THE PARIS EXHIBITION.

[FROM SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.]

The International Exhibition now begins to assume a more definite character, and the easy manner in which operations within it are being carried on indicates that the authorities are of opinion that all will be ready for the opening day—a consummation most devoutly to be wished, but rarely accomplished in the case of exhibitions, and especially those containing machinery.

The only part in which any pressing activity is apparent is in the grounds. The old soil (which looks as if much of it had at some time or other been paved with cement) is being carted away and replaced by a very rich mixture of peaty loam for the gardens. Among the trees and bushes that have been planted are some good samples of magnolias, but it is doubtful they will bloom this year, on account of having been so recently planted; nor do I think that the gardens will show to any very great advantage, except in so far as the flower beds are concerned, and one rockery that is already finished.

The utmost activity is being shown in grounds round about the Eiffel Tower, where the ground is deep in mire through the wet weather and the cartage of soil, which is being done in the usual one-horse cart that tilts to dump, nobody here seeming to have any idea of the American four-wheel cart with movable bars at the bottom, which is so much more handy. With the two-wheel cart and the horses tandem, the shaft horse does nearly all the work, and the two horses rarely start to pull together. There is so little moving of earth in London (whether because of its flatness or that there is less improvement, it is hard to say) that there is some excuse for using the old tilting cart; but one sees a great deal of this class of work in Paris (or, at least, such has been the case for the past few months), and American carts with movable bar bottoms would find plenty of use.

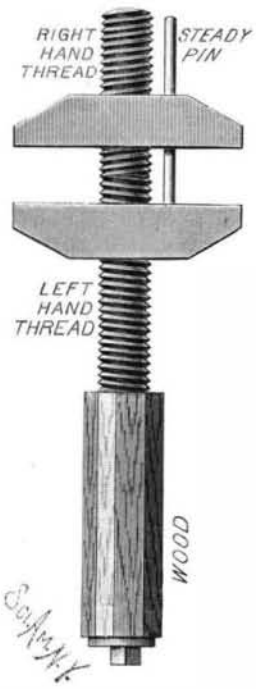
I mentioned in my last letter that the hoisting engines on the Eiffel Tower had Porter governors on them, but I omitted an item that I now supply, to wit, a piece of what I certainly consider, to say the least, unnecessarily expensive construction on at least one of the engines, and a sketch of which is given herewith, being the crank pin end of a connecting rod in which the key is secured by a small bolt and nut, the bolt passing through a slot provided in the key and through a projection on the head of the gib. This is a very expensive method of holding a key, and no better than a set screw.

First impressions are often modified by experience, and are hazardous to put in black and white; but, nevertheless, I venture to say that my first impressions of French engineering are that it is in a transitory condition, and that while I find much that is old and discarded in the United States and in England, nevertheless I find much that is new and evidencing a desire to adopt the most advanced methods.

In a former letter I called attention to the copying of American machines in England, and I see that since then one of the sufferers named by me (the Brown & Sharpe Manufacturing Company, of Providence) have publicly protested against this copying.

Now, I do not desire to enter into the moral ethics of copying, or the circumstances under which it is justifiable or otherwise; but I do wish to point out that, looking at the matter from a purely mechanical standpoint, I would sooner see a copy of a first class machine than a poor attempt to accomplish the same end by a roundabout method in order to avoid the stigma of copying. For instance, I saw in a large woodworking shop in London some emery wheel machines for saw sharpening, and they were a skeleton framework of wings and arms that one almost expected to see crawl around like a spider. To my mind, the designer had far better have copied some American machine right out, and the only consolation one had in looking at the machine was that the designer had at least had sense enough to know the value of emery wheels for sharpening purposes, and that is more than a good many, both in France and England, can say.

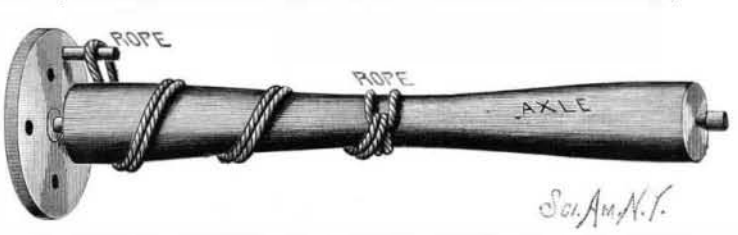
I have seen in France some very ingenious machines that I consider a decided advance upon anything I know of in the same line, but I have also seen some that, while good enough, for a beginning, are not equal to American machines designed for the same purpose; but whether this arises from a dislike to copying or ignorance of the existence of the American machines, it is hard to say. In either event, however, it gives evidence that there is a market here for American machines as well as small tools.



A FRENCH MONKEY WRENCH.

Speaking of small tools reminds me to give you a sketch of a French monkey wrench I saw the other day, the stem being threaded through both jaws, and a steady pin preventing them from turning with the screw. Now, putting aside the awkwardness of having the upper end of the screw stick out so that the wrench cannot be used in any other but the most open of situations, and the general heaviness and clumsiness as well as the uselessness of a double set of jaws, let us consider the cost of making such a tool as this as compared to that of making one of Coe's or any other first class American monkey wrench, and we shall see that there is more work in the right and left hand screw and the steady pin than there is in the whole American wrench.

But, before going any further, let me say that, while I propose to use an unsparing hand in criticising the machines and tools I find here, whether of French, English, or American origin, I shall nevertheless give a full measure of credit where it appears due, my object being to give a full account of all I see that is of interest to the mechanical world, and not to pick out either the good or the bad. This programme, however, naturally operates somewhat to the disadvantage of the French, since it is not the worst of English or of American tools or productions that are brought into France, the worst being left at home and not usually put forward by the home journals. As an illustration, take the case of the monkey wrench, which is by no means a fair representation of that class of tools as generally found in France. Nevertheless, I found it here, and do not remember ever having seen a worse one, although I have seen some pretty bad ones in England.

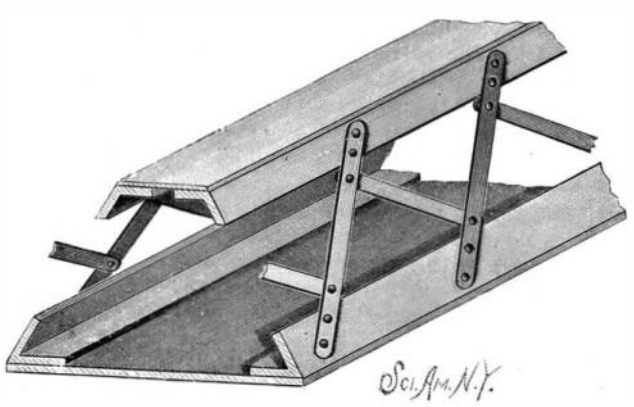


A FRENCH METHOD OF DRIVING AXLES IN THE LATHE.

A very neat and interesting wrinkle that I found in a French shop is that of driving an axle by a rope, as shown in the sketch. I never saw anything like it before, and am particularly pleased with it. There is no loose dog or clamp to slip about on the axle while it is being put in the lathe or to fall off the live center if it is hung there; there is no monkey wrench to pick up or look for to fasten the set screw of the dog or clamp; and, furthermore, the same sling will do for lifting the axle by the crane (if the lathe has one), and, finally, there is no slipping of the dog. A cut half an inch deep was being taken off the axle I saw this device on.

There is not much progress to report in the machinery department, but there are a great many foundations for engines and machines finished, with the bolts all in; and very solid they look, which is a source of comfort, as the giving way of foundations is not an uncommon occurrence at exhibitions, or, at least, this is sometimes put forward as the reason why a pound or a knock is heard when it should not be.

The girders for carrying the line shafting are all up, and I send you a sketch representing its construction. It is a built-up affair, composed of angle iron and plate, with braces. The shafting hangers are V-shaped, and are riveted to the plate, as shown in the sketch.



THE GIRDER FOR THE LINE SHAFTING AT THE PARIS EXHIBITION.

The window which occupies a great part (all the upper part) of the end of the machinery department is painted a pale yellow, with pale green and blue ornamentation, the latter also including some small crimson stars.

A good part of the ornamentation of the buildings is being made of sheet zinc, and I saw some (for the exterior of one of the domes) whose extreme dimensions were say six by seven feet. Finer examples of work in zinc I never saw or expect to see, the soldered seams being as clean and smooth as could be, notwithstanding their running around mouldings, beadings, etc. Indeed, there was not a sign of a crinkle or warp anywhere.

There are a great many cornucopiæ among the ornamentation (over 100 in the machinery department alone), filled with fruit, flowers, etc., and all these are worked up in zinc.

In some of the departments the cases are all ready for the exhibits, while in some instances these cases are being ornamented with plaster or stucco figures in a most effective manner, as the buildings are but temporary. These stucco figures serve very well and are light, being built up on a light wooden framework. A great deal of ornamental tile work is being used in the decorations, among which I noticed some tile casings for round columns, the sections being about two feet long, and in width embracing about a third of the circumference of the column. The surface had raised vines, leaves, flowers, etc., upon it, the whole giving a very pleasing effect.

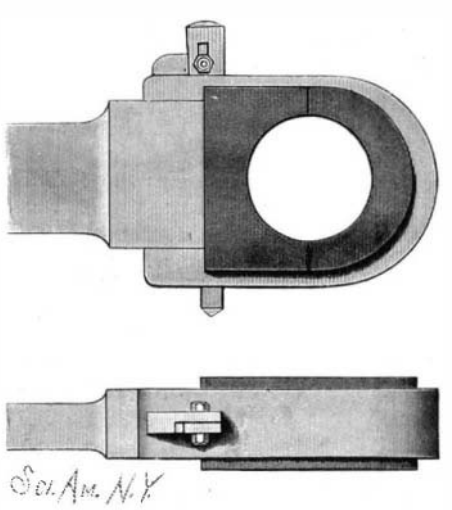
J. R.

A Drop from the Clouds at Bombay.

The first descent from a balloon in India after the manner of Professor Baldwin took place at Bombay on January 27. The aeronaut was a young Englishman, Mr. Percival Spencer, who had created much excitement among the natives by the announcement that he would make an ascent in his balloon, the "Empress of India," and when attaining an altitude of 2,000 feet would leap into space and return to Mother Earth by means of a parachute. Accordingly an enormous crowd of some 190,000 persons assembled to witness the feat, and the aspect of the motley throng is stated to have been marvelously quaint and picturesque, the gayly decked Orientals in all colors of the rainbow, and in a great many which the rainbow knows nothing about, walking, driving, riding, crowding, along the dusty thoroughfares, surmounting hills, trees, and gates, and climbing on to walls and sheds and house roofs—in fact, upon any place whence a glimpse of the proceedings could be obtained. Mr. Spencer ascended from the grounds of Government House, Parel. At the words "Let go," the balloon at once shot up like a rocket amid deafening cheers. When an altitude of 1,760 feet had been reached, Mr. Spencer took the hoop of the parachute in his hand, and flung himself from the balloon. After descending with lightning-like speed for 150 feet the parachute expanded to its full extent, and then gracefully floated down the remainder of the distance, landing the aeronaut safely in the roadway a short distance from the grounds. On his return to the starting place, Mr. Spencer was most enthusiastically welcomed, and everybody crowded round him to give him a hearty shake of the hand. Mr. Spencer's parachute was twenty-five feet in diameter, was covered with tough raw flexible silk, and weighed about twenty-eight pounds. It was attached to the balloon by a thin line, the breaking strain of which was eighty pounds. Mr. Spencer's weight is almost double this figure, so that the line broke immediately he threw himself from the balloon.—*The Graphic.*

A Hot Salt Water Well.

A hot water artesian well, at Alma, Mich., is interesting in connection with the notes on the Ponce de Leon well in a late article. A well has just been sunk at the Sanitarium in that city, and on March 22 hot saline water was struck at a depth of 2,876 feet below the surface. The water had a temperature of 156° F. when brought to the surface. The well has 220 feet of 8 inch pipe, and inside this is 560 feet of 6 inch and 1,580 feet of 4 inch pipe, the latter ending in the solid rock. The well has cost $10,000, and will be continued in the hopes of striking gas or oil.



A FRENCH METHOD OF FASTENING CONNECTING ROD KEYS.

Combination Enlargements.

Supposing it is decided to introduce say a group of figures taken instantaneously on a quarter plate negative into an enlargement from a 5×4, or larger size, landscape negative, the work may be successfully carried out by a method based on that introduced many years ago by Mr. T. Edge for double printing.

In the first place, the figures negative must be dealt with, the figures being carefully stopped out by neatly painting round them for about the eighth of an inch with black varnish. The remainder of the negative is then covered with opaque paper, so that if it were printed from in this state, the figures only would appear on a purely white background. This done, the landscape negative must now be taken in hand, and have small pieces of gum paper fixed on its two sides, and on the top and bottom, to indicate the amount of subject it is desirable to include in the finished picture. This negative is now put into the enlarging lantern, and the image projected on to a piece of very stout cardboard the size the picture is to he—let us say 18×15 inches. The cardboard should be adjusted and fixed in the following manner: Two small French nails are driven into the board of the easel for it to rest upon, whilea third one is driven at the right hand side to serve as a guide, against which it is placed. A couple of drawing pins at the top will hold it securely in position. Now it is manifest that the cardboard can be removed and replaced in exactly the same position as often as may be required; so, of course, could any other rigid substance the same size.

The image is next arranged to size and focused, a bold pencil mark being made exactly where each of the four strips of gum paper are shown. The object of this will be seen hereafter. The image being in focus, the place at which the figures should be introduced is determined upon. They are then roughly sketched on the cardboard the size required. The landscape negative is now removed from the lantern, and the figure one inserted in its place, the size and position of the figures being made to coincide with the pencil sketch when the image is sharply focused.

A piece of bromide paper, 18×15 inches, is next attached to a piece of glass the same size, by means of a few touches of India rubber solution on the back. The lens is now capped and the cardboard removed from the easel and the bromide paper fixed in its place, care being taken that the side of the glass is placed in contact with the register nail. The exposure is then made, and the lens capped with a piece of yellow glass, which, while protecting the image from further action, allows it to be distinctly seen. Of course, if the picture were developed at this stage it would have the figures only with a plain white background. We have now to protect the already exposed portion while the exposure is made for the landscape. This we do by painting it over, while *in situ*, with an opaque pigment—Indian ink for example. This is simply done by tracing over the image as projected through the yellow screen.

The bromide paper and its glass are now removed and placed in the dark, and the cardboard again placed in position. The figure negative is next taken from the lantern, the landscape one introduced, and the size of the image adjusted to its original proportions, known by the gum papers on the negative coinciding with the pencil marks on the cardboard. The lens is then capped and the sensitive paper again made to take the place of the card, the precaution being taken that the side of the plate is pressed close to the guide nail. The second exposure is then made. All that now remains is to wash off the color with water, assisted by a pledget of cotton wool, develop, and fix the picture in the ordinary manner. And, if the work be neatly executed, the juncture of the two negatives will not be perceptible.

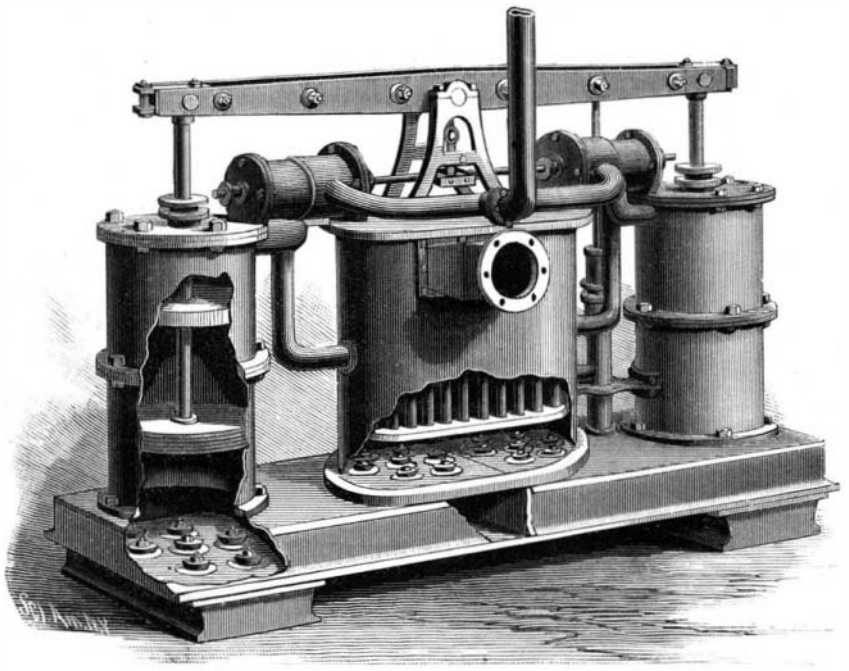
In our first two or three essays the Indian ink was removed completely by the cotton wool, but in some subsequent ones, when using a second sample of paper, a slight stain was left on the surface, but this did not interfere with the development, and in the clearing, fixing, and washing, it disappeared entirely.

There are other methods by which the first exposed image can be protected while the second is impressed. Here is one. After the figure image is focused, take a small piece of bromide paper and expose it and then develop. This picture need not be fixed, only washed and dried. The figures are then cut out neatly by a pair of scissors or a sharp-pointed knife, and used as a shield instead of the pigment. It may be attached to the paper with a touch or two of India rubber solution. The India rubber can be easily removed, when the paper is separated, by gently rubbing with a clean finger.

When a number of enlargements of the same subject are required, this plan of masking will be found more convenient than the painting, as the same figure shield will serve any number of times. The reason why rubber solution is used as a cement is that it causes no expansion in the paper, and is easily removed without injury to the gelatine surface.—*Br. Journal of Photography.*

AN IMPROVED PUMP AND CONDENSER.

The illustration herewith represents a duplex pump and condenser more particularly adapted for marine service, while also useful for other service. It has been patented by Mr. John Reid, of Rio de Janeiro, Brazil, South America. It has a hollow bed divided by a transverse partition into two similar chambers opening to water inlets provided with upwardly opening flap valves, which control the inflow of water to the chambers. At opposite ends of the bed, over the inlets, are two cylinders, the condenser being also supported on the bed between the cylinders. The cylinders are open at their bottoms to the water in the chambers, and the condenser communicates with the chambers controlled by upwardly opening flap valves. The cylinders each have two pistons, held on their respective piston rods, which are connected to the opposite ends of a beam fulcrumed in bearings on pillow blocks mounted on a plate which forms the top of the condenser. The condenser has upper and lower transverse partitions, forming chambers at its bottom and top, these chambers having communication with each other only through a series of pipes or tubes, expanded into the partition plates, the space between these plates around the vertical pipes forming a chamber to receive the steam exhausted from the pumping cylinders. A flanged collar is fixed to the upper part of the condenser, communicating with the upper chamber, and



REID'S DUPLEX PUMP AND CONDENSER.

forms the outlet for the water forced upward through the condenser tubes, while man-hole plates allow of access to the top and bottom parts for purposes of cleaning or repair. Separate steam and exhaust valves are provided for each of the main cylinders, the valves for each cylinder being connected to a stem actuated from the walking beam, and the steam piston valves are larger in diameter than the exhaust valves. The live steam chambers of the valve cylinders have ports which open to opposite ends of a main steam supply pipe common to both valve cylinders, and the exhaust chambers of the valve cylinders have ports which open to the upper ends of pipes which face downward and are fixed to the end walls of the condenser, about midway between its upper and lower tube plates. A pump at one side of the condenser is operated by a rod connected to the walking beam, and discharges the water of condensation from the condenser. For further particulars with reference to this invention address Messrs. J. H. McKinnell & Co., Rio Janeiro, Brazil.

An Ancient Reservoir.

The works which the Gas and Water Company of Tunis are now completing are of exceptional interest from an historical point of view; being nothing less than a restoration of the old covered reservoirs of Carthage, which date back fully 2,000 years. From the description given in *Le Genie Civil*, it appears that these reservoirs form a block measuring 420 feet long by 89 feet 6 inches broad. The interior is divided into eighteen compartments, all of which are in communication with each other and with the incoming and outgoing conduits. During their long existence these cisterns have passed through four periods, alternately of repair and neglect, evidences of which are furnished not only by the different varieties of masonry occurring where repairs have been effected, but also by the character of the various layers of deposit on the walls of the tanks. The first layer of this deposit is uniform, and corresponds to a considerable lapse of time; that portion which was first deposited is yellowish, becoming whiter as time went on and more care was taken with regard to the quality of the water impounded. After the Roman conquest the tanks fell into disuse, and the water in them rapidly became foul; an irregular dark-colored layer being deposited on the sides. The Emperor Adrian repaired the tanks and impounded in them other waters; and during this period a third layer, pure and white as the first, was deposited. But this state of affairs was put an end to by the irruption of the Arabs in 697. Since that time the cisterns have been entirely neglected; and during this period the fourth layer was deposited, which is similar in all respects to the second. The French company have practically revived the scheme of the imperial engineer; and under their auspices the reservoirs will enter upon a new career of usefulness. In cutting through the retaining walls of the cisterns, it was found that these walls were thicker near the ground level than lower down; the reason for this arrangement probably being that the ground was excavated without any arrangement for keeping the sides of the excavation vertical, and the space between the earth slope and the true vertical line was filled in solid with masonry instead of soil.

Magnetic Viscosity.

BY THOMAS T. P. BRUCE WARREN.

When experimenting on the magnetic permeability of oils and other liquids, I found that if a magnetic substance, like soft iron, be covered by different liquids, not only was its susceptibility modified by the permeability of the intervening medium, but distinct evidence was obtained in every case of a molecular stress being produced in the medium, and which indicated itself by a decided tendency of a balanced magnet to stick, as it were, when it was allowed to remain a short time over the soft iron.

The explanation seems to be that the maximum effect of a magnet on soft iron depends on the rapidity with which the medium accommodates itself to the constrained condition necessary for the soft iron to take its greatest degree of magnetization.

As time is an element of importance in attaining a full maximum magnetization from any magnet of a certain intensity, it is not unreasonable to suppose that when a *non*-magnetic medium bas been so constrained by the lines of force passing through it, the molecular stress, which is also favorable to an increased magnetization of the soft iron, will retain the magnet with a slight but decided extra force. I propose to call this extra force, which is due to molecular stress, *viscosity*.

Viscosity is more probably a function of permeability. We have the magnet acting across the medium to the soft iron, and conversely the soft iron reacting through the same medium to the magnet, until the molecular arrangement of the medium accommodates itself to a maximum.

If a galvanometer needle, suspended in the usual way, be forcibly deflected by a current, it is found that the needle regains its fiducial position very slowly. This has been attributed to a crushing effect on the fibers. This effect has been called viscosity. I do not think it is entirely due to mechanical causes. The term as used in this communication is applied to a very similar phenomenon.

The experimental arrangement was as follows: A balanced horseshoe magnet was suspended from one of the arms of a balance. Immediately under the magnet was placed a shallow specimen glass (salver) with the usual flat glass cover. The cover prevented the magnet being wetted with the liquid, and allowed the attraction to be balanced through a uniform depth of liquid. The soft iron rested on the bottom of the glass.

When the magnet was allowed to rest on the cover for a short time, it required an increased weight being placed in the other pan to pull the magnet off than when the magnet was momentarily in the same position, or only for so long as to restore equilibrium in the balance.

I propose giving some experimental results on a future occasion, and to point out its importance as an adjunct to analytical research.—*Chem. News.*

THE "Julins Pam" diamond, which is valued at from £15,000 to £30,000, has arrived in London from Kimberley. It weighs 241½ carats, or fully 90 carats more than that other beauty, the Porter-Rhodes diamond, and was found in the New Jagersfontein United Mine, of which Mr. Julius Pam is principal owner. It is longish in shape, and of exquisite color—a pure blue white. The only larger diamond in existence is the Imperial, but it is said to be inferior in quality to the "Julius Pam."