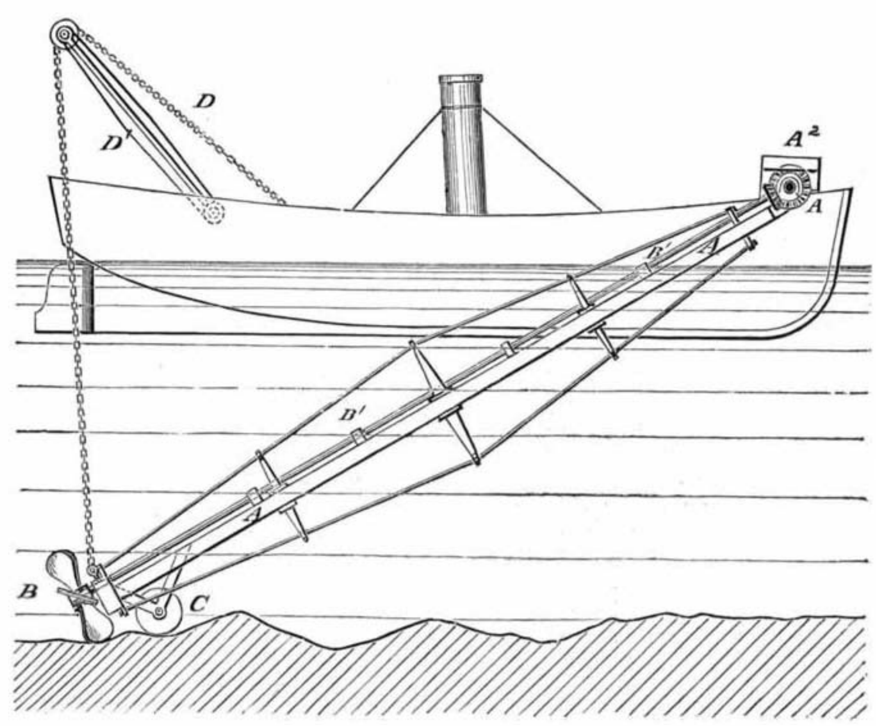
A NEW DREDGING APPARATUS.

In the dredging apparatus represented in the engraving, propellers driven by suitable motive power work partially in the material or sand bank to be removed, so causing whirlpools and bringing the mud or sand into a state of suspension in the water, where the current washes it away. The propellers are carried at the ends of beams, which, at their opposite ends, are hung to a lateral frame of a barge or vessel. The ends of the beams carry back of the propellers rollers to run upon the mud or sand, and prevent the propellers and beams from entering too deeply into it.

In the engraving, A A are the beams, of suitable construction and length, that are hung at the upper ends to a shaft A^1, that is supported in bearings of a lateral frame, A^2, of a suitable barge or vessel, and driven by a steam engine on board of the same. The driving shaft, A^1, revolves, by beveled gear wheels, the shafts, B', that turn in bearings of the beams, and are provided at their lower ends with a propeller or propellers, B. Each propeller or stirrer, B, consists of a four-bladed screw of unusual strength, with two blades set in advance of, and being somewhat longer than, the other two. The propellers are lowered to the bottom of the river or canal, or other water courses, and then revolved to work on the sand bank or material to be removed, so as to stir up the same and bring it into a sufficient state of suspension in the water to admit of its being carried away by the current. A roller or rollers, C, are arranged back of the propellers, turning in suitable bearings of the beams, A, to prevent the propellers from entering too deeply into the mud so as to break or get stuck.

The propellers and beams are lifted by means of chains, D, and crane, D', into position alongside of the vessels, when the work of removing the sand is to be interrupted, the propellers serving then to move the vessel.

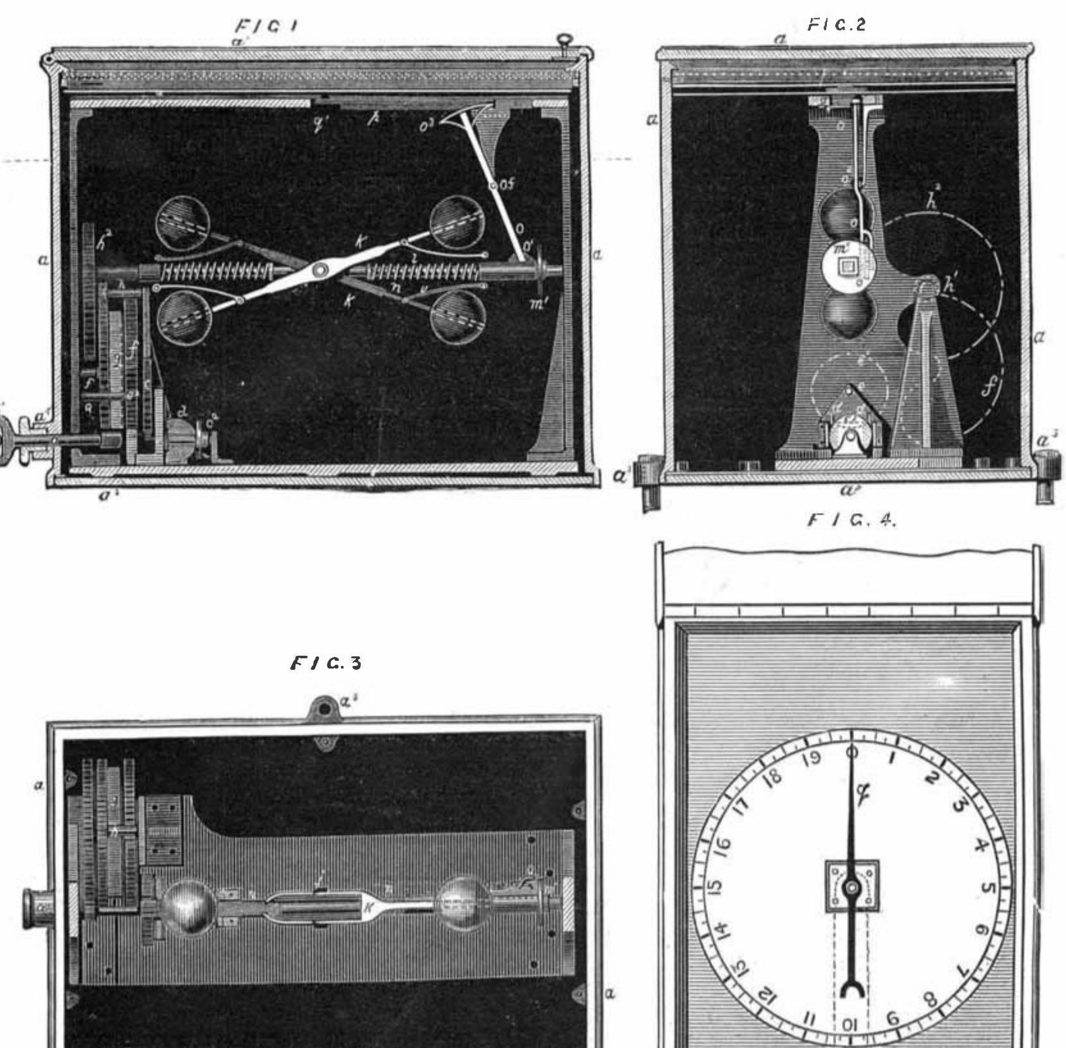
This invention was patented through the Scientific American Patent Agency, November, 7, 1876, by Messrs. J. J. Van Rietschoten and W. Houwens, of Rotterdam, Netherlands.



DREDGING APPARATUS.

IMPROVED SHIP'S SPEED INDICATOR.

We illustrate, from *The Engineer*, a ship's log or speed indicator, patented by Mr. W. de Normanville, of Bridge-road, Hammersmith, England. Fig. 1 is a longitudinal section of the apparatus; Fig. 2 is a transverse section: Fig. 3 is a plan with some of the parts removed: and Fig. 4 represents separately the dial and index. *a a* is the case of the instrument; it is constructed of cast iron, and is provided with a hinged lid, a^1, immediately beneath which there is a plate of stout glass secured in a watertight manner. Lugs are provided, by which the instrument is secured to the rail of the ship or vessel; a^4 is a stuffing box in the side of the case to receive a spindle, *b*, carrying a universal joint, b^1, through which the connection with the rotator is made; a^6 is a screw plug in the bottom of the case, which, when taken out, leaves a hole admitting of the introduction of a turnscrew to insert or remove the small screw pin, b^2, by which the spindle, *b*, is held in a socket, c^1, at the end of the axis, *c*. The frame which carries the axis, *c*, and the other working parts of the instrument is fixed to the bottom, a^2, of the case, so that the whole of the mechanism comes out with the bottom when that is removed; c^2 is a disk on the axis, *c*; it bears against friction rollers, *d d*, mounted on the frame so that the axis may revolve freely, notwithstanding the strain to which it is exposed in towing the rotator through the water; c^3 is a pinion on the axis, *c*; it drives a wheel, e^1, on an intermediate axis, *e*, on which again is a pinion, e^2, driving a wheel, f^1, fixed on an axis, *f*; f^2 is another similar wheel on the same axis, but able to turn upon it. It is fixed to the spring box, *g*, in which is a coiled spring, having one end fixed to the axis and the other to the interior of the spring box. This arrangement constitutes a regulating apparatus: the spring, being wound up by the action of the rotator, is the maintaining power driving the indicating instruments, to which it imparts a regular velocity free from sudden changes. The wheel, f^1, drives a pinion on the axis, *h*, on which is also a spur wheel, h^2, gearing with a pinion on the main axis, *i*. In the middle of the axis, *i*, is a pin, which serves as an axis for the two weighted arms, *k k*; they have weights at their ends arranged so that the divergence of the arms is not affected by the pitching of the vessel. *l l* are links connecting the arms, *k*, with the sliding collars, *m m*. When the instrument is in use the centrifugal action of the weighted arms compresses the springs, *d n*, more or less, according to the speed of rotation. On one of the collars, *m*, there is a disk, m^1, against which a friction roller, o^1, carried by the lever, *o*, bears. The lever, *o*, carries at its upper end an arc, attached to which is one end of the fine chain wound round a barrel at q^1, on the axis on the index. *r* is a light spring surrounding the axis, q^2, and attached to it at one end, while the other end is fixed to the frame; it serves to hold the index back against the action of the lever, *o*, to keep the chain, *p*, always tight, and to hold the roller, o^1, against the disk, m^1. The dial is graduated to indicate the speed of the ship in knots per hour. The prime motor of this instrument is a small screw or rotator similar to that used in other logs, drawn after the vessel by a line some 150 feet in length. The shaft of the rotator is about 12 inches long by about 1 inch in diameter, made of such specific gravity that if left to itself it would slowly sink, but it is easily kept up by the line to which it is attached, drawing it through the water, some 8 feet below the surface. This rotary motion of the screw is conveyed by the line to the rest of the mechanism.



NORMANVILLE'S SHIP'S SPEED INDICATOR.

A New Autographic Process.

Autography is a long known process by which manuscript, or drawings, made on common paper by means of a peculiar kind of ink, may be transferred to a lithographic stone and then printed.

A new method, which is said to be both simple and cheap, is described by Professor G. O. Sars, of the University of Norway, in the *American Journal of Science and Arts*. The drawing is done on common letter paper, which, on one side (where the drawing is to be made), has been coated, by means of a sponge, with a thin film of starch. As it is not well for the shading to use quite glossy paper, it is a good way to give it a granulated surface by pressing it against a lithographic stone. By using for this purpose stones with more or less smooth surface, the paper will assume any degree of smoothness required, according to the character of the drawing. The next process is to fasten the paper to a sketching board or a piece of pasteboard; the drawing is then made by means of the lithographic crayon.

The paper must be cut to the size intended for a full plate, and the drawings arranged in the same order as they will have to appear in the printed plate. The method is the same as in common drawing with lead pencil, or rather crayon. The figures should, however, first be sketched in outline on common paper and then transferred to the prepared paper in the usual manner, by means of transparent paper and plumbago paper, blue paper, or, still better, red paper, the transferring being done with a lead pencil that is not too soft. The details of the figures, the shading and finer structural conditions, may be drawn off-hand with the crayon on the prepared paper, after the outline has been transferred. Any correction or change in the drawing can easily be done by erasing with a fine scalpel, taking care only that the starch film be not injured. When the plate is finished to satisfaction, it is transferred to a common smooth lithographic stone, in the following simple way: The back of the paper is moistened with water containing a small portion of nitric acid; and, after having been put for some time between moistened soft printing paper, the plate is laid, face downward, on the stone, which then for a moment is put in the press. To make more sure of it the outside of the paper may be slightly rubbed with the finger; if then the paper be stripped off, the drawing and the entire film of starch will remain on the stone, the figures being reversed. Now the stone is to be treated in the common way with gum arabic and a weak etching, and will then be ready for printing. The whole process of transferring the drawing from the paper to the stone is simple, but requires practice and great care. This should, therefore, be left to the charge of a professional lithographer. This process is especially well adapted to the uses of zoölogists, microscropists, and naturalists generally, as it enables them to prepare their own illustrated plates at minimum expense.

Potato Bug Cure.

Many different means have been tried to destroy the beetle, but without effect, until the present method was found, and this method is so effective and so cheap, that he must be a very careless farmer who still lets his potatoes be ruined. It is the following: Take 10 lbs. of lime and mix it well with 1 lb. of Paris green, which is in no way deleterious to the potatoes, giving 11 lbs. of mixture for each acre. Get a small wooden box, 10 inches by 8 inches, and 6 inches deep, and nail a piece of millcloth, as used for sifting by wheat millers, instead of a wooden bottom beneath, also a piece of lath across the middle of the open top as a handle for shaking the box. Every morning from 5 to 9 o'clock or longer, as long as the dew is on the plants, this mixture has to be applied. Children of 8 to 12 years can easily do it, by putting about one pint into the box and sprinkling it as dust by slow shaking on the leaves of the plants. I guarantee that if this is done at the beginning of the growth in spring, as soon as the first insects are seen, the plants will remain perfectly free. Within two days all the beetles will have disappeared, and this result is quickly arrived at, even if the field has been real ady completely devastated, and only the stalks remain covered with the insects and their larvæ. The cure never fails, and it has already been proposed by our farmers in the papers to compel all potato growers by law to apply this mixture on all their fields, for then, within two years, the bug would be entirely destroyed.

Distillation of Crude Petroleum.

The crude oil to be treated is first placed in large settling tanks, to allow the subsidence of any water intermixed. It is next pumped into large upright cylinders, or stills, holding about 12,000 gallons, and these are generally heated by steam alone. In the iron worms proceeding from the still cupola and surrounded by cold w ter, the various grades of naphtha, constituting about 15 per cent of the crude oil, are condensed, *seriatim*, and conducted to separate tanks.

The crude oil remaining in the naphtha stills is then pumped into stills heated by direct fires underneath. These charges are distilled to coke, which remains in the stills, or to a thick residuum, which is drawn of and used in making fertilizers, etc. The uncondensable gases pass into the atmosphere, and the oils are condensed and separated into crude burning oil, intermediate oil, and crude lubricating oil Each of these products is redistilled, and the distillate from each separ ted, as before, into lighter, intermediate, and heavy oils.

Number one from this second distillation is thoroughly agitated with strong sulphuric acid, and then with a solution of caustic soda. It is afterwards redistilled, and yields about 80 per cent of finished kerosene and mineral sperm oil, and nearly 20 per cent of dense oils, from which solid paraffin is obtained.

It was in the agitator described, and after the second distillation, that the strange fire occurred, as recently mentioned in the SCIENTIFIC AMERICAN, at Hunter's Point. Most probably the usual quantity of 5 per cent of sulphuric acid had been added to unite with the remainder of the lighter products, and those substances causing the unpleasant odor of crude or partially crude petroleum. The important question here arises: Does the inattention or ignorance of workmen ever allow an undue quantity of the dangerous hydrocarbons to pass into the agitator, there to come in contact with great heat and strong chemical action? We know but too well that there is scarcely a manufacturing process of any kind that is free from such irregularity, and in extensive refineries the impossibility of managers being always at hand, and the necessary frequent engagement of new hands, might easily occasion such a difficulty and such an opportunity for unexpected chemical combinations.

It has been already stated that there is doubt as to whether it was a stream of cold water or a jet of steam which was turned into the agitator. It is much more probable that it was steam than water, because one of the first efforts in the distillation is to get rid of all water in the oil, and many refiners, I am informed, blow steam at high pressure through the crude petroleum, to aid in eliminating the naphtha, before the oil is run into the fire stills. Whether steam thus introduced is a safe process, or whether unlooked-for circumstances may not develop a danger always slumbering amidst such violent action, is a ques ion for grave consideration. In the case in point I do not know whether an excess of the lighter hydrocarbons were allowed to enter the agitator, but if it were so, and high pressure steam admitted —and there could also be too much pressure and heat for safety—danger might well be feared, although it, like an impending steam boiler explosion, might long be averted.

In the lighter and more dangerous hydrocarbons the quantity of carbon ranges from 89·55 to 92·31 per cent, and hydrogen only 7·69 to 10·45 per cent. As the chief danger from fire is known to arise from these lighter products, it is evident that the carbon in them, and not the hydrogen, is the dangerous substance. Carbon, as is well known, cannot inflame except by the presence of oxygen, and it is reasonable to believe that, when oxygen in steam is vastly expanded and attenuated by the heat which has put it into the form of steam, and when the latter is brought into contact with a substance so rich in carbon—the latter also much elevated in temperature and expanded by the admixture of sulphuric acid—there are furnished additional facilities, so to speak, of combination between the oxygen in the steam and acid and the carbon of the lighter products, if the latter exist in too great proportion. There would then be mechanical division of oxygen (by expansion through heat), to promote chemical action, the latter at the same time varying, in an unknown ratio, to the heat equivalent, and to the quantity of carbon unintentionally introduced by the lighter products.

Besides this danger from the ignition of fumes of naphtha, already mentioned, there may be a danger from the sudden evolution of electricity, which is sometimes generated in large volumes in the most unexpected manner. Should this happen, the chemical combinations I have been considering might be hastened, or made at untoward times. Two volumes of hydrogen and one of oxygen, if placed in a tight vessel, can be condensed into water, with explosion, by the passage of an electric spark, with the production of a great amount of heat. Perhaps, in a similar manner, electricity, suddenly evolved, might cause instantaneous combination of the oxygen in steam or water with the carbon of certain of the petroleum products—the heat consequent upon such combination inflaming the whole of the oil.—*American Exchange and Review.*

The Electric Light at Sea.

The Téméraire, eight, 8,412 tons, 7,000 horse power, Captain M. Culme-Seymour, ironclad double turret ship, having been fitted with the electric light, a number of experimental trials were lately carried out on board in the repairing basin, Chatham dockyard, with the object of enabling the authorities to be satisfied as to the official working of the light previously to the vessel taking her departure from this port for the Mediterranean, which she will do in the course of a few days. The electric lights on board the Téméraire, as is also the case in the Alexandra, are fitted in a commanding position of the ship; and during the trials, which were carried out under the supervision of the Admiral-Superintendent of the yard, C. Fellowes, C.B., and other officials, every portion of the vessel was vividly lighted up, while for a distance of several hundred yards around the ship the minutest objects on the surface of the water and the land were clearly discernible. Indeed, so powerful was the light that during the experiments the houses and buildings in Chatham and Rochester, including Rochester Cathedral and Rochester Castle, a couple of miles distant, were brought out into full relief, and were clearly discernible as the rays of the powerful electric light were directed towards them. The crucial trials, which lasted some time—the night being exceeding favorable for the experiments—were considered to be exceedingly satisfactory, and it was the unanimous opinion of all who witnessed them that the Téméraire possesses in the electric light a most powerful auxiliary in enabling the presence of torpedoes and other obstructions, as well as the positions of any vessels, hostile or otherwise, to be readily and clearly ascertained, although some miles distant. The electric light apparatus on board the Téméraire and the Alexandra having proved such a valuable acquisition to those vessels, the Admiralty has now directed the contractors to put similar apparatus on board the armor plated turret ship Dreadnought, which is now fitting for sea at Portsmouth.

Compound Locomotives in France.

M. Mallet has submitted a report to the French Academy of Sciences relative to three compound locomotives recently built at the Creuzot Works for the railroad between Bayonne and Biarritz. There are two exterior cylinders acting relatively at right angles. Ordinarily the smaller cylinder first receives the steam, and the latter then passes into the larger cylinder in the usual way; but when the engine is started, or when a heavy grade is to be surmounted, a special valve arrangement allows of the steam entering both cylinders directly from the boiler, so that the engine works no longer on the compound principle.

The locomotives weigh from 19 to 20 tons each. The two cylinders are respectively 9·3 and 15·6 inches in diameter, with a uniform stroke of 17·5 inches. The four wheels, coupled, are 46·8 inches in diameter. The boiler has 481·5 square feet heating surface.

The road from Bayonne to Biarritz is 4·8 miles in length, and has a grade over 1·8 miles of ·015 to 1. The locomotives have traveled over 24,000 miles in all, and the results obtained are highly successful. There was no lack of stability even when running at 24 miles an hour, a high speed for wheels of such small diameter. With regard to expenditure of fuel, the gross amount was 148 lbs. of Cardiff coal per mile—the weight of the train being from 40 to 75 tons, exclusive of the locomotive.

More Satellites to be Discovered.

M. Wilfred de Fonvielle writes to the London *Times* to point out that the number of the satellites of the heavenly bodies probably varies in geometrical progression, of which the ratio is two for the great planets from the earth. Thus we have but one moon, Mars twice as many—two; Jupiter twice as many as Mars—four; Saturn twice as many as Jupiter—eight. It may be supposed, according to this, that Uranus has twice as many moons as Saturn—sixteen, and consequently that Neptune has thirty-two—it being impossible to see these owing to the immensity of distance from the earth. M. de Fonvielle also states that M. Frederic Petit, of the Observatory of Toulouse, advocates the existence of a second satellite of the moon, which he believes he has seen several times. If the diameter of the satellites of Mars is as small as reported, such bodies could easily revolve round the moon unnoticed by astronomers on the earth, and their presence might account for some of the known irregularities in the moon's motion.

Specific and Melting Heat of Platinum.

M. Violle states that the quantity of heat yielded by 15·4 grains of platinum from the melting point to 59° Fah.—the average temperature of the calorimetric liquid in the experiment—is 166·4°. The temperature of fusion of platinum is 3234·2°, but the increase of specific heat of the metal with the temperature is accelerated, doubtless, in the neighborhood of the fusing point, the platinum passing through a pasty state before becoming liquid. The true temperature of fusion should therefore be somewhat less than the number thus obtained. The latent heat of fusion of platinum is 80·8°. The melting point of silver is 1749·2°.

The Horse's Back.

The first thing to observe in judging of a horse, so far as his back is concerned, is the length of it. A long back is a weak back the world over, and in every instance. By superior excellence of structure in other respects, the weakness of the back may be, in some measure, made up; but the horse can never be the horse he would have been had his back been a shorter one. We do not care how short a horse's back is; for it is a sure evidence that he can carry or drag a heavy weight a great distance, and not tire; neither, if he be speedy, will two or three seasons of turf experience break him down, as is the case with so many of our speedy, long-backed horses.

Old Morrill and Flora Temple are instances in the past; and the famous grandson of Old Morrill, Fearnaught, and Taggart's Abdallah, are good illustrations among later horses. This conformation of the back was, in our opinion, a grave objection against Young Morrill and Rysdyk's Hambletonian. In spite of all their excellence both of them would have been decidedly better horses had they been coupled shorter and more strongly on the back. If Young Morrill had had the back of his sire—one of the most marvellous specimens of perfect bone structure and muscular power ever bred—he would never have gotten so many swayed-backed colts as now stand to his charge. The same was the case in even greater measure with Rysdyk's Hambletonian. We know what he did in the stud. We know that, crossed on mares of a certain pattern and blood, especially on the daughters of American Star, the son of the great Henry, he gave us trotters of the highest speed, and second to none in endurance. But all this was true in spite of his back, not because of it; and where he sired one colt closely and strongly coupled up in the back and loins (as every colt should be) he sent forth five or ten without this admirable construction, nay, representatives of the other form.

One may attend the fairs of the country, and eight out of every ten of the Hambletonian stallions exhibited will present to the eye this unfortunate peculiarity. In reply it will be urged that these long-backed horses have an "enormous stride." We grant that they do stride a great distance, but we also notice that their feet stay under the sulky a long time. The power to "twitch their feet out from under the wagon," as an old driver once expressed it, does not belong to them. One never finds it in connection with a long back. We wish to breed colts with an "enormous stride" as earnestly as any one; but we wish that these colts blessed with an "enormous stride" should have the knack also of gathering quickly.

But, in respect to the length of the stride, we have this to say—that it is not in any way the result of the length of back, but the position of the pasterns, the slope of the shoulders, and the position of the great bones of the hind-legs. There must be length somewhere, of course, or else the horse cannot stride far; or, if he attempts it, will be forever "over-reaching," or "forging," as the phrase goes. But where should the length be located? That is the question to be answered; and we say, the length should be located below, and not above. The length should be put in between the shoulder joint and the hams of the horse. There is where it was put in Flora Temple, and which gave her so tremendous a stride for so small an animal; and there, too, is where you find it in Dexter, Fearnaught, and Taggart's Abdallah, whose stride on a sandy track we have measured and found to be twenty feet! If that is not an "enormous stride" enough to satisfy any one, we should be pleased to know what is; and yet Abdallah had a short, muscular, Morgan-like back, as his sire, Farmer's Beauty, and his grandsire, Gifford Morgan, had before him.

There never was a falser theory, or one calculated to beget more mischief among breeders, than this—that we must breed long-backed colts, in order to get length of stride. We have always noticed that the horses long in the back, and loosely coupled at the hips, are the horses that always come to the judges' stand padded and swathed with "pads," and "shields," and "protectors" enough to stock a small-sized horse-clothing establishment. The reason is, because there is too little strength in the back and loins to deliver their strokes in a straight line, or to "catch" quickly and handily when they "break." It is at such a time—the supreme hour of the animal's life, perhaps—when fame and money hang evenly in the balance, and ten thousand eyes are watching him, and the horse is going at the top of his speed, that formation and perfection of organic structure tell.—*Golden Rule.*

How to be a Successful Sawyer.

The following hints are given by Emerson, Smith, & Co., in the "Sawyer's Own Book":

1st. Acquire sufficient knowledge of machinery to keep a mill in good repair.

2d. See that the machinery and saws are kept in good order.

3d. It does not follow because one saw will work well that another will do the same on the same mandrel, or that even two saws will hang alike on the same mandrel. No two saws can be made that will run alike.

4th. It is not well to file all the teeth of circular saws from the same side of the saw, especially if each alternate tooth is bent for the set; but file one half the teeth from each side of the saw, and of the teeth that are bent from you, so as to leave them on a slight bevel and the outer corner a little the longest.

5th. Never file any saw to too sharp or acute angles under the teeth, but on circular lines, as all saws are liable to crack from any sharp corners.

6th. Keep your saw round so that each tooth will do its proportional part of the work, or if a reciprocating saw, keep the cutting points jointed on a straight line.

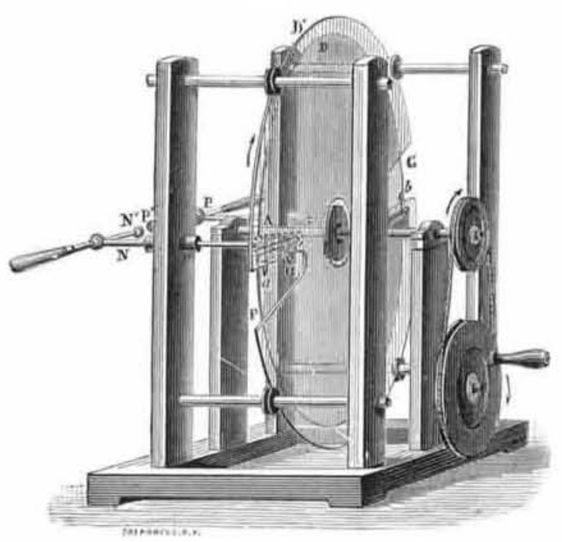
7th. The teeth of all saws wear narrowest at the extreme points; consequently, they must be kept spread so that they will be widest at the very points of the teeth, otherwise saws will not work successfully.

8th. Teeth of all saws should be kept as near a uniform shape and distance apart as possible, in order to keep a circular saw in balance and in condition for business.

NEW ELECTRICAL MACHINES.

In the accompanying illustrations, taken from a new work on static electricity, published in France by M. Mascart, are represented the latest forms of the Holtz, Carré, and Thomson electrical machines. The Holtz machine, Fig. 1, acts as a continuous electrophorus. It consists of a vertical plate, D, of thin glass varnished with gum-lac, which is

Fig. 1.

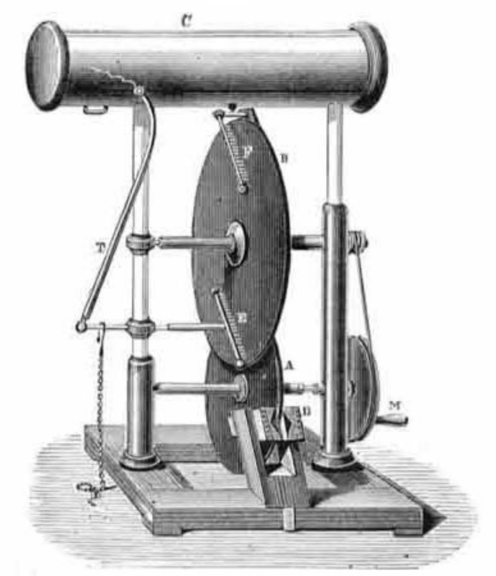


rotated at a speed of from 5 to 10 revolutions per minute. In face of this plate and at a short distance from it is a fixed plate, D′, slightly larger and pierced with a central opening, through which passes the axis of rotation. In this plate are made two rectangular apertures, F and G, at the extremities of the same diameter. On one of the sides of each one of these apertures is attached a layer of paper, A, applied on both sides and having one or two projecting portions, *a*, terminating in the openings, F and G. The two layers, A and B, serve as inducers, and are symmetrically disposed with reference to the axis of rotation. The first is represented in dotted lines in the engraving, in order to exhibit the portions in rear of it. On the other side of the movable plate are placed two insulated conductors, P and N, terminated by combs, which are directed toward the paper layers. These two conductors may be united by a kind of exciter with ebonite sleeves, the arms of which may be approached or withdrawn at will.

When the apparatus is operated, the conductors, P and N, are connected by bringing in contact the balls, P′ and N′. The movable disk is then turned in a direction contrary to that of the paper points, and one of the layers, *a*, is electrified. For the latter purpose a plate of ebonite, electrified by rubbing with the hand or with cat skin, may be used The fluid, supposed to be carried to *a*, persists as long as the machine is in operation, but disappears as soon as the latter stops, so that to begin again it is necessary to prime the instrument anew.

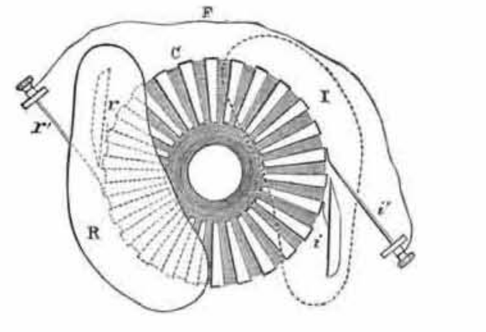
In the Carré machine, represented in Fig. 2, this difficulty

Fig. 2.



is sought to be avoided. The disk, A, of ebonite or glass passes between two leather cushions, D, and is carried directly on the axle of the crank, M. A pulley on the same shaft communicates, by means of a cord, rapid rotation to another and larger ebonite disk, B. In face of the latter are two combs, E and F; the second of which is opposed to a fixed leaf of ebonite furnished with paper layers, terminating in points and designed to serve as a second inducer, as in the Holtz machine. The upper comb communicates with

Fig. 3.



an insulated conductor, C, and the lower comb is also insulated, or communicates with the soil. An arm, T, serves as exciter.

The remainder of our illustrations relate to the Thomson machines. Figs. 3 and 4 represent what is known as the charge reproducer. A wheel, C, of ebonite carries a certain number of insulated metallic plates, disposed in sectors on the two faces, and appearing at the circumference like the teeth of a gear wheel. Two metallic plates, I and R, bent so as to envelop completely half of the wheel (one of these is indicated by dotted lines), serve both as inducer and receiver, that is to say, they act by induction on an intermediary conductor, F, and then receive by effect of the motion the electricity so developed. Hence it results that the charge of each of them augments at first in geometric progression, as in all analogous apparatus. Two receiving springs, *i* and *r*, communicating separately with the metallic envelopes in the interior of which they are placed, receive the electricity carried by the different sectors and communicate it to the corresponding envelopes. Two other springs, *i′* and *r′*, called conductors, placed behind the former ones with reference to the direction of rotation of the wheel, are connected by the wire F.

Fig. 4.

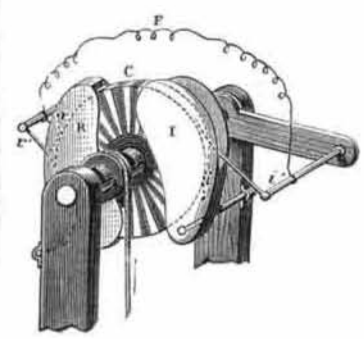
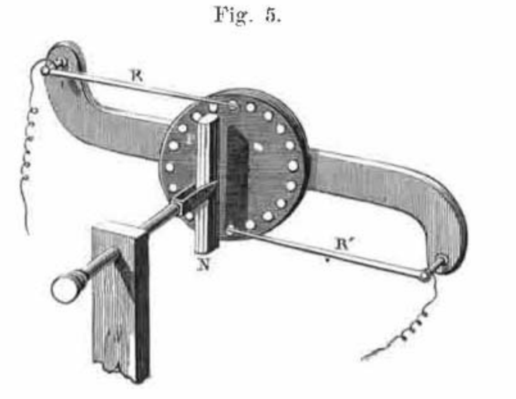


Fig. 5.



Supposing that one of the inducers, I, for example, be first charged with negative electricity. The corresponding spring, *i*, is then charged with positive electricity, which it communicates to the successive teeth of the wheel, which, by the receiving spring, *r*, transmit this electricity to the second inducer, R. The opposite spring, *r′*, is similarly charged with negative electricity, which comes back by the sectors and by the receiving spring, *r′*, to the first inducer, I.

As constructed, the wheel is not more than 2 inches in diameter, and may be set in motion by the motor of a Morse telegraph instrument. A few seconds after it is started it produces brilliant sparks. A dry pile of 40 elements, the two poles of which were placed in communication separately with the two conductors, sufficed to charge the machine or suddenly to reverse the electrical signs.

Thomson's tension equalizer, Fig. 5, works like a series of contacts by a proof plane, in order to establish on a conductor the tension which exists in the surrounding atmosphere. A disk of ebonite, C, turning around a vertical axis, carries a certain number of metal pins, on which are applied two springs, R and R′, in communication with the two electrodes of an electrometer. If one of these springs is submitted to the influence of an electrified body, the keys which detach themselves from it in succession carry continuously electricity of contrary sign to that of the inducing body, until the electric density at the extremity of the spring becomes null. If the two springs are at the same time submitted to the influence of two conductors at different tensions, equilibrium will be attained at the end of a certain time, and quite rapidly, because the electricity carried off at one of the springs is taken to the other. The difference of tension of the two springs, or of the two electrodes of the electrometer, will be proportional to that of the two inducing bodies.

In Fig. 6 we represent another Thomson machine, in which T is a metallic tube, communicating with the soil. This is placed in the interior of a metal cylinder, I, which may be termed the inducer, having negative tension. This tube is electrified positively; and if liquid drops are allowed to escape therefrom, they carry with them contrary electricity, which is reproduced indefinitely. These drops fall into another metal cylinder, R, the receiver, which has a funnel within. The electricity of the drops expands over the surface of the receiver, and the drops escape in a neutral state from the spout of the funnel. The charge of the receiver then augments more and more until sparks are produced between the cylinders, or until the drops no longer fall into the receiver, on account of their being thrown off laterally by the electric repulsion which they encounter. Under such conditions it is necessary to maintain the tension of the inducer, I, by a foreign source. But it will easily be seen that two similar apparatus may be disposed so as to react one on the other, and to augment reciprocally their electric charges. For this purpose the receiver, R (Fig. 7), of the first, communicates with the inducer, I′, of the second, and the receiver, R′, of the second with the inducer, I, of the first. The drops which fall from the second inducer, I′, are then charged with negative electricity, which is collected in the receiver, R′, which augments the charge of the first inducer,

Fig 6

Fig. 7.

I. Two conductors are united with the interior covering of two Leyden jars, A and B. These jars are covered exteriorly with tin, and contain a certain quantity of concentrated sulphuric acid. In the liquid are plunged lead rods terminating below with leaden plates. The rods are surrounded with glass tubes, and pass through an ebonite cover, so that the absolutely dry air contained in the bottles is not affected by the atmosphere. If the glass (Glasgow flint) is of good quality, the insulation of the bottles may be so perfect that the electric loss may not exceed one one-hundredth of the charge, in three or four days.

Under these conditions, one of the jars being electrified at a tension so weak as not to be appreciable but with a very delicate electrometer, the valves are opened in order to allow the water to escape drop by drop. These drops become subdivided into very small ones, which separate by their mutual repulsion. After a few minutes a rapid succession of sparks is produced in some part of the apparatus. It is stated that the loss of electricity in this apparatus is so small that a single drop falling from each tube every three minutes is sufficient to maintain the charge constant indefinitely.

New Method of Preserving Fish.

The flesh of fresh fish, either raw or boiled, is cut in thin slices and plunged in a bath of water strongly acidulated with citric acid. After two or three hours soaking, the fish is removed and dried, either in the air or under moderate heat. In the latter case one hour is sufficient; in the former there should be an exposure of five or six days. M. D'Amelie states that fish thus treated will keep anywhere for an indefinite period, and that it becomes as hard as wood. To prepare it for use three or four days' soaking in fresh water is necessary.

MR. RICHARD HANKS, a coal miner, living near Galesburg, Ill., is reported to have dug out of the earth, fifty feet below the surface, the entire carcass of a petrified mastodon, sixteen feet long and nine feet high, in almost perfect shape.