of which is permanently distended to embrace the port through which the material passes. This passage, in one direction, is direct and unresisted through the valve, while it cannot take place in the opposite direction by reason of the collapse of the tube by the pressure on its sides. The valve, being of much greater length than diameter, presents an extended bearing or contact surface between its two sides, and therefore closely engage and surround whatever obstruction may be passing through it at the time of its collapse, forming about the obstruction an airtight joint, Fig. 2. At the succeeding stroke the valve is again distended, and the obstruction passes forward without in the least interfering with the action of the pump. Each valve is provided at its base with rigid straps or braces, C, which prevent it from being forced into the port by external pressure.

Fig. 2

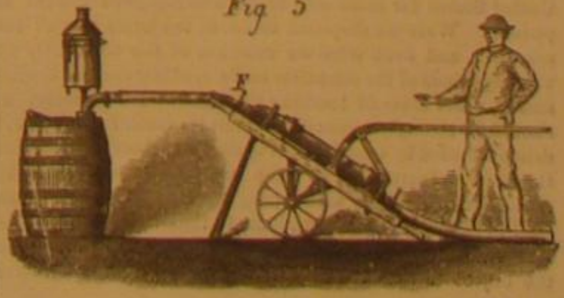


The pump is single acting (Fig. 2), and in form a straight cylinder, provided with one fixed valve (the induction) and one movable, both marked A in the engraving, the latter attached to the piston, D, moving in the center of the cylinder. The passage of the material through the pump is therefore direct and without counter currents; and such is its capacity for passing obstructions that we have seen large pieces of cloth (and it is stated, an entire pair of heavy cloth pants may be) pumped through with ease. In fact, any obstacle not too large to enter the suction hose, and of whatever length, will pass freely through the valves without interfering with their action. This capacity for passing obstructions renders the use of a strainer on the end of the suction hose superfluous, and it is used with a clear, free opening. Usually this will not become obstructed, the hose being of three inches inside diameter; but in cases where a large quantity of tough and tangled material is present in the vault, such as masses of shavings and rags, a curved foot pipe is used, having an opening on its side of the full capacity of the hose. Should an accumulation of tough materials occur at this point, it is removed occasionally by the action of a sliding blade or cutter, attached to the foot pipe and operated by a rod. This device is only used in the worst cases, but by its use the capacity of the apparatus is greatly increased, and it is under more perfect control.

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

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

Fig. 5



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

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

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

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

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

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

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

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

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Contents.

(Illustrated articles are marked with an asterisk.)

TECHNICAL RESEARCH AND EDUCATION.

One of the most eminent English chemists is reported to have recently said, in response to a question relative to the progress of original investigation in England, that in that country such research seemed to be declining, while in the United States far more was being accomplished toward its pursuit. Were we disposed to doubt the latter part of this assertion, and even were we unaware of the constantly advancing labors of the scientists of Yale, of Harvard, of Cornell and of other seats of learning throughout the country, we should be strongly inclined to admit its truth from the evidence afforded by a recent visit to that model technical school, the Stevens Institute. In three laboratories we found original labor in virtually actual progress, and from three workers—professors, yet only students in that highest of colleges, Nature—we gleaned a few general words in explanation of the object to which the researches of each were directed, President Morton's investigations into the beautiful phenomena of "fluorescence," and also his brilliant discoveries of thallene and petrolucene, we have already described in detail. We have also alluded to his spectroscopic researches in relation to the uranic salts, and we found him still engaged upon the same subject. We were shown his laboratory for the purification of the uranium, a process of some length, carried on by himself in order that he may obtain the metal free from impurities, with which he states it is always combined when obtained direct from commercial sources. From the result of this operation he obtains various compounds of the body, among which are several new salts; among others, thallio-uranic sulphate and rubidio-uranic sulphate. President Morton is also investigating the properties of chrysene and pyrene, both substances obtained from coal tar subsequent to the production of anthracene, and which differ from each other in many respects. We were also shown a specimen of pure anthracene, which appeared in delicate sheets of a pearly luster, almost perfectly white. Other specimens of the same substance, not so pure, had a decided greenish yellow tinge, while another preparation, by distillation; of the material resembled moist sugar, with, of course, the above noted difference in tinge. A very beautiful product also obtained was pure alizarine, from anthracene, the last process of the operation being sublimation, when the alizarine appears of its natural brilliant orange red hue. Dr. Morton tells us that he has been unable, thus far, to obtain thallene in sufficiently large quantities to meet his requirements—he wanted a barrel of it—and that he is therefore turning his attention to anthracene as being the nearest similar substance. He hopes, eventually, to be able to produce, from thallene, artificial alizarine.

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

Professor Thurston, our late correspondent from the Vienna Exposition, has returned to this country and is engaged in the continuation of his experiments on the torsional strength of materials; obtaining his results by the aid of the testing machine of his own device, an invention which we have already described. His most recent work has been upon specimens of iron and steel, from which he has obtained the following data: The pieces were made in nearly uniform thickness and of about 3$\frac{3}{4}$ inches in length. In the center, a neck was formed $\frac{5}{8}$ inch in diameter, to which point the strain was applied. Sample No. 1 was of Ulster iron, 1 inch bar, twisted to 220°; it broke under a torsional force of 225 pounds. No. 2, ordinary spike iron, nail rod, $\frac{3}{4}$ inch bar, angle 150°; it broke at 240 pounds. No. 3, French tool steel annealed, 1$\frac{1}{2}$ inches round, angle 160°; it broke at 400 pounds. No. 4, Bessemer steel 1$\frac{1}{2}$ inches round, angle 75°; it broke at 300 pounds. No. 5, Lowmoor iron, 1 inch square forged down from 1$\frac{1}{2}$ inches, angle 220°; it broke at 200 pounds. No. 6, common American iron, make unknown, $\frac{3}{4}$ inch bar, angle 220°; it broke at 200 pounds. No. 7, Naylor's tool steel, $\frac{3}{4}$ inches octagon, angle 140°; it broke at 400 pounds.

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

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

THE VIENNA PRIZES.

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

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

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

FAILURE NO. 2 OF THE BALLOON TO EUROPE.

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

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

CAOUTCHOUC FROM COMMON PLANTS.

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

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

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

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

RECENT GUNNERY TRIALS.

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

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

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

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

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

CRUDE PETROLEUM FOR FUEL.

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

He states that further trials, from which more exact data may be expected, will shortly be made; and it is therefore unnecessary to give his present letter in full. He informs us that the price of coal at Lamokin, Pa., is $6.30 per tun, and the price of crude oil 6¼ cents per gallon in bulk; and, on an allowance of 4 lbs. of coal per horse power per hour as a basis, he figures the relative costs of the two fuels at $5.40 for coal for ten hours, and $4.37½ for the petroleum.

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

By reference to back numbers of the SCIENTIFIC AMERICAN, our correspondent will find plenty of examples of marine, portable, and stationary steam engines which run on 2 lbs. of coal per hour per horse power. Nearly all of the ocean steamers now plying between New York and Liverpool run on 2½ lbs. per horse power per hour, some of them on 2 lbs., while the Cowper compound marine engine runs on 1½ lbs. This latter is the best practice yet reached, we believe; but theoretically, we ought to use only ¼ of a pound of coal per horse power per hour.

STREET PAVEMENTS.

About three years ago, the subject of street pavements attracted considerable attention, and we had specimens of nearly every description that had ever been patented laid in various parts of the city. The general interest in this matter seems of late to have died out; but to those who own horses or have any regard for the sufferings of the noble animals, this will always be a subject worthy of consideration. The patent pavements, almost without exception, were found to be worthless, and the city authorities at last found this out and came to the conclusion that stone in some shape, and stone only, was fit for the pavement of our streets, particularly the thoroughfares. Of the other kinds of pavements, the Nicholson is the only one which has still any advocates. It is a good pavement as long as it lasts; but its lack of durability, the insecure foothold it affords in frosty weather, and its high price, are drawbacks which will always tell against it; besides, it cannot but be considered prejudicial to the public health, for it absorbs a portion of the effete matter constantly deposited upon it, and retains this in a moist state, favorable to decomposition, much longer than any other pavement we have. Of the stone pavements, the Belgian and the Guidet are generally acknowledged to be the best; and their superiority over the cobble stones, as usually laid in our streets, cannot be denied. The principal complaint against these pavements, particularly the former, is that the stones wear smooth and the horses slip; not only in winter, when there is frost, but at all times when dragging heavy loads and on starting. The fault found with the cobble stones, as they are put down in the streets of New York, is that the smaller stones sink after they have been subjected to a certain amount of travel, the larger ones, against which the hoof is apt to strike when thrown forward, remaining prominent, tearing off the shoe and causing the horse to stumble. Moreover, owing to the numerous inequalities of the surface, the horse must expend an increased amount of force to pull his load, and starting is rendered very difficult. But if cobble stones are properly selected, that is, if they are small and of a uniform size, they are superior to any stone pavement ever put down in giving a good foothold and doing little injury to the hoof.

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

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

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

CURIOSITIES OF BUTTER AND CHURNING.

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

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

The ancient Christians of Egypt burnt butter in their lamps instead of oil; and in more recent times, it was used for the same purpose in Roman Catholic churches, during the Christmas festival, to avoid the great consumption of olive oil. The Cathedral of Rouen has a tower called the butter tower, from the fact that the Archbishop of Rouen, in A. D. 1500, finding the supply of oil to fail during Lent, permitted the use of butter in lamps, on condition that each inhabitant should pay six derniers, with which money the tower was built. There are other "butter towers" at Notre Dame, Bourges, etc.

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

SCIENTIFIC AND PRACTICAL INFORMATION.

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

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

CURIOUS SUBSTANCES IN GUANO.

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

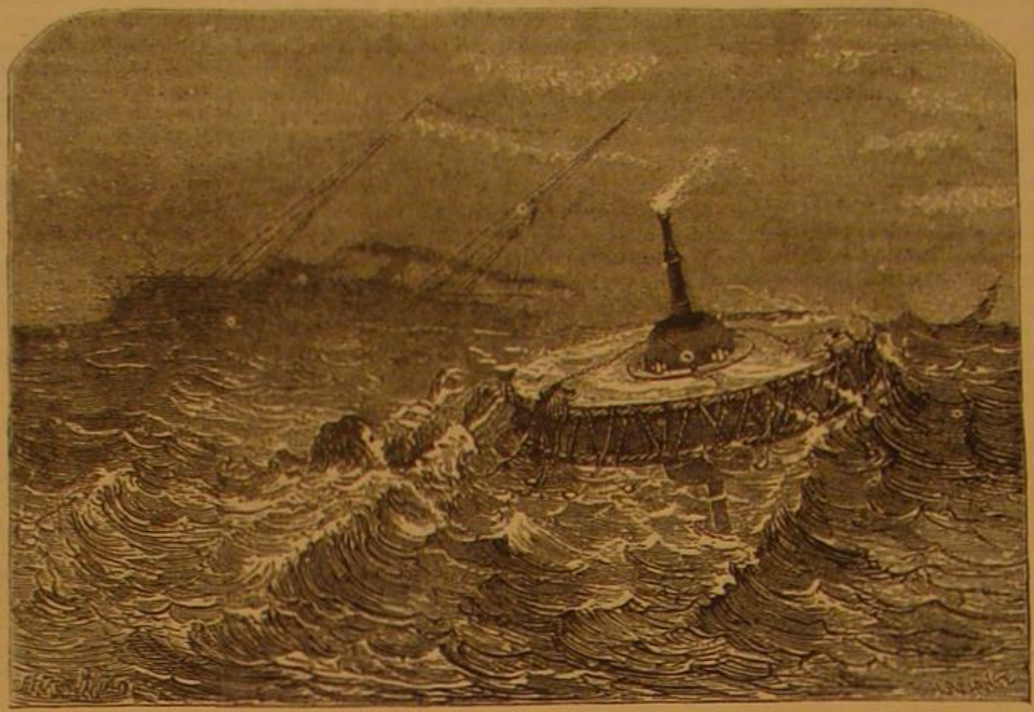
It is quite credible that this effervescence might take place if the guano were placed in a moist field, the material losing instantly all its excess of carbonic acid and consequently its activity. Once saturated, it becomes inert. M. Chevreul finds that the material dissolved by the water is crystalline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

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

INEXTINGUISHABLE FIRE FOR LIFE BUOYS.

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

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



INEXTINGUISHABLE FIRE FOR LIFE BUOYS.

As may be imagined, there is an objection to the use of any combustible liable to be extinguished by water or wind, as, if portfire or other composition be not directly put out by spray or rain, its flame may be so weakened as to render its light too faint for the discernment of objects in its neighborhood. Messrs. Silas and Seyferth, in order to obviate this objection, have suggested the use of phosphide of calcium. This substance is prepared by distilling phosphorus over lime heated to a low redness. An anhydrous mass of a dull red color is obtained, hard enough to strike fire from steel, which experiences no change in dry air nor in oxygen at the ordinary temperature. In a moist atmosphere it slakes, emits phosphuretted hydrogen, mixed, however, with free hydrogen, and not self-lighting; but if it be thrown directly into water, phosphuretted hydrogen gas only is evolved, and this, as is well known, takes fire spontaneously in atmospheric air. The form of apparatus proposed is represented in our engraving, for which we are indebted to *La Nature*. The buoy is of wood or cork, analogous in form to that ordinarily employed in the French navy, and has in its center a hollow space in which is arranged the lighting arrangement. The latter is composed of a metallic box containing the phosphide of calcium, through which passes a tube which extends beyond it a short distance both above and below. This tube, in the portion which traverses the box, is pierced with a number of holes so as to admit the water necessary for the decomposition of the phosphide. Two cocks, arranged one at the upper part of the tube and the other below the metallic reservoir, are rigidly connected together by a rod. These are worked by the traction of a cord attached to the upper cock, which is protected against shocks by a metallic cup, through which the line passes. The latter arrangement is connected to the tube with a screw, so that it may be removed and the box lifted out to renew the phosphide when exhausted. There is also provision made for hermetically sealing the contents by a little melted rosin in a suitably placed cavity.

The entire device is suspended by a single cord, which is cut by the operator. A slight line is connected with the cocks, and also with a staple on a pulley through which the suspending cord of the buoy passes, so that when the latter falls its weight is sufficient to cause the thread first to open the cocks and then to break. The apparatus adrift, the water enters the bottom of the tube and, rising up, enters the phosphide through the perforations. The reaction set up disengages gas, which escapes at the upper orifice of the tube, giving a flame of intense brightness and, during the first five minutes, of some 11 inches in length. On the occasion of experiments recently made at Toulon, with a charge of 7,084 grains of phosphorus and a tube with an opening of 0·1 inch in diameter, the flame lasted for one hour and ten minutes.

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

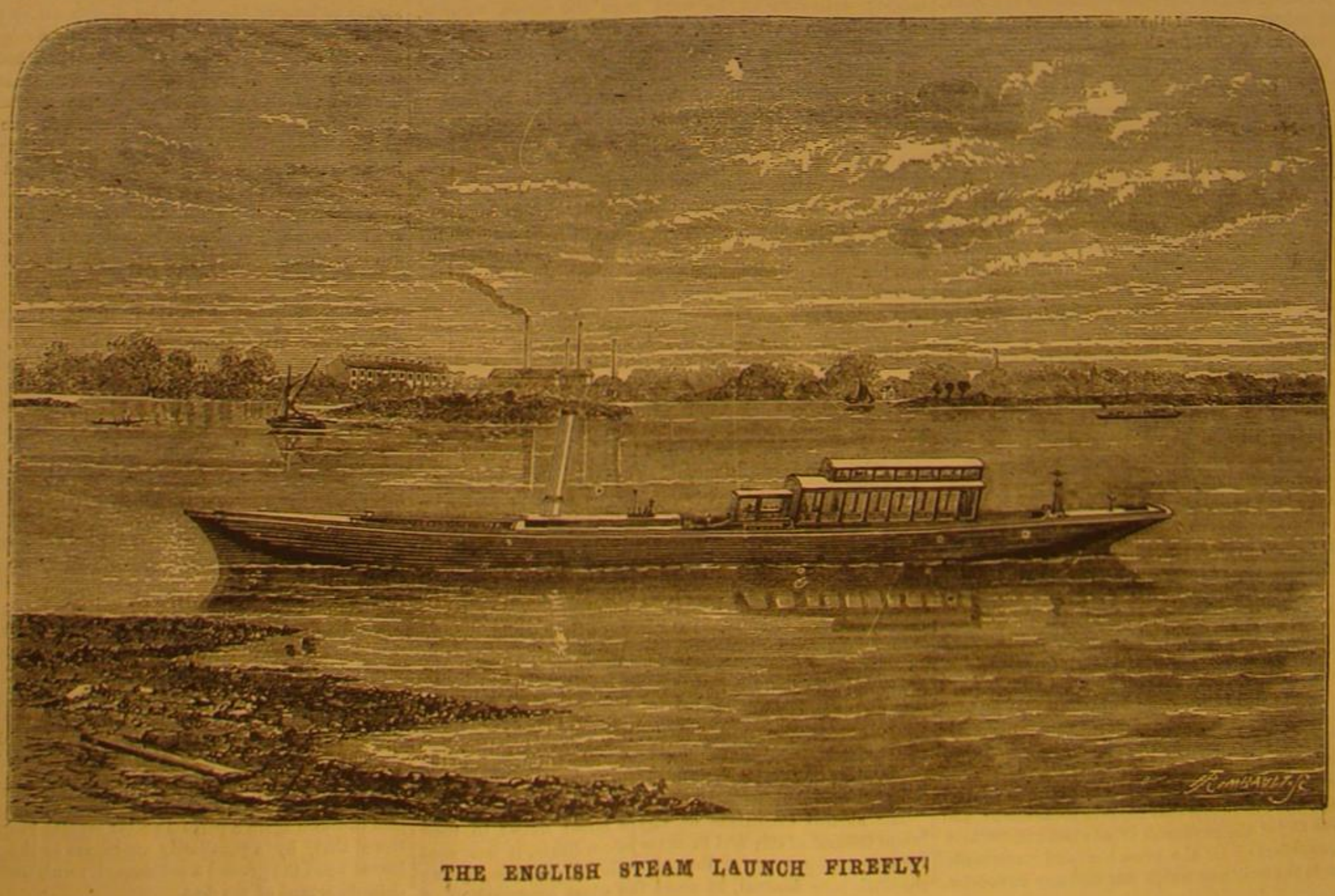
We learn that the apparatus, as above described, has been distributed throughout the French navy, for experiment in different parts of the world, in order to determine not only the operation in cases of necessity, but also whether the phosphide will keep perfectly when submitted to variable atmospheric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

Ditching by Steam Power.

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

THE ENGLISH STEAM LAUNCH FIREFLY.

Some ti ne ago we gave an account of the trial of the steam launch Firefly, one of those wonderful little high speed vessels for which Messrs. John I. Thorneycroft and Co., of Chiswick, England, have gained such a reputation. Of this craft we now publish a sketch, from *Engineering*, which will serve to show her general character. Although only 53 feet long over all, 6 feet 6 inc'ies beam, and 2 feet 6 inches draft of water, the little vessel made, on her trial the speed of 18·94 miles per hour, the observations of the runs being made with a care and accuracy which admits of no question. The Firefly is driven by a pair of engines of the inverted direct acting type, wi.h 6 inch cylinders and 8 inch stroke, also made by Messrs. Thorneycroft; and it was



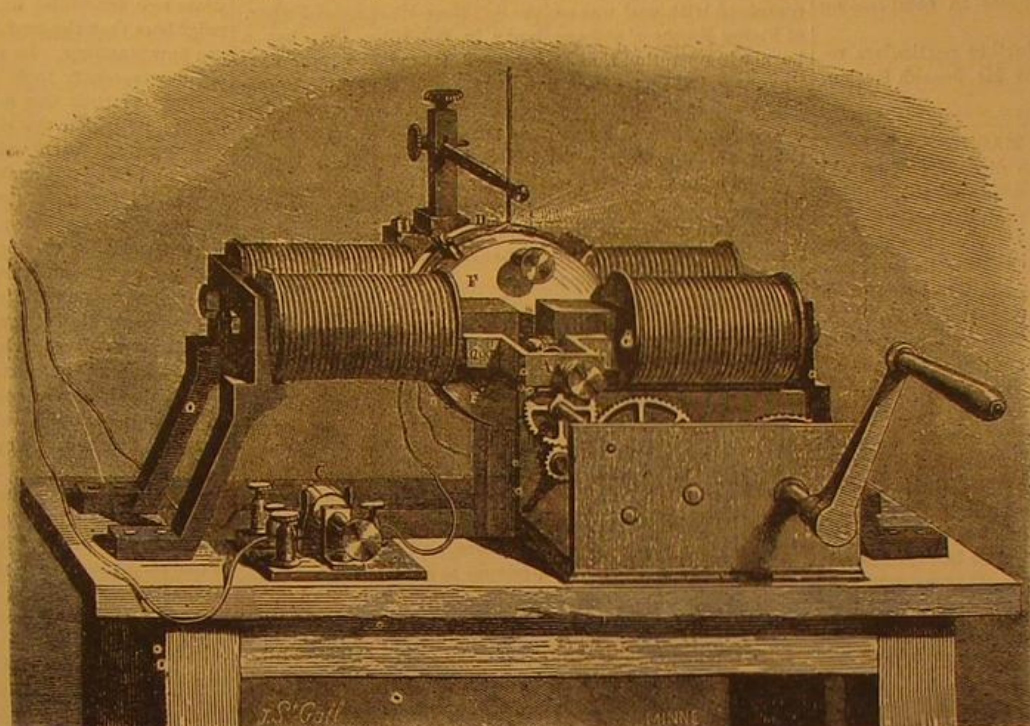
THE ENGLISH STEAM LAUNCH FIREFLY.

built for Mr. Henry Morel, of the *Société de la Lys*, of Ghent. Messrs. Thorneycroft and Co. have made a specialty of these high speed boats, and there appears to be constantly increasing demand for them. The firm are now constructing some of these launches with compound engines.

PERIPOLAR INDUCTION.

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

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



PERIPOLAR INDUCTION.

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

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

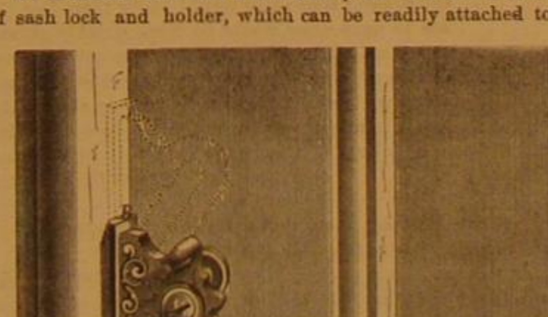
Thus arranged, the machine forms a powerful Foucault apparatus, with which the experiments above indicated can be repeated. But above the cores of the magnets are placed other pieces of soft iron, F, arranged similarly to those marked F'', which, we have stated, are fixed below. When this portion of the device is in position, all the pieces become magnetized by contact with the electro-magnets; and as is evident, the disk, D, in its entire extent, is submitted to the action of a magnetic field presenting the greatest symmetry in every direction. Here, however, the contrary of that which has been heretofore observed takes place; the rotation of the disk is as easily accomplished when the current passes as when the circuit is interrupted; and that the same resistance experienced in the Foucault apparatus is not here encountered is proved by the fact that the copper does not become sensibly warmed.

The current nevertheless passes, and zinc is dissolved in the battery. Here then is expended energy which should manifest itself somewhere. The study of the effects which should be produced by reason of the induction led M. Le Roux to admit the existence of a current running from the center of the disk to the circumference; and he proceeded to verify his conclusions. To this end, a vertical metal support is placed in contact with the axis of the disk, and a horizontal rod fixed to this support terminates in a copper wire, the end of which rests on the periphery of the disk. When the latter is turned, with no current passing, no especial effect is observed, except the slight warming of the copper wire by the friction. If, however, the flow of electricity be established, at that instant a continuous series of sparks leaps from the point of contact of wire and disk, thus denoting the existence of a very energetic current in the circuit formed by the disk, its axis, and the various pieces already described as arranged in connection therewith.

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

DEMMING'S CROWN SASH FASTENER.

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



any window without mutilation of the wood work. The device has no spring to wear out and is composed of but two pieces and a fastening screw. The latter serves as a pivot for the small cog wheel, A, the teeth of which engage in projections, formed, as shown, on the casting, B. When the sash is down the apparatus takes the position shown, so that, on attempting to raise the windows, the wheel, acting against the upper part of the casting, presses the face of the latter firmly against the batten and prevents the elevation of the sash. By turning the wheel by means of the small projection formed upon it, its motion through the bent slot raises the piece, B, and at the same time draws the face of the latter away from the casing so that it no longer binds.

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

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

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

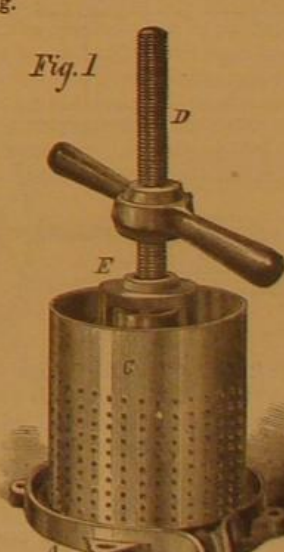
Proposed New Basis for Decimal Measures.

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

IMPROVED PRESS FOR FRUIT, LARD, ETC.

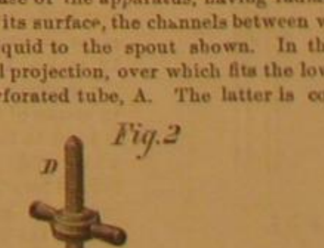
The annexed engravings are views of a new and simple form of fruit or lard press, in which, among other advantages claimed, the usual framework for the screw is rendered unnecessary, and there is a peculiar construction of the press chamber for facilitating the removal of the cake left after pressing.

Fig. 1



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

Fig. 2



a perforated bottom which, when in position, rests on a flange made by turning the lower edge of the outer perforated wall, C. In the center of the base is a screw, D, on which is a nut provided with suitable handles. This nut has a conical depression in its lower face to engage with a corresponding projection on the follower, E. The form of the latter is clearly shown with that of the other detached portions in Fig. 2, while Fig. 1 represents the apparatus set up.

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

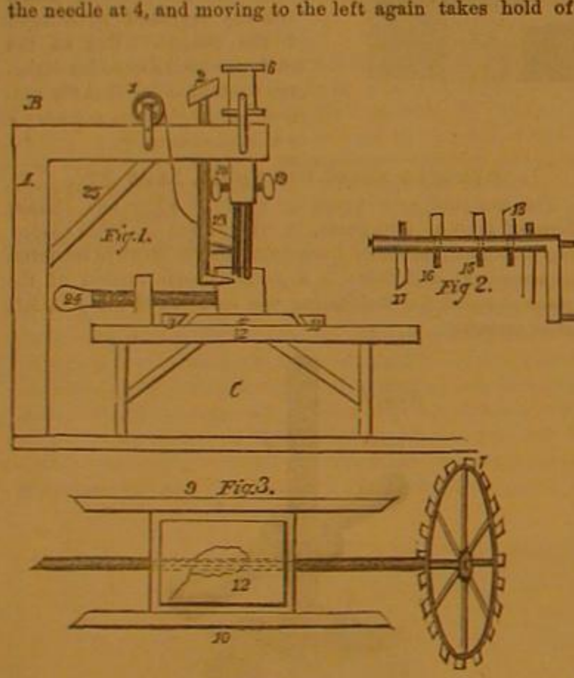
The inventor informs us that the apparatus is well adapted for pressing fruit used in the manufacture of wines, cider, and jellies, and also for dairy purposes in compressing cheese and butter.

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

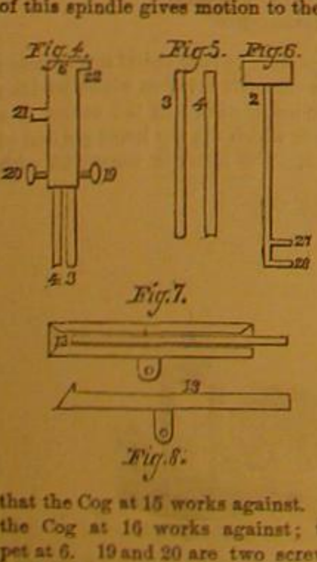
THAT ANCIENT SEWING MACHINE.

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

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



the stitch and keeps it tight till the needle has brought another stitch through the last taken; and so it goes on alternately until the whole article is completely stitched. 3 is the awl that makes the holes for the needle to pass through. 5 is a spindle that goes through the poppet at 6; while by turning the spindle at 5, the awl and needle is worked by the cogs 15 and 16, which are in the spindle at 5; and the motion of this spindle gives motion to the prongs 26 and 27, which are in the spindle at 2. 14 is a cog that gives motion to the wheel 7, which gives motion to a slide at 12 which moves along the grooves at 9 and 10 by means of a screw that is fixed in the wheel, to which slide the article is fixed for stitching. The prong 26 goes into a hole at the slide 13 and gives motion to it "which draws the thread on the under side of the article and holds it tight till the next stitch is taken, and so on till it is done. 22 in Fig. 6 is a shoulder that the Cog at 15 works against. At 21 is a shoulder that the Cog at 16 works against; these work (in?) the Poppet at 6. 19 and 20 are two screws to fasten the Awl and Needle 3 and 4: in 23 is the thread passing in between the Awl and Needle which the eye of the Needle receiveth. 24 is a screw to regulate the distance from the edge or side of the article you are stitching. 25 is a Brace or support to the top of the Machine. The Cogs 14, 15, 16, 17 and 18 in the Spindle at 5 should be so fastened as to be screwed up or down according to the quality of the article and fineness or coarseness of the stitching required."



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

Correspondence.

Crude Oil for Fuel.

To the Editor of the Scientific American:

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

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

The Hot Air Engine.

To the Editor of the Scientific American:

I have read with much interest the suggestions lately made by the different correspondents for the improvement of the hot air engine. I have had the care of a caloric engine for almost two years. It is of 2¼ horse power. I am troubled to keep the upper door and also the poppet valves tight. I would throw out two suggestions that I think would make them better as far as valves and doors are concerned, they are these: Have the door seats cast separately from the engine, and have them fastened to it by a flange around the seat, with bolts screwing into the engine; the door and seat could then be easily taken from the engine and planed or ground together as the case might require. As they now are, it is a vexing tedious job to grind them to a surface by hand, and the change might sometimes save the removal of the whole furnace to a shop for repairs.

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

Illuminating Gas from Crude Petroleum.

To the Editor of the Scientific American:

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

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

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

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

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

52 and 54 Murray Street, New York city.

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

Strange Lightning Freak.

To the Editor of the Scientific American:

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

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

San Cristoval, New Mexico.

The Bisulphide Auxiliary Engine.

To the Editor of the Scientific American:

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

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

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

New York city.

A White Blackbird.

To the Editor of the Scientific American:

It will give the ornithological world some pleasure to learn that another *rara avis* has been added to its collections. This is none other than a "white blackbird" or, more properly speaking, a "red winged starling." It was secured by Mr. E. A. Andrews, of Watertown, N. Y. While Fayette Noble, of Ellisburg, was "sitting" this gentleman for ducks on the marsh at the mouth of Sandy Creek Landing, Mr. Noble discovered a "white blackbird" amid the thousands of starlings that frequent that marsh. Of course such an object could not fail to attract attention and by dint of careful paddling, Mr. Andrews was at length placed in a position to secure this rare prize. The bird, as we have said, is of the red winged variety, a fledgling of this year, with cream colored feathers interspersed here and there throughout its snowy coat, the cream color predominating especially on the wing, where in another year the red would appear. It is unnecessary to say that the bird was a great curiosity. The oldest hunters on the marsh, who have seen myriads of blackbirds, as they call them, come and go, never saw such a thing as a white one before. The appearance of this anomalous bird, as he arose and settled amid his companions of a darker hue, was very striking, they seeming to care no more for him than if he were one of their own color.

BIRD LOVER.

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

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

NUMBER 15.

PARIS, September, 1873.

LIEGE,

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

THE BIRMINGHAM OF BELGIUM.

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

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

ANCIENT SMELTING FURNACES,

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

From that time to the present, the Flemings have never lost their skill as workers in iron, and they have succeeded well in keeping pace with the progress of improvement. To day, we are told that Liège possesses 98 iron works, turning out, in 1872, 178.000 tuns of pig metal and 103,000 tuns of finished iron. Charleroi threw into market 400,000 tuns of pig and 250,000 tuns of manufactured iron. Verviers, where was built the Thompson road locomotive exhibited at Vienna by Bede & Co., Seraing, where is the establishment of the Cockerill company, Ghent, Brussels and Antwerp and many other towns are well worth visiting, but we had not time to explore other cells of this busy hive of the Flamands.

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

The work people are not usually as well provided with the comforts and conveniences of life as they should be, but instances are not infrequent of employers making special provision for their welfare in a degree which is not actually incumbent upon them. I am very confident, however, that in no instance, at home or abroad, does the employer fail ultimately to receive a bountiful return for all capiatl expended in providing for the physical, intellectual and moral welfare of his employees. Physical benefits conferred bring back a return in healthful energy, intellectual training gives intelligence which invariably finds application, and moral advancement results in an increased sense of responsibility; and all together promote wonderfully that appreciation of the mutual obligations binding master and man which is the best of all preventives of strikes and lock-outs, and of all those unfortunate disagreements which divert the trades unions from their legitimate work and bring embarrassment and distress upon all classes. The Messrs. D'Andrimont have erected, at their collieries at Micheraux, the

HOTEL LOUISE

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

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

COTTON AND WOOLEN MILLS,

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

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

BRUSSELS,

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

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

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

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

During the short period of our stop here, we have had opportunities of visiting the more interesting portions of the city and of inspecting the principal edifices. We have visited

NOTRE DAME,

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

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

CONSERVATOIRE DES ARTS ET METIERS.

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

R. H. T.

A Compound Locomotive.

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

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

PALMER'S POWER SPRING HAMMER.

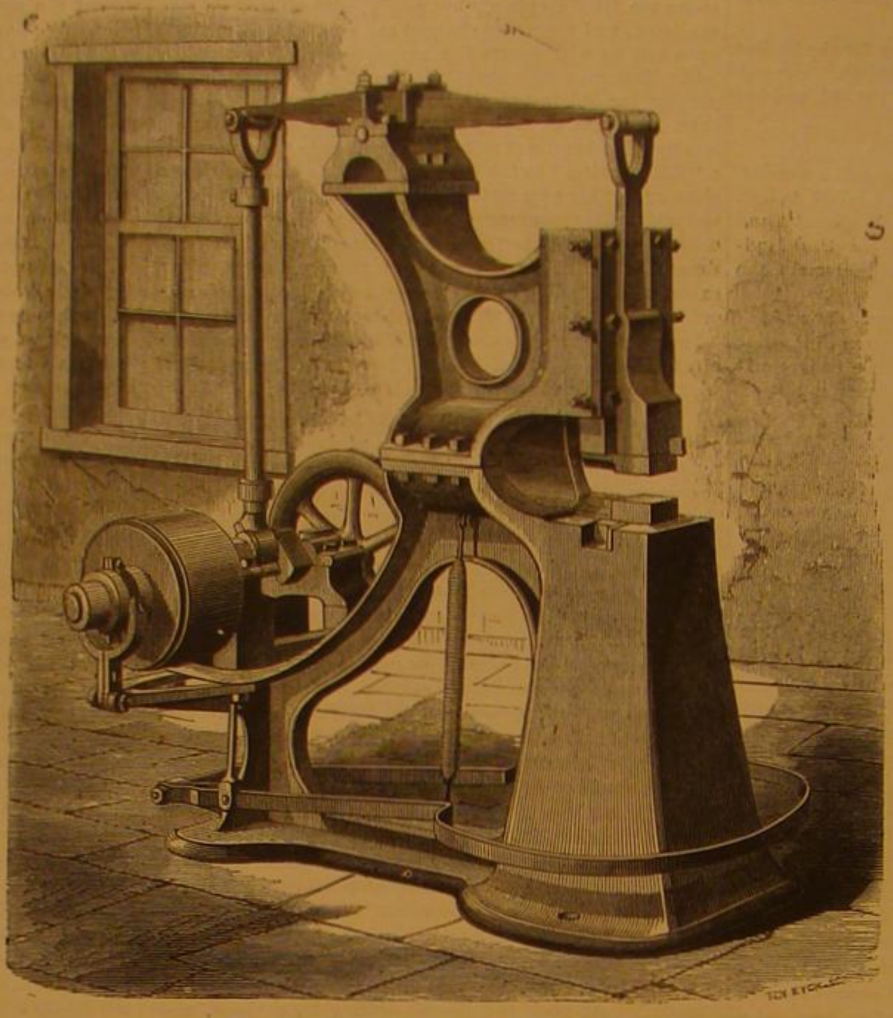
In the illustration is presented a view of Palmer's power spring hammer, an invention, it is claimed which has the advantage of being operated by the same power as is used to run the works in which it is used and without the additional expense of extra boilers and attendants. The machine, it is stated,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

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

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

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

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



PALMER'S POWER SPRING HAMMER.

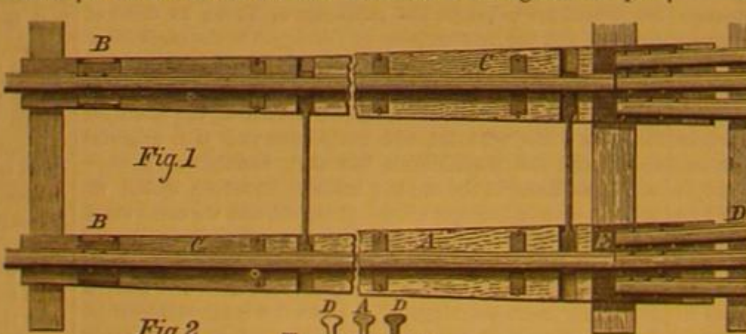
IMPROVED RAILROAD SWITCH.

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

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

It will be observed that it is not so much the intention to overcome the expansion of the switch rail, A, from point, B, to bed plate, as such would only be about ¼ inch in some 18 feet; but the main object sought is to make a firm connection, between rails A and D, so that the adjoining rails of the track cannot crowd the former together. The inventor states, as the result of his experience, that unless some arrangement of this kind be used, the rails, when the fish plates are tightly screwed up, will run perhaps for a quarter of a mile, shoving up the switch joint (that being the weakest part) in preference to overcoming the friction of the fish plates and closing the usual ½ inch spaces left to allow for expansion between every two rails. By the present system, it is claimed, through the means above described, the rails are obliged to fill up these spaces completely, as they cannot crowd or creep toward the switch, so that the latter remains unaffected and the relative distance between the ends of the rails always uniform. The device, we are informed, has been in use on the Central Pacific Railroad during the past summer, and, even when the thermometer ranged from 100° to 110°, worked with perfect success. The construction is such as to resist any strains to which may be subjected the plates under both throw and stationary rails, being bent at the end so as to cut down into the timber and thereby be prevented from any possibility of slipping.

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



ADAMS' RAILROAD SWITCH.

Important Patent Litigation.

The loom improvements patented by William Webster pertain to the operation of the wires used in the manufacture of carpets and other pile fabrics. The practical result of the use of the Webster invention is to augment the production of the loom by more than 33 per cent, without increase of the power or other expenses. No sooner had the success of the improvements been practically demonstrated than various carpet and other factories sought to modify their looms so as to gain the same advantage. In this they are alleged to infringe the patents above alluded to, and an extensive series of litigations has been commenced on the part of the patentee. Testimony is now being taken, prior to argument in the United States Court.

Habits of the Baltimore Oyster.

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

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

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

Determination of the Heat of Combustion of Explosives.

M.M. Roux and Sarran communicate to *Les Mondes* the following description of the mode of determination and results obtained, in testing the heat disengaged by the combustion of various kinds of gunpowder. The deflagration was produced in cylindrical cast iron shells of 0·9 inch in thickness and of an interior capacity of from 16 to 17 cubic inches. These bombs were closed by a bronze screw plug through which passed an isolated wire, which conducted a current sufficient to heat a thinner wire within to redness and thus inflame the charge. They were placed in a copper vessel 4·5 feet in diameter, 5·1 feet in hight, and containing about 4 pounds of water. The temperature of the bath was determined by the end of a thermometer graduated to tenths of a degree, with reading to hundredths. The water was first brought to a temperature equal to that of the surrounding atmosphere, the explosion caused, and then the difference in warmth noted. The following results were obtained:

	Sulphur	Saltpetre	Charcoal	Units of heat per 2·2 lbs. of powder.	Weight of gas per 2·2 lbs
Fine sporting powder	10·0	78	12·0	807·3	0·337
Cannon "	12·5	75	12·5	752·9	0·412
Musket "	10·5	74	15·5	730·8	0·414
Ordinary com. "	13·0	72	15·0	694·2	0·446
" blasting "	2 ·0	62	18·0	572·2	0·499

New Method of Preparing Caustic Soda.

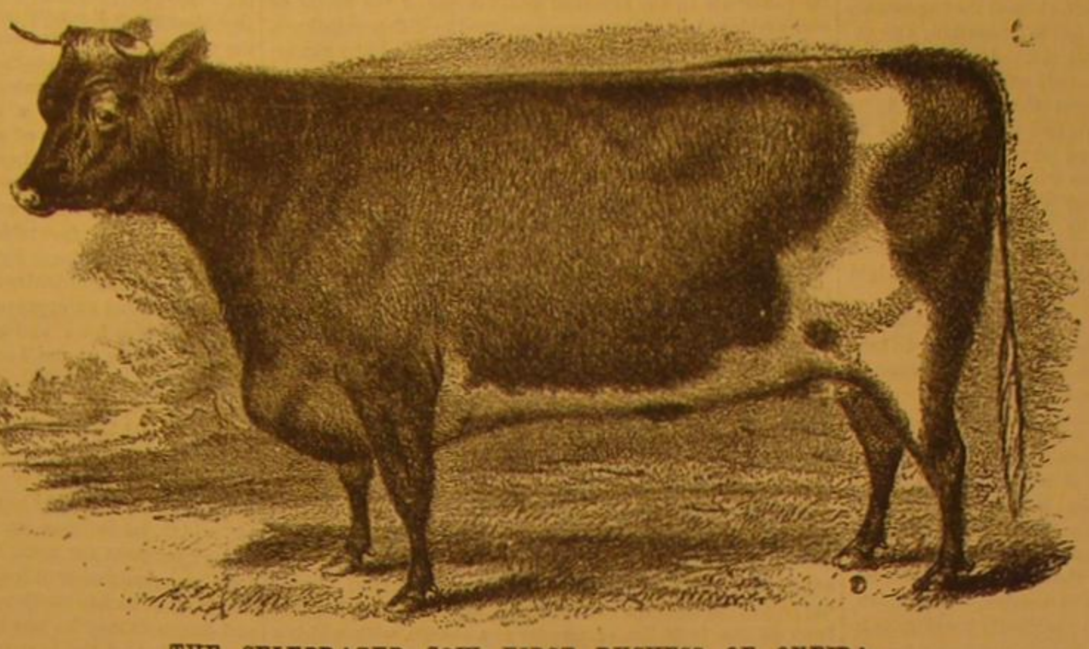
The crude lye is evaporated in cast iron boilers. At a certain heat the cyanides contained in the pasty mass are decomposed, with escape of ammonia and deposition of carbon. When this point is reached, the heat is raised to redness, and the mass becomes more fluid. A sheet iron cover is then fitted upon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

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

A FORTY THOUSAND DOLLAR COW.

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

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



THE CELEBRATED COW, FIRST DUCHESS OF ONEIDA.

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

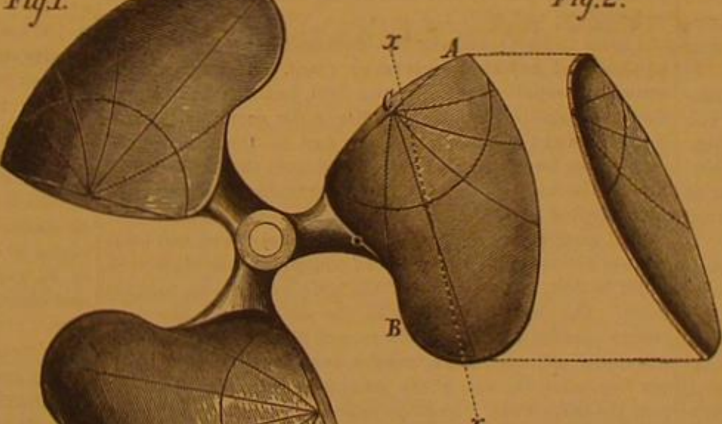
HELICOIDAL CONCAVO-CONVEX PROPELLER.

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

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

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

Fig. 1. *Fig. 2.*



HELICOIDAL CONCAVO-CONVEX PROPELLER, OR EAGLE WING.

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

The following are the data of the trial: Helicoidal: Average steam 60·35 lbs.; number of revolutions, 41,920; time occupied, 2h. 54½m. Eagle Wing (or helicoidal concavo-convex): Average steam, 59·7 lbs; number of revolutions, 32,660; time occupied, 2h. 46m. Differences in favor of Eagle Wing: Revolutions, 9,260; time, 8½ minutes.

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

Helicoidal: Revolutions, 25,180; time, 1h. 30m. Eagle Wing: Revolutions, 21,200; time, 1h. 23¾m. Difference in favor of Eagle Wing: Revolutions, 3,980; time, 6¼ minutes.

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

A form and pitch of blade proper for, say, 200 revolutions per minute, if revolved 250 or 300 per minute, instead of throwing the water back coincidently with the line of the vessel's motion goes further, and throws it across the line.

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

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

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

Telegraphing Maps and Plans.

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

The Siemens Steel Furnace as Described by the Inventor.

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

Taking the specific heat of iron at ·114, and the welding heat at 2,700°, Fah., it would require ·114 × 2700 = 307 heat units to heat 1 lb. of iron. A pound of pure carbon develops 14,500 heat units, a pound of common coal 12,000, and therefore 1 tun of coal should bring 39 tuns of iron up to the welding point. In an ordinary reheating furnace a tun of coal heats only 1½ tuns of iron, and therefore produces only one twenty-third part of the maximum theoretical effect. In melting 1 tun of steel in pots 2½ tuns of coke are consumed, and taking the melting point of steel at 3,600° Fah., the specific heat at ·119, it takes ·119 by 3,600 = 428 heat units to melt a pound of steel; and taking the heat producing power of common coke also at 12,000 units, 1 tun of coke ought to be able to melt 28 tuns of steel. The Sheffield pot steel melting furnace therefore only utilizes one seventieth part of the theoretical heat developed in the combustion. Here, therefore, is a very wide margin for improvement, to which I have specially devoted my attention for many years and not without the attainment of useful results.

Without troubling you with an account of the gradual improvements, I will describe to you shortly the furnace which I now employ for melting steel. This consists of a furnace bed made of very refractory material, such as pure silica sand and silica or Dinas brick, under which four regenerators or chambers filled with checkerwork of brick are arranged in such a manner that a current of combustible gas passes upward through one of these regenerators while a current of air passes upward through the adjoining regenerator, in order to meet in combustion at the entrance into the furnace chamber. The products of combustion, instead of passing directly to the chimney as in an ordinary furnace, are directed downwards through the two other regenerators on their way towards the chimney, where they part with their heat to the checkerwork in such a manner that the highest degree of heat is imparted to the upper layers, and that the gaseous products reach the chimney comparatively cool (about 300° Fah.). After going on in this way for half an hour, the currents are reversed by means of suitable reversing valves, and the cold air and combustible gas now enter the furnace chamber, after having taken up heat from the regenerator in the reverse order in which it was deposited, reaching the furnace therefore nearly at the temperature at which the gases of combustion left the same. A great reversion of temperature within the regenerative chambers is the result, and the two first mentioned regenerators are heated to a higher degree than the latter. It is easy to conceive that in this way heat may be accumulated within the chamber to an apparently unlimited extent, and with a minimum of chimney draft. Practically the limit is reached at the point where the materials composing the chamber begin to melt, whereas a theoretical limit also exists in the fact that combustion ceases at a point which has been laid down by St. Clair Deville at 4,500° Fah., and which has been called by him the point of dissociation. At this point hydrogen might be mixed with oxygen, and yet the two would not combine, showing that combustion really only takes place between the limits of temperature of about 600° and 4,500° Fah. To return to our regenerative gas furnace. It is evident that there must be economy where, within ordinary limits, any degree of heat can be obtained, while the products of combustion pass in the chimney only 300° hot. Practically a tun of steel is melted in this furnace with 12 cwt. of small coal consumed in the gas producer, which latter may be placed at any reasonable distance from the furnace, and consists of a brick chamber containing several tuns of fuel in a state of slow disintegration. In large works a considerable number of these gas producers are connected by tubes or flues with a number of furnaces.

The Devil Fish.

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

MEETING OF THE BRITISH ASSOCIATION.

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

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

STEEL.

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

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

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

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

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

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

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

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

It is not alone in the relative weight or in the relative cost that the advantage of the stronger material is important, but with steel we shall be enabled to cross openings which are absolutely impracticable in iron. Steel is used in the Illinois and St. Louis Bridge in America, a bridge of three arches, each of 500 feet span.

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

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

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

THE BURLEIGH ROCK DRILL IN GREAT BRITAIN.

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

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

RARE CHANCE TO ADVERTISERS.

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

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

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

We are now collecting names of all persons engaged in manufacturing pursuits, of railroad officials, contractors, engineers, mechanics, machinists, chemists, inventors, and men of science generally throughout the entire country; and we may safely assert that there will not be a single village or town in the United States, into the hands of some of the inhabitants of which this special number of our journal will not find its way. It should be remembered that this is no random list of names selected from publications printed for the purpose; but in a great measure a category of persons and firms who have come to our notice during our long experience and intercourse with the industrial and inventing population of the land; so that advertisers will understand that they reach the very people from whom they can expect the most substantial returns, and to whose combined notice they can hope to introduce their products through no other medium extant. Our rates, as stated in our advertisement, remain the same as for a regular weekly issue, thus completing the advantages of an offer, the value of which, we consider, needs no further demonstration.

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

A VALUBLE DRAFTING INSTRUMENT.

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

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

The Most Powerful Gun in the World.

The new reinforced siege guns lately added to the German artillery, of 21, 28, and 30½ centimeters rifled bore, are said to be the most powerful guns in the world. Their performances are truly remarkable. The last mentioned gun, with 120 to 130 lbs. of prismatic powder of from 1·74 to 1·76 specific gravity, fires a chilled cast iron shell of 600 to 610 lbs. weight with an initial velocity of 1,607 feet per second, which is said to have never been attained before by any rifled gun. At a distance of 1,200 paces, or 988 yards, it sends the shell clean through a 14 inch armor plate and backing. The gun is very handy and easily manœuvred; it requires one man to handle the breech piece, two to lift up and insert the shell by means of a davit lift, two men to give it its greatest elevation of 17 deg. in 16½ seconds, or its greatest depression of 6½ deg. in 11 seconds, and two men to give it its lateral direction by means of a chain running over jack pulleys.

New Field Guns for the French Army.

The new French field gun, the *canon de sept*, which is constructed by Colonel Reffye, and likely to be adopted as the principal field gun of the army, is, says *Engineering*, made of bronze, with a bore of 8·5 centimeters, length of barrel 187·5 centimeters, and contains 14 grooves, 1·5 millimeters deep, these being twisted from right to left at an angle of 8 deg. 32 minutes, or of 21·2 calibers to a complete twist. The breech closing apparatus is a screw, which fits in a steel nut that is inserted in the end of the barrel, flush with its end face. Screw and nut have their threads cut out at three sixths of the circumference, so that the former may be inserted in the latter by simply pushing it inwards, when it is fastened in it by a turn to the right of ⅙ of its circumference. The screw rests in a kind of swing door, similar to the first Prussian model of field gun with piston breech, which supports it when drawn out of the barrel, and facilitates its insertion. The inner head of the breech screw has a slightly concave surface, and bears on the side three twist grooves, which arrangement is intended for extracting the metallic cartridge shell, which serves as gas check. This shell consists of a thin brass bottom, which is provided with a perforated ignition cup, while the cylindrical part is made of tinned sheet iron. The touch hole is bored at an angle through the breech screw and opens at the center of its inner surface in the gun just where it meets the ignition cup, so that the fire ignites the cartridge centrally. The latter consists of 5 disks of compressed gunpowder, each weighing 0·226 kilogramme, and provided with a central canal of 5·2 centimeters in diameter; their total weight is 1·13 kilogrammes. The projectile is an elongated shell, 3 calibers long, weighing 6·9 kilogrammes and is provided with two lead rings as guides. The first trials with this gun, at the Polygon of Vincennes, date back as far as 1870; but only in 1872 was it tested again at Calais in its improved form, and its chief merit seems to be its low trajectory, though it may leave something to be desired with regard to range, accuracy, and durability.

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

NEW BOOKS AND PUBLICATIONS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Recent American and Foreign Patents.

Improved Metallic Roof.

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

Machine for Forming the Hooks of Machine Needles.

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

Improved Screw Valve.

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

Improved Car Coupling.

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

Improved Butter Tub.

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

Improved Stove Pipe Joint.

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

Improvement in Securing Wheels to Axles.

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

Improved Fire Escape Ladder.

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

Apparatus for Cleaning Cesspools, Sinks, etc.

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

Improved Windmill.

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

Improved Revolving Fire Arm.

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

Improved Brick Machine.

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

Improved Harvester Cutter.

William K. Shoales, Sharburne Four Corners, N. Y.—This invention pertains to the construction of the shanks of harvester cutters and their mode of attachment to the finger bar. By moving the bar until the end of the forward edge of the shanks comes opposite a notch, the shanks may be raised and withdrawn. In this way any desired section may be detached and replaced without disturbing the others. By this construction, also, the cutters will operate with a shear cut, and, the rear ends of the shanks being pivoted, the cutters will have a greater movement than the bar, so that the pitman crank may be made shorter than is necessary when the cutters are rigidly connected with the cutter bar.

Improved Railway Car Brake.

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

Improved Spring Bed Bottom.

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

Improved Loom Shuttle.

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

Improved Slings for Loading and Unloading Hay, etc.

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

Improved Gage for Gang Saws.

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

Improved Corn Planter.

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

Improved Heat Regulator.

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

Improved Metallic Piston Packing.

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

Improved Spring Hinge.

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

Improved Car Brake.

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

Business and Personal.

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

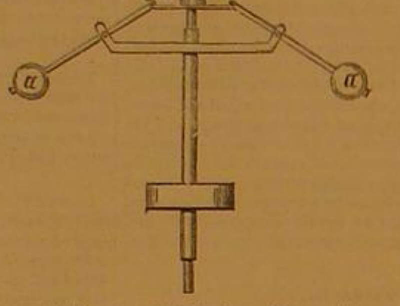
Notes & Queries

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

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

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

E. A. P asks: Suppose I have a governor rotating upon a horizontal shaft at a speed of 30 revolutions per minute, and the balls weigh 10 lbs. each, also that, when diverged to their fullest extent, they describe a circle of 6 feet diameter, and that the longer arm of the lever is ⅞ of its entire length, which, measuring from



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

Answers to Correspondents

C. S. D. will find a recipe for ink on p. 106, vol. 27.—A. D. can try powdered borax as a remedy for roaches.—A. S. will find full information on silkworm culture on pp. 307,381, vol. 26.—A. S. will find the recipe for cement for leather on p. 119, vol. 28.—J. W. E. will find that a cement for mending rubber boots is described on p. 155, vol. 26.—W. E. L. will find the wheel question answered on p. 262, vol 28.—D. S. W.'s solution of the train and siding query is correct.

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

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

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

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

W. F. W. asks: When an engine with a 1½ inch inlet for steam is set 400 feet from the boiler, with 60 lbs. pressure, will the engine get hotter steam by a steam pipe of 1¾ inches diameter than by one of 2 inches diameter? 2. Is it economy to lay a steam line 400 feet long in a box underground? Answers: 1. A pipe just large enough to supply the engine will probably be the best, as there will be less radiation. 2. Yes, if you mean to compare this method with that of having the pipe exposed.

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

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

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

C. E. C. asks: What is French polish composed of, and how is it applied to furniture and to turned work? Answer: Several varnishes are used under the name of French polish. One is pale shellac 5½ ozs., finest wood naphtha, 1 pint; dissolve. The varnish may be colored to modify the character of the wood. A reddish tinge is given with dragon's blood, alkanet root, or red sanders wood; yellow, by turmeric root or gamboge. The process of French polishing is as follows: The surface of the wood is made as smooth as possible with glass paper and pumiced to give the light. A rubber is made by rolling up a strip of thick woolen cloth (list) which has been torn off, so as to form a soft elastic edge. This should form a coil from 1 to 3 inches in diameter. The workman moistens the middle of the flat face of the rubber with the polish by laying the rubber on the mouth of the narrow necked bottle containing the varnish and shaking up the varnish against it once. The rubber is next enclosed in a soft linen cloth doubled, the rest of the cloth being gathered up at the back of the rubber to form a handle. The face of the linen is now moistened with a little raw linseed oil applied with the finger to the middle of it, and the operation of polishing commenced. For this purpose the workman passes his rubber quickly and lightly over the surface uniformly in one direction, until the varnish becomes dry, or nearly so, when he again charges his rubber as before, omitting the oil, and repeats the rubbing until three coats are laid on. He now applies a little oil to the rubber and two coats more are commonly given. As soon as the coating of varnish has acquired some thickness, he wets the inside of the linen cloth before applying the varnish, with alcohol or wood naphtha and gives a quick, light and uniform touch over the whole surface. The work is lastly carefully gone over with the linen cloth, moistened with a little oil and rectified spirit or naphtha without varnish, and rubbed as before until dry.

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

W. H. J. asks: What is the proper diameter and length of bearing of the crank pin of a steam engine, in proportion to the diameter of the cylinder? Answer. Let D = diameter of cylinder in inches. d = diameter of crank pin in inches. l = length of crank pin in inches. P = maximum steam pressure in cylinder, in pounds per square inch. n = number of revolutions of engine shaft per minute. Then, according to Mr. Van Buren's formulas: $l = (P \times D^2 \times 0.7854) \div 350{,}000$, or the least allowable length of the crank pin in inches is equal to the total steam pressure divided by 350,000. Having settled upon the length of the pin, the diameter may be found by the following rule: $D = \sqrt[3]{(D^2 \times P \times l) \div 1690}$, or the diameter of the crank pin is found by multiplying the square of the diameter of the cylinder by the maximum steam pressure per square inch and by the length of the pin, dividing the product by 1690, and taking the cube root of the quotient.

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

H. M. P. asks: Can a small skiff be propelled by a cylinder, 18 inches long 8 inches in diameter, attached to the stern of the boat beneath the water, and having this cylinder arranged so you can pack it full of water and, with a force pump, put on a pressure of 200 lbs. to the square inch? "I propose to have a valve in the end of cylinder half as large as the cylinder itself; and when the pressure is at its hight, to let go the valve. Would the amount of pressure escaping instantaneously exert any power to move the boat in the opposite direction? If so, how much? Answer: The plan is practicable. You will find much valuable information on jet propulsion in standard works on the steam engine and steam navigation.

J. L. C. asks: What advantage is an air pump to an engine, or rather what increase of power does it give to the engine in proportion to the power it takes to drive it? Answer: We will give you an example of an actual case. A pair of high pressure engines, of 200 horse power, were fitted with a condenser and air pump. The mean pressure per square inch was 31 pounds, or 31 ÷ 200 = 0·0155 pounds per square inch of pressure on the pistons for one horse power. The air pump had to do the work required to lift 2792·19 pounds of water 14 feet high per minute = 2792·19 × 14 ÷ 33,000 = 1·18 horse power, and in doing this, exerted an efficiency of 44·38 per cent, so that the actual power required for the air pump was 1·18 × 100 ÷ 44·38 = 2·68 horse power, equivalent to a pressure of 2·68 × 0·0155 = ·042 pounds per square inch. Before the condenser was attached, there was a back pressure of 2·29 pounds per square inch; and with the condenser, the mean pressure due to a vacuum was 5·14 pounds per square inch; so that the gain from the use of the condenser and air pump was 5·14 + 2·29 − ·042 = 7·388 pounds per square inch, or 7·387 × 100 ÷ 31 = 23·83 per cent.

J. T. S. asks: If I sell a horse for $40 and gain thereby as much per cent as the horse cost in dollars, what would be the price of the horse? Answer: Let x = the cost. Then x + x per cent of x = 40. $x + \frac{x^2}{100} = 40$. $100x + x^2 = 4000$. $100x + x^2 + 2500 = 6500$. $x + 50 = \sqrt{6500} = 80{\cdot}65 - 50 = \$30{\cdot}65$, nearly.

G. W. S. says: D. should make his lemon sirup as follows: Take pulverized citric acid 2¼ drams oil of lemon, 5 drops; simple sirup 1 quart. Cut the oil with a little alcohol, then stir the whole together; and after heating, strain through muslin.

J. L. says, in answer to the queries of R. C. G. and C. F. C. regarding steam yachts: R. C. G.'s engine is far too large for his boat, and moreover condensing engines are not adapted for use in small screw steamers. If he will put his 20 square feet of heating surface into a vertical tubular boiler 3½ feet high and 20 inches in diameter, capable of withstanding safely a pressure of 80 or 100 lbs. to the inch, and use a direct acting engine 3 x 6 inches, running at 300 revolutions per minute, with a suitable screw, his boat, if of moderately good shape, will probably make about 7 miles per hour. C. F. C.'s engine is also larger than is necessary. A cylinder 4 x 6 inches would be large enough; for which he will need a boiler about 4 feet high and 22 inches in diameter, with 25 square feet of heating surface. With this he may obtain a speed of 8 miles an hour, more or less, according to the shape of his boat. It will most likely be difficult to get a much greater speed in either of these cases. "I think your allowance of 18 to 25 square feet heating surface per horse power is unnecessarily large, and would be inconvenient for this purpose. For successful steam yachting is required a well proportioned boat, small strong boiler with large fire box and many tubes, by which rapid combustion and a high degree of heat are maintained; a well constructed engine with small cylinder and very large steam passages, working somewhat expansively at a high rate of speed with considerable steam pressure; engine and boiler protected from radiation."

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

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

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

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

COMMUNICATIONS RECEIVED.

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

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

Also enquiries from the following:

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

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

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

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States

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September 23, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

22,590.—CLARIFYING CANE JUICE.—R. A. Stewart. Dec. 10.
26,581.—PLANING CURVES.—J. P. Grosvenor. Dec. 10.
26,614.—POROUS WARE.—B. S. Pierce *et al.* Dec. 10.
26,627.—CUTTING VENEERS.—B. F. Sturtevant. Dec. 10.
26,679.—SEAMING MACHINE.—L. T. Hulbert. Dec. 17.
26,822.—CUTTING ROUND TENONS.—L. A. Dole. Dec. 24.

EXTENSIONS GRANTED.

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

DESIGNS PATENTED.

6,890.—TYPE.—E. C. Ruthven, Philadelphia, Pa.
6,891.—FURNITURE.—D. Shales *et al.*, Boston, Mass.
6,892 & 6,893.—TYPE.—R. Smith, Philadelphia, Pa.
6,894.—CHAIRS.—J. M. Waters, Cincinnati, O.

TRADE MARKS REGISTERED.

1,461.—SILK FABRICS, ETC.—Bernstein *et al.*, N. Y. city.
1,462.—HARD SOAP.—O. Cutts & Co., Port Au Prince, Hayti.
1,463.—JOURNAL PACKING.—P. S. Devlan, N. Y. city.
1,464.—SAWS, ETC.—H. Disston & Sons, Philadelphia, Pa.
1,465.—SHIRTS.—Finlay *et al*, New York city.
1,466 & 1,467.—BOOT PEGS.—Kearsarge Peg Co., Andover, N. H.
1,468.—LIQUORS.—G. W. Kidd & Co., New York city.
1,469.—CLOTHING.—M. Newman *et al*, New York city.
1,470.—TEAS.—Newton & Co., San Francisco, Cal.
1,471 & 1,472.—LEAF TOBACCO.—Weiss *et al.*, N. Y. city.

SCHEDULE OF PATENT FEES:

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On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
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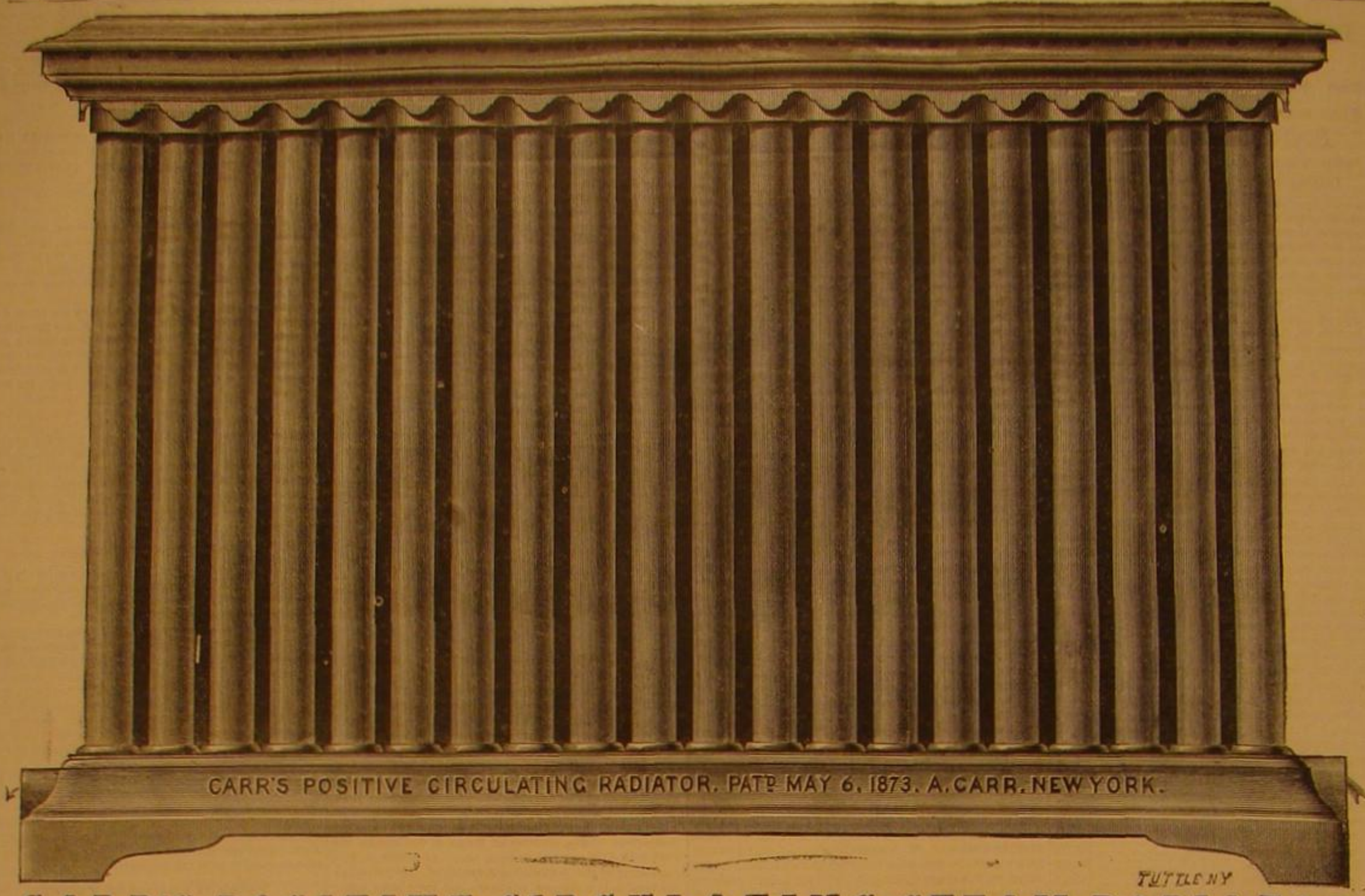

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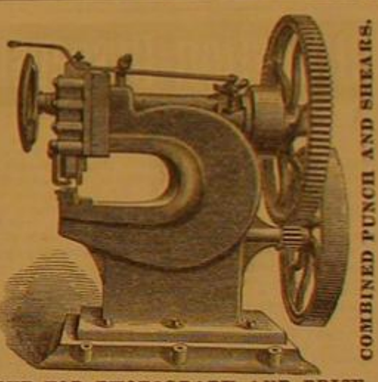

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