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The Canadian Patent Office Record and Mechanics' Magazine

Vol. I.—No. 11. FEBRUARY, 1874. Price in Canada $1.50 per An.
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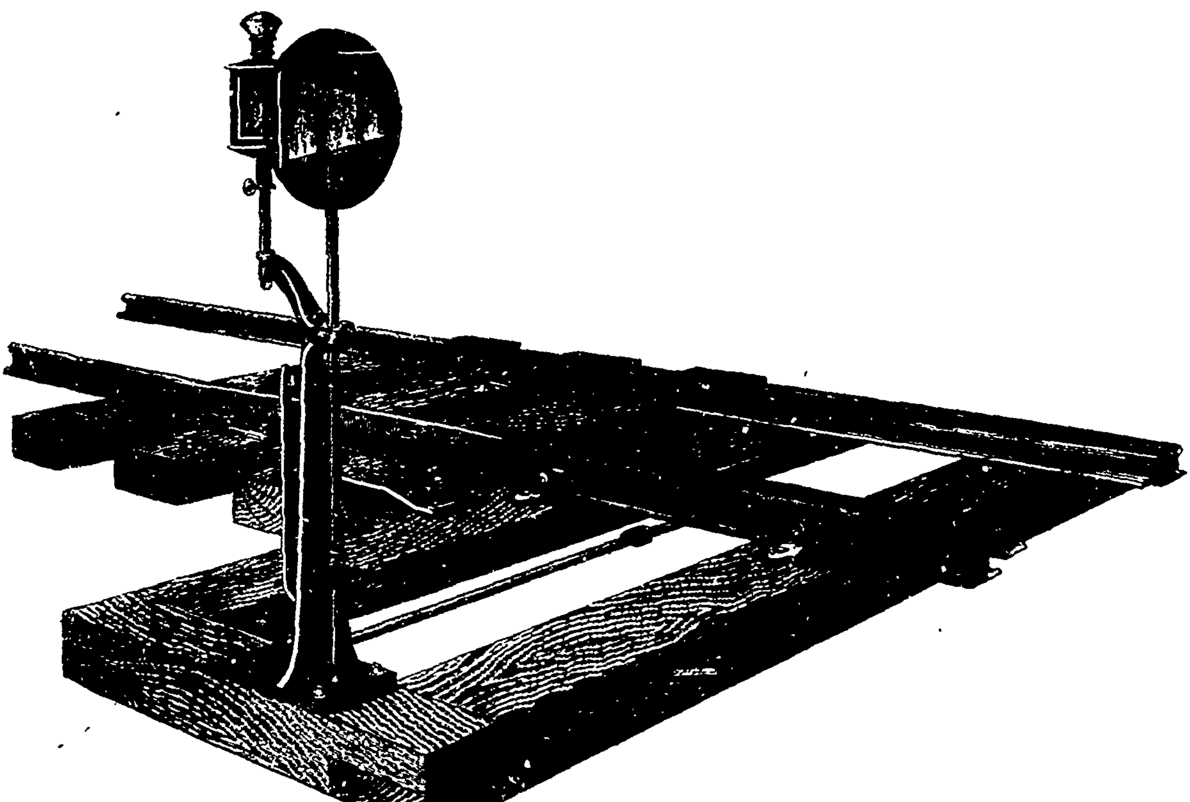


MESSRS. PARAVICINI AND CLEMENT'S SAFETY APPARATUS FOR POINTS.

RAILWAY SIGNALS AT THE VIENNA EXHIBITION.

We illustrate, from *Engineering*, on page 323, a system of switch exhibited at Vienna, in the Hungarian department, by Messrs. Paravicini and Clement. This arrangement consists chiefly of an iron bar *a*, *b*, between 6 ft. and 10 ft. long, of strong section, and fastened to the outside of the rail, which is next to the stock-rail of the switch. The one end of this bar is carried by a bolt passing through a bearing *c*, and the web of the rail, whilst the other end is provided with a nose placed under the head of the rail in order to prevent the untimely lifting of the bar. At a corresponding distance from the latter end of the bar a wedge *d*, is fastened, which rests upon a wedge *f*, of the same shape, and slides over it on pointing of the switch. This wedge *f*, is connected by the bell crank *g*, and the rod *h*, with the tongue of the switch; the bell crank is fastened with its fulcrum *k*, upon the bearing plate *i*, which serves also as sliding surface for the bell crank at the point where the wedge *f*, is fastened; the two wedges *d*, and *f*, have inclined sides of 45 deg. In the normal condition of the switch the bar *a*, *b*, is level with the rail, whilst during the changing of the points, the motion of the tongue is transferred by the screw bar and the bell crank to the lower wedge, which presses with its inclined surface upon the top wedge, so that the bar *a*, *b*, is lifted over the lever of the rail, but sliding back on the other side of the wedge occupies again its normal position If the tongue, however, is not firmly pressed against the stock-rail, the bar *a*, *b*, will project above the lever of the rail, but it will be pressed down by the wheels of the passing train when the tongue is forced into its proper position before the wheels have reached it. This safety arrangement is intended for preventing the danger of running off the rails if the tongue is not placed in the proper position. It is stated that practical use of this arrangement has given satisfactory results.

The tongues are simply moved by hand, and the turning of the signal disc is effected by the same lever; this latter is connected with the lever V, which is provided at the upper end with an oval hole, through which the pin *x*, is passed with one end, whilst the other end is connected with the up-right bar which carries the signal disc. Moving the lever V, will therefore produce a turning of the upright bar and the disc.

PREPARATIONS FOR THE DEPARTURE OF THE TRANSIT OF VENUS EXPEDITION.

The time is now drawing on for the departure of the English expedition for the observation of the transit of Venus. In a few weeks the parties proceeding to all the stations except Egypt ought to be on the sea. At the dinner of the Astronomical Society Club, on the 8th of this month, Sir George Airy stated that he had reviewed the English and Russian plans for carrying out the work, with the Society's illustrious guest, Otto Struvé, the Astronomer Royal of Russia, and had arranged them in complete harmony with one another. We may therefore consider that the time is ripe for the consideration of the English plans in a more definite shape than when we noticed them. We may add that the general scheme, as explained in our previous article, is unaltered.

To take up the question so as to make its features intelligible to readers who are not astronomers, we may again point out that the "parallax of the sun" may be said to be the angle that any point of it subtends on such a base line as the earth affords; and without again describing how this angle is measured by the observations taken, we may treat it as an angle taken in three ways.

The first is Halley's method, on which the angle is taken between two chords across the disc of the sun, each one being the apparent path of Venus as seen from some position where the entire transit is visible. Such positions are taken in pairs in suitable northern and southern localities—the length of the base line depending mainly on their difference in latitude. This work is carried out, as far as England is concerned, by Kerguelen's Island—covered by Rodriguez—and by New Zealand. These form the southern ends of bases coupled with certain Russian stations dotted across Siberia, connected together by a telegraph wire for obtaining longitude by telegraph.

The second and third measures and lines of bases are on Delisle's method. One base line depending on observations taken at ingress, and extending from the Sandwich Isles to Kerguelen's Island, Rodriguez falling near the latter. The other base line depends on the observations taken at egress, one end being at New Zealand, with Kerguelen's Island sufficiently far along it to be a substitute should it fail; the opposite end being Egypt and certain Russian stations not far from the Caspian Sea. Rodriguez falls too near the centre of this base line to be of much use.

Having thus recapitulated our stations in their positions in the base lines which we drew in on the figures in our former article, to which—in the aspect in which we endeavour to make the matter clear — we cannot do better than refer our readers, we will pass on to the equipping and arming of each point, and the peculiar character of its duties.

We may first notice that the work of every station must consist of two branches — first, the work of observing and recording the phenomena of the actual transit when it takes place; second, the systematic work—which may occupy many weeks or months—necessary to establish the latitude and longitude, so as to fix the precise position of the station and give meaning and value to its observation and the records of the phenomena seen at transit.

Under the head of observations and records of the actual transit must be classed the work performed by what we may call the gazing telescopes, from the larger equatorials down to the 4 in. ones with tripod stands and slow motion imparted by hand, as well as all the peculiar work of the photoheliographs.

Figs. 3 and 4, page 326, are fair specimens of the equatorials. The former we give on account of its historical interest, being the Lee telescope, with which the late Admiral Smyth drew up the well-known "Bedford Catalogue." Those who are familiar with this work may remember the characteristic enjoyment with which Admiral Smyth dwells on the 8½ ft focal length, the object-glass by Tulley ($5\frac{9}{10}$ in.), with all its beauties of correct form and "space penetrating power," and the sharpness with which it came to focus, carrying the reader so along with him that he almost feels as if it was an extraordinary instrument, perhaps almost making an audible click as it came to focus. It is unnecessary, therefore, to dwell on features which if the truth must be told, are not in these days extraordinarily good, even in the optical parts. It may be said briefly that the mounting, though old-fashioned, is simple and effectual, the clock powerful and good, and the instrument altogether capital for the work required. Astronomers who know what a favourite this telescope has been in its day, and the excellent work it has done, look at it with a feeling akin to respect and affection, and may feel glad it should have the prospect of again performing important work. In the figure it is shown, we need hardly say, pointed towards some polar star, near its upper culmination. Consequently, for the transit to be seen with the sun rising in the south-east, it is necessary that the side of the building in the corner directly beyond the centre portion of the telescope should be capable of removal, and it was so made three years ago by Sir George Airy, when designing the huts for the expedition. Fig. 3, is an equatorial, designed and made by Simms, with a 6 in. object-glass; the mounting is, of course, good, and of a general character, readily admitting of adjustment to almost any latitude. Beyond this there is little to remark in connection with it. With these and all the larger telescopes the sun is to be observed not directly, but by reflection off the surface of a glass prism; by which means not only is the glare enormously diminished, but also the heat rays which pass on through the glass being got rid of, there is no risk of the dark glass suddenly failing and the observers being blinded — a fate which has too often befallen examiners of the sun Double image micrometers are used, as described in our previous article, and contact observed in as nearly as possible the same phase by all the English and Russian observers.

Fig. 1, exhibits the photoheliograph employed at every main station. It is designed and made by Dalmeyer, and deserves a few words. Its optical part consists of a tube with an object glass resembling that of an equatorial telescope, but constructed so as to combine the optical focus with that of the chemical rays, so that to the eye it would not be truly corrected for colour, but is admirably adapted for facilitating adjustment to the work required. A little beyond the focus of the object glass is a photographic camera lens or enlarger, consisting of two double lenses symmetrical in form and position, at some inches apart, each one consisting of a concavo convex crown and convexo concave flint glass. This throws an enlarged erect image of the sun on the plate exposed in the posterior or camera end shown in the figure, where the chemical and optical rays are again brought to the same focus. The pointing and adjustment of the instrument are facilitated by the use of ground glass, both in the camera, and in a small pointer fixed to the side of the tube. In the focus of the object-glass are fixed cross wires, and immediately beyond them is an exposing shutter, consisting of a close sliding brass plate with a small horizontal slit admitting of adjustment to greater or less width. The shutter is pulled down by a strong spring, but can be raised and held above the field of view by a piece of thread and pulley, on cutting which the shutter flies across the field, every part of the sun being photographed by the momentary exposure given through the slit in its rush over the field. For a rapid series of photographs, such as it is wished to obtain of the advance of the planet on the solar disc, another device is employed, which is a modification of Jansen's revolving shutter, which exposes in succession a number of small circular spots, arranged in a circle on the plate, which is itself made to revolve so as to bring each one in turn in the required position. The chief difficulty is to avoid the bad effect of vibration, which appears to have been done by Mr. Christie's arrangement, to the satisfaction both of the Astronomer Royal and Monsieur Struvé. The idea of employing photography, as we noticed in our previous article, we owe to Mr. De La Rue, who first brought solar photography to such a high standard of perfection and accuracy. The dry process which is adopted is that advocated by Captain Abney, R.E., who has directed the training of the photographers of the expedition. The mounting of the photoheliograph is that of an equatorial; the design we prefer to Simm's on the whole. We cannot say the same for the fitting and motion of the wheels; but all is good. The systematic observations necessary to establish the exact latitude and longitude of each station are carried out at the main stations by transits, altazimuths, or vertical circles, and in one case by telegraph comparisons. At the secondary stations it is done by portable instruments and comparisons of various kinds.

The transits are made by Simms (40 in. focal length, 3 in. aperture). They have moveable systems of wires connected with micrometers. The altazimuths and vertical circles differ from each other chiefly in the former having horizontal circles read by microscopes in four places and in many details. The altazimuths are supplied to stations whose latitude is such that azimuth readings are required. Fig. 2, shows the instrument belonging to the Kerguelen Station, which is the best in design and in its performance.—*Engineer.*

LEAD MINING IN CANADA.

Lead-mining operations in the Dominion of Canada have hitherto been limited to what may be called surface explorations, although the finest rock of lead ore exhibited at the late Paris International Exhibition came from Canada. We learn from a prospectus of the Canadian Leading Mining and Smelting Company (Limited) that extensive operations are about to take place to develop the champion mineral lodes in the township of Lansdowne, in the county of Leeds, Ontario. Sir Wm. Logan, Geological Survey, has frequently called attention in his officials reports to the promising character of the lead lodes in this district. He says, speaking of the nature of the lode, that "through the gangue, which is calc-spar, galena (lead) is found in masses, sometimes 5 or 6 inches in diameter. A trial shaft of 50 feet, which was sunk in one of the lodes, is said to have yielded sufficient ore to pay the expenses of sinking, and that four other lead-bearing lodes run parallel with the main, the whole being included in a breadth of about 1,000 feet."

Pacific Railway.—It has been determined to survey the valley of the Fraser River, with a view to making the terminus of the Pacific Railway at Burrard's Inlet. Mr. Sandford Fleming has received orders to proceed with the work at once.

WEAVING.

Ancient Looms.

When it is considered how little is known of the early history of weaving, it may be easily understood how much less likely it would be for a description of its various processes to exist. The products of the loom, under certain advantageous circumstances, may be preserved for thousands of years, and still give proof of their peculiarities, either in excellence or defect of manufacture. Thus, the mummy cloths of Egypt supply abundance of proof, not only concerning the existence of weaving 4000 years ago, but of the general excellence of the products then produced. Numerous specimens of this cloth, still wrapped round the embalmed bodies, are to be seen in the various public museums, and nothing could give more conclusive evidence regarding the state of the art in those, the earliest periods of history.

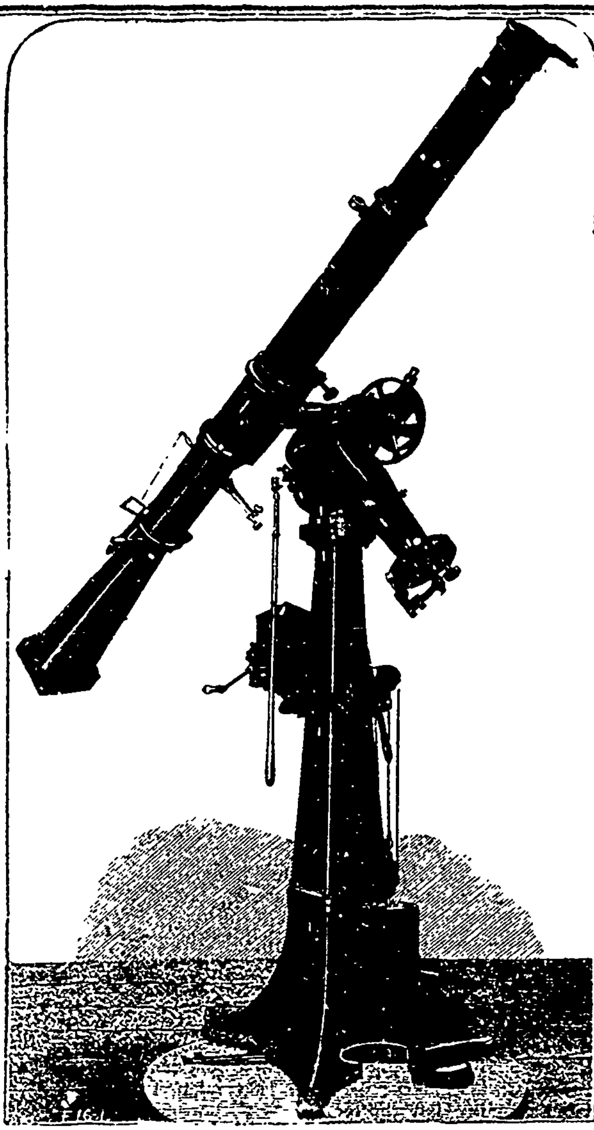
Although woollen and cotton cloth have always been most commonly used for clothing and other purposes, it is fortunate that the Egyptians did not enshroud their dead with either of those materials, and particularly so with wool, which owing to its property of breeding, or being liable to become infested with worms and insects, would be more likely to perish than linen cloth. Thus linen was purposely chosen for shrouds on account of its cleanliness and lasting qualities. The dead were encased in its folds, so that the bodies should be preserved uninjured, for a period of 3000 years, when it was believed that the former spirit would return, after its transition state and habitation of the bodies of various animals, to resume its previous existence.

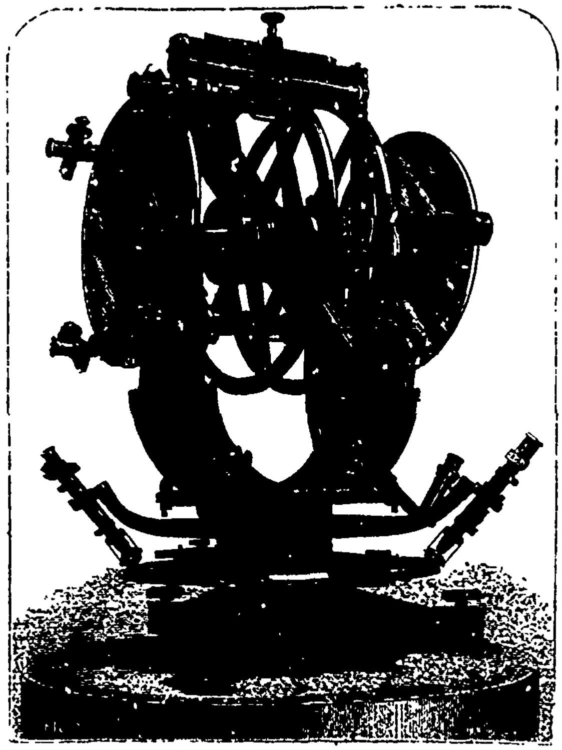
It is to this circumstance that we owe what actual knowledge of ancient weaving we now possess. The Egyptians also used wool and cotton for weaving purposes, the poorer classes being clothed with woolen cloth, and the rich with cotton and wool. The priests wore linen, in accordance with their idea of its purity, for they were not allowed to enter the temples with any article of dress composed of wool, that material being considered unclean, from the circumstances before mentioned.

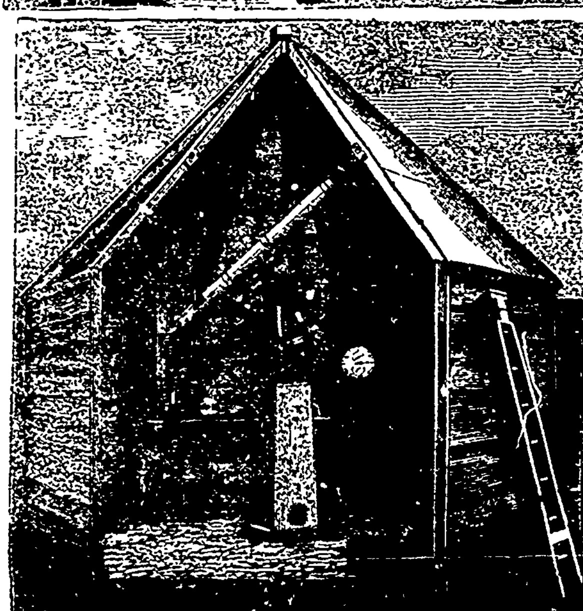
But although it is possible to preserve cloth for long periods of time, when it has been prepared and deposited for that purpose, it is quite another matter as regards the loom in which it was woven. It is characteristic of many things in every-day life which have long been in use, that they rarely suggest to the mind that they may be supplanted by quite different methods, and for the old systems to become totally forgotten. How many of the ancient arts have been lost through the historian making no record of their processes? We therefore cease to wonder that no certain knowledge of the ancient loom exists. Fortunately, there are a few very ancient paintings on the walls at Thebes representing several processes of weaving and spinning, but the looms are not clear enough to understand.

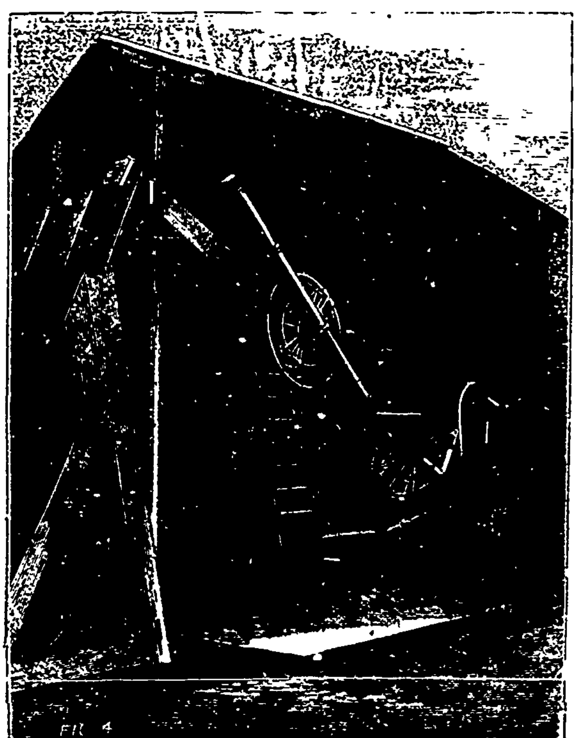
An account of these paintings is given by Sir Gardiner Wilkinson in his "Manners and Customs of the Ancient Egyptians," to which work we are indebted. Thus Fig. 1, on the page 327, represents a weaver at work upon a piece of cloth, woven in a horizontal position on the ground, and Figs. 2 and 3, represent vertical looms—for both vertical and horizontal looms were used by the Egyptians. In Fig 2, the weaver is shown weaving cloth with a coloured border, and in Fig. 3, two females are shown at work at the loom. It required the services of two to weave with the vertical loom—one, perhaps, to open the shed and attend to the warp, and the other to work the shuttle and attend to the weft.

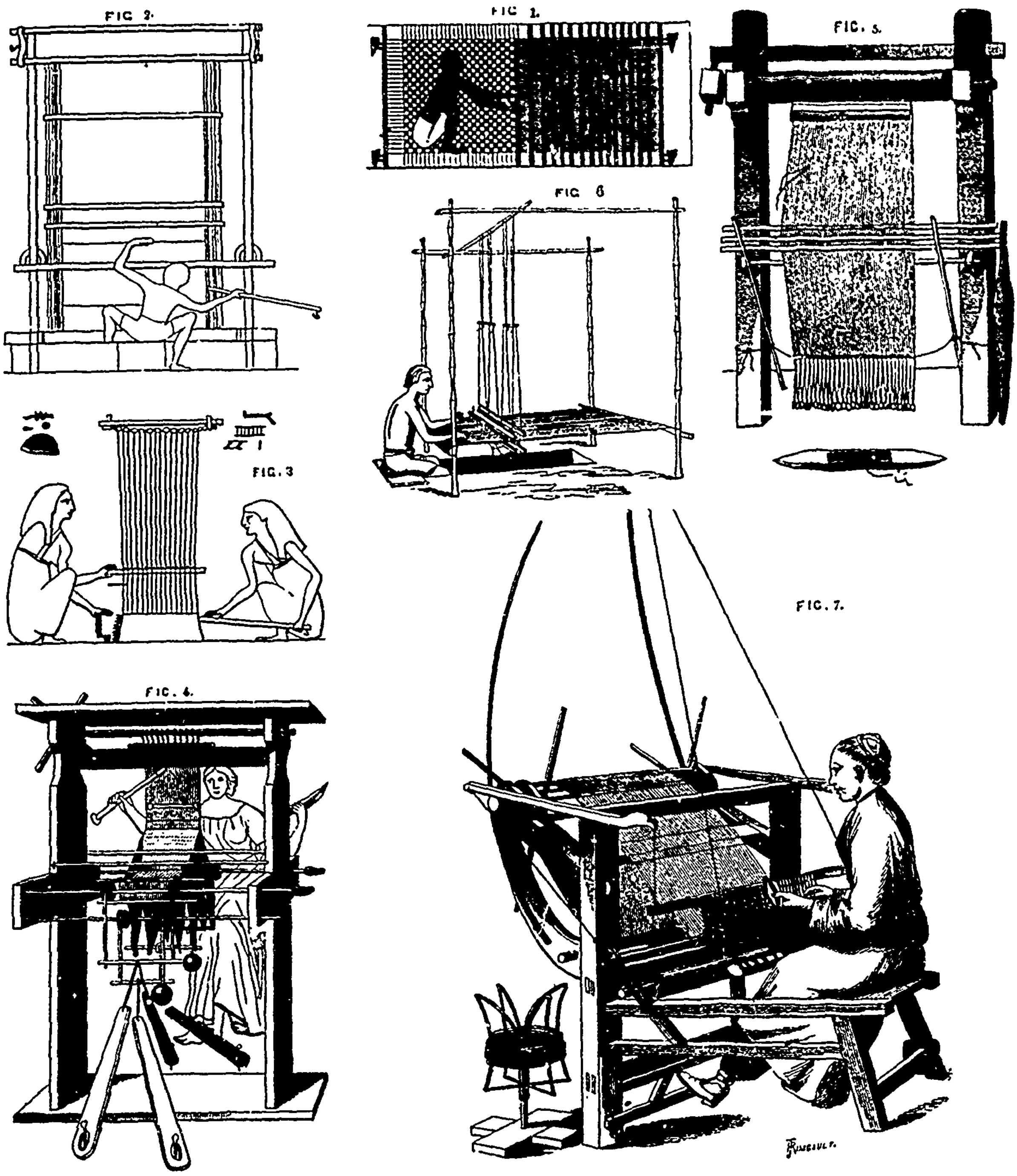
It will be noticed in both Figs 2 and 3, that the weaver holds a stick, or lever, in the right hand; at the end of these levers there is a hook. Sir Gardiner tells us that he thinks these hooks were for the purpose of drawing the weft thread through the warp—in a similar manner, we may suppose, to willow or horse hair weaving, where short lengths only can be used. If such a system really was in use by the Egyptians, and the cloth which now exists was woven by drawing the thread through the warp shed, the cloth would give evidence of it, for it must necessitate the formation of an open selvage, or fringe, on at least one edge of the cloth, and, even if the thread was drawn through by the hook, in such a manner as to use long lengths of weft, it would then have a double weft thread, with a perfect selvage on one edge of the cloth, and an open one on the other—similar to the weaving by some of the modern shuttleless looms. But the Egyptian cloth that we have seen has no double threads, and both the selvages are











ANCIENT LOOMS.

perfect, showing that the shuttle was passed entirely through the shed, from side to side alternately, as in ordinary weaving. Therefore, what can these sticks, or levers with hooks, be for? They must either represent the shuttle itself, or the means wherewith it was thrown. Before the reed was invented the weft thread is said to have been combed evenly into its place by means of a comb adapted for the purpose, and the blow was given to drive them together by the use of a flat sword-shaped piece of wood, which was introduced into the shed for the purpose. This latter instrument was called the "spatha." The cloth was woven by forcing the weft downwards, and Sir Gardiner quotes Herodotus, who states that the Egyptians wove their cloth in that manner, whilst other nations wove it by pushing the weft upwards. In the latter way of weaving, it is easy to see how to slide the shuttle when the cloth was woven downwards. The shuttle was probably thrown from hand to hand, without any shuttle race or reed for it to slide upon, otherwise it would be difficult to understand how the loom could be worked with the simple mechanical means they appear to have possessed.

In Dr. Smith's dictionary of "Greek and Roman Antiquities," under the article Tela (Greek loom), Mr. Yates, in describing the ancient Greek loom, compares it with the common loom used in Iceland, if not at the present, at all events in very recent times. Fig. 4, is a representation of this loom. The warp is suspended from the top beam of the loom, and the lower ends are tied up in separate portions, which are weighted to keep the threads in tension. The cloth was woven upwards. A comb was used, as already described, and the spatha also, which is shown in the drawing

It may be here remarked that the use of the comb ought not in all cases, to imply that a reed was not used. It is far from being uncommon for weavers of the present day to use a comb, especially when they have a sticky warp to weave, or a warp that, owing to the felting property of the material, such as wool, requires to be separated frequently. In cloth weaving there is a special contrivance for this purpose in order to prevent the shuttle being thrown out of its course by coming into contact with threads that have adhered more or less to the adjoining ones.

The reed itself is but a species of comb, and takes its name from the material of which it was formerly made, viz., slips of reed It is not, therefore, unreasonable to infer that the reed was used in ancient times, as well as the comb, in the weaving of the finer descriptions of cloth; and in weaving rugs or matting, the spatha, and the hook before mentioned, would thus be satisfactorily explained.

Fig. 5, represents a loom which is asserted by Montfaucon to be copied from an ancient manuscript supposed to be of the fourth century, and entitled the "Virgil of the Vatican." It formerly belonged to the monastery of St. Denys, in France.

The loom used in India for the production of the most delicate muslin, cloths, shawls, and other fabrics is of an exceedingly rude nature, and it is highly probable that it is, in mode of construction, the most ancient loom known. Consequently a full description of it can scarcely be omitted here. Fig 6, represents a common Indian loom as used in the celebrated manufactures of Dacca.

Dr. J. Forbes Watson, M.A., in his work on "The Textile Manufactures and the Customs of the People of India," enters very fully into their mode of spinning and weaving, and descriptions of their ornamental fabrics. In describing the looms which produce the famous muslins of Dacca he extracts from the work of Mr. Taylor, which was published for private circulation only. Mr. Taylor formerly resided at Dacca, and was intimately acquainted with the mode of spinning and weaving there From these sources we learn that at Dacca the loom is always placed under a shed or under cover, or in the weaver's house, and not in the open air as usually represented The warp is fixed to the cloth beam by a small slip of bamboo passed through the loops and fixed into the groove. The beam is wound up by a winch, and held by a stick passing through a mortice hole, and fixed to the ground.

The batten consists of two flat pieces of wood, into which grooves are cut for the reed or sley, which is fixed in by iron or wooden pins, and is suspended from the cape of the loom The range of motion of the batten is adjusted by passing slings through several pieces of sawn shell. By lengthening or shortening the slings the extent of motion is adjusted, for upon this the regularity of the blow depends.

The balances of the treadles, having the slings fixed at their extremities, are suspended from the transverse rod above. The treadles are made from pieces of bamboo, and are contained in a pit dug in the ground about 3 ft. long, 2 ft. wide, and 18 in. deep.

The shuttle is made of light wood, of the betelnut tree (Areca catechu), and has spear-shaped iron points It is from 10 in to 14 in. long, and $\frac{3}{4}$ in. wide, and weighs about 2 oz. It has a long open space for the wire, upon which the reed, on which the weft is wound, revolves. The weft passes through an eye at the side of the shuttle.

The temple (the instrument for stretching the cloth from selvage to selvage during the operation of weaving) is formed of two pieces of wood, connected together with cord, and having at their ends two brass hooks or pins, which are inserted in the edges of the cloth on the under surface.

The weaver sits with his right leg bent under him, upon a piece of board or mat, placed close to the edge of the pit, and depresses the treadles alternately with the great toe of the left foot. The stretch of the warp seldom exceeds one yard in length, and the depth of the shed is about $\frac{1}{4}$ of an inch.

To lessen friction, the shuttle, reed, and lay (shuttle race), are all oiled, and a brush smeared with mustard oil is occasionally drawn along the warp. The brush is made of a tuft of fibres of the nul plant (Arundo karka). When ten or twelve inches of cloth are woven it is sprinkled with lime water, to prevent its being injured by insects. The most favourable condition of the atmosphere for weaving is about 82 deg., combined with moisture, and to effect this in very dry weather, shallow vessels, containing water, are placed under the loom. A piece of Dacca muslin measures twenty yards in length by one yard in width. In the preparation of the warp it takes two men from ten to thirty days.

The weaving of such cloth takes two persons (one to weave and the other to prepare the weft and attend) from ten to fifteen days for the ordinary assortments Twenty days for fine, and thirty days for superfine. The fine superfine takes from forty to forty-five days, and the dooreas or charkana assortments, sixty days.

A specimen of cloth called mulmul khas (muslin made for the king), and measuring ten yards by one yard, contained 1800 or 1900 threads in the warp. It weighed 3 oz. 2 dwt. 14 grains troy. It is so fine as to pass through the smallest ring. Price 100 rupees, or 10*l*. Another specimen, as worn by native dancers and singers, measuring twenty yards by one yard, had 1000 threads in the warp, and weighed $8\frac{1}{2}$ oz.

The Indian method of weaving figured muslin may be taken as the general mode adopted for weaving the various beautiful fabrics for which they are so celebrated. Mr. Taylor describes the process as follows:—

"Two weavers sit at the loom. They place the pattern, drawn upon paper, below the warp, and range along the track of the woof a number of cut threads equal to the flowers, or parts of the design intended to be made, and then with two small, fine pointed bamboo sticks, they draw each of these threads between as many threads of the warp as may be equal to the width of the figure which is to be formed. When all the threads have been brought between the warp, they are drawn close by a stroke of the lay. The shuttle is then passed by one of the weavers through the shed, and the weft having been driven home it is returned by the other weaver. The weavers resume their work with the bamboo sticks, and repeat the operation with the lay and shuttle in the manner above described, observing each time to pass the flower threads between a greater or less number of the threads of the warp, in proportion to the size of the design to be formed."

It is thus seen that the ornamental fabrics of India are purely a handicraft work, and performed in the rude description of loom already described.

The Chinese loom shown at Fig. 7, presents such a contrast to the other primitive looms represented, that it cannot fail to be appreciated for its originality of form and the suggestiveness of its various parts Compared with the modern hand loom it is singularly compact and adapted for household use. In ancient times weaving was practised in all the great houses, where a room was set apart for the purpose. Should small looms, for fancy or domestic use, ever be introduced in a similar manner to the sewing machine, some modification of the Chinese loom would, perhaps, alone commend itself to favour. The drawing is copied from a larger one in the "Traité de la fabrication des Tissus," by M. Falcot.

THE VICTORIA REGIA AT CHATSWORTH, ENG.

Chatsworth, a seat of the Duke of Devonshire has, among its other attractions splendid arrangements for horticulture. Our illustration on page 330, represents the hot-house devoted to the display of the enormous water-lily of the Amazon, the Victoria Regia which is grown there with greater success than any where else in England, the leaves measuring often $7\frac{1}{2}$ feet in diameter The large tank seen in the centre contains another tank, 16 feet in diameter and considerably deeper than the outer portion; this contains the soil in which the Victoria lily is planted. The walls of the tanks are built of brick, and the bottom is paved with stone; the tanks are lined with lead throughout, and the two inch hot water pipes which supply them are also made of lead.

While the plant is growing, a little wheel, in the form of an overshot mill wheel, is fixed near the edge of the tank, and continually kept in motion by a small jet of water from a tap immediately over it; thus the surface of the water is always rippled. The Victoria Regia, being an annual, dies in November, when the water in the tank is drained off, and the soil contained in the inner part removed. The lilies in the angular tanks, being also out of season, are, about the same time, mostly cleared away and stored in troughs filled with water in the cucumber house. The aquarium, thus stripped of its summer occupants, is filled in winter with large chrysanthemums for furnishing cut blooms. As the Victoria lily annually produces and ripens a good stock of seeds, these are preserved in vessels of water until sowing time comes round, which is generally about the middle of December, or between that and January. The plants are potted singly, and re-potted as they advance in growth, until they have attained sufficient strength, when the best plant is planted out in a heap of fresh soil.

THE GRASS EATING FISH.

Nature makes no leaps; on the contrary, she appears to fill up, by design, the gaps which appear to exist between each parallel series of beings. Numerous examples exist, or have existed, of these odd connecting links; the Australian ornithorincus, a quadruped with a bird's beak; the apteryx, a bird with hair and no wings; the pterodactyl, or winged lizard of antiquity, the fossil turtles, with teeth, found in the Cape diamond diggings—are illustrations in point, and still another is found in the queer fish represented in our engraving. It is called the *ceratodus Fosteri*, and is allied to the fishes through the *lepidosiren*, a singular animal found in the streams and ditches near Bahia, Brazil. The *lepidosiren* is popularly termed the caracurus, and is known by its odd shaped, elongated body, covered with scales, appearing to terminate in a fish's tail, while its means of locomotion consist in four fins located underneath. French naturalists have placed this animal in a distinct class of amphibious reptiles. Owen, on the other hand, pronounces it a fish, and the connecting link between fishes and reptiles.

The discovery of the *ceratodus*, however, adduces an even closer connection between the two families. The genus was established by Agassiz, who found the fossil teeth and jaw bones of the animal in the jurassic and triassic formations of many parts of Europe. It was supposed that, save in these ancient remains, the creature did not exist, until a few years since, when living specimens were found in the rivers of northern Australia, exactly corresponding to the fragmentary relics.

In the engraving on page 330 is represented the appearance of the living fish and also of the skeleton. Its length is about 38 inches, and its diameter 7 inches. Its habits are as peculiar as its form. Although living in the rivers, it rarely ascends above the brackish water, and finds its sustenance in the vegetation which, growing in shallow places, is left uncovered by the ebb of the tide. At night the fish leaves the water, crawling in among the plants and feeding. The quantity of nourishment it needs is enormous, and it is said that the amount of half-digested myrtaceous and graminaceous foliage found in its intestines is out of all proportion to the apparent requirements of the animal. In order to pursue its habits, it is evident that air-breathing apparatus must be present in the organization, and such is the case. Its [illegible]ls are a sort of porous lung, of very complicated constr[illegible]ction, [illegible]ng ramifications which expand into cavities filled with a coagulum, the function of which has not been definitely determined.—*Scientific American.*

THE Hamilton *Spectator* says:—A rather unusual thing was noticed the other day on the farm of Mr. Joseph Williamson near Stony Creek. A large rat was seen on several occasions to retreat from the garden, in which a number of bee-hives are kept. The advent of the rodent among the flowers being considered a somewhat erratic proceeding especially as rats have in them no love for "the concord of sweet smells," it was watched and was observed to go towards the bee-hives, when, poising itself on its hind legs with its fore feet on the bottom board of a hive, it destroyed bee after bee by snatching them and eating them as they came to and from the hive. After several attempts the rat was caught and killed, and was found to be one of immense size, and in a very fat condition. The habit of rats killing bees is very rarely if ever, noticed, though mice have been known frequently to do so.

THE DICEY STEAMSHIP.

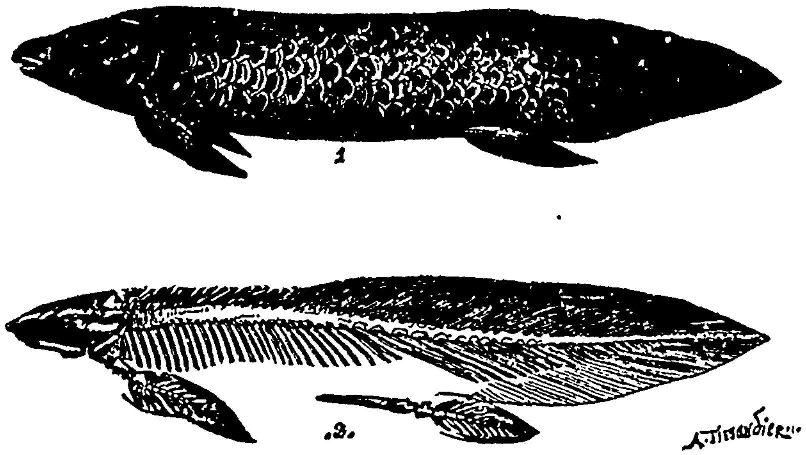
In our number for May 1873, we gave a short description of the new large steamers which are now being built to act as ferries between the coasts of England and France. These, or at least two of them, the "Bessemer" and the "Dicey" steamers are rapidly approaching completion. On page 331 we give illustrations of the Dicey Steamship which is so far advanced in construction that she will be launched in April and ready for the service in June. The vessel is 290 ft. long, with an extreme breadth of 60 ft., with the small draught of water of 6 ft, so that she can enter the ports on both sides of the Channel at all times of the tide. She will afford accommodation for upwards of 600 passengers, with first and second class saloons, ladies' and private cabins, and a sufficiency of closets; and over the saloons a fine promenade is arranged. Excellent refreshment-rooms are provided, and the comfort of the passengers is in every way studied, so as to insure the success of the undertaking.

COAL IN NEW BRUNSWICK.

The long disputed question of the occurrence of thick coal-beds at Grand Lake—a question of much interest to all New Brunswickers—would appear at last to have been definitely settled. From a report upon this subject by Messrs. Bailey & Matthew, contained in the last Report of Progress of the Geological Survey, and just submitted to the Dominion Parliament, we learn that the entire thickness of the coal formation in this region, as determined by a study of its geological structure, does not exceed 600 feet, of which not more than 200 feet represent the middle or productive coal measures, the remainder being composed of barren beds, which under, or overlie the latter. An important fact in connection with this subject is, that at three separate points, on different sides of the Newcastle coal openings, rocks older than those of the carboniferous formation come to the surface and occupy considerable areas, thus indicating either an exceedingly shallow basin, as that in which these coal deposits were originally formed, or that they have since lost much of their thickness by denudation. In this latter case it is still possible that the pre-carboniferous areas alluded to may really represent simply the summits of ridges—islets as it were in the carboniferous sea—and therefore separated by troughs in which the coal formation deposits may be deeper. Still, this does not seem probable, the attitude and character of the strata, as well as that of the fossils, alike indicating that the formation here is but of little thickness; to which may be added the fact that in two attempts to determine this question by boring, one at Newcastle and the other near the shore of Grand Lake, the slates which underlie the coal formation were in both instances struck at a depth of a little over 200 feet.

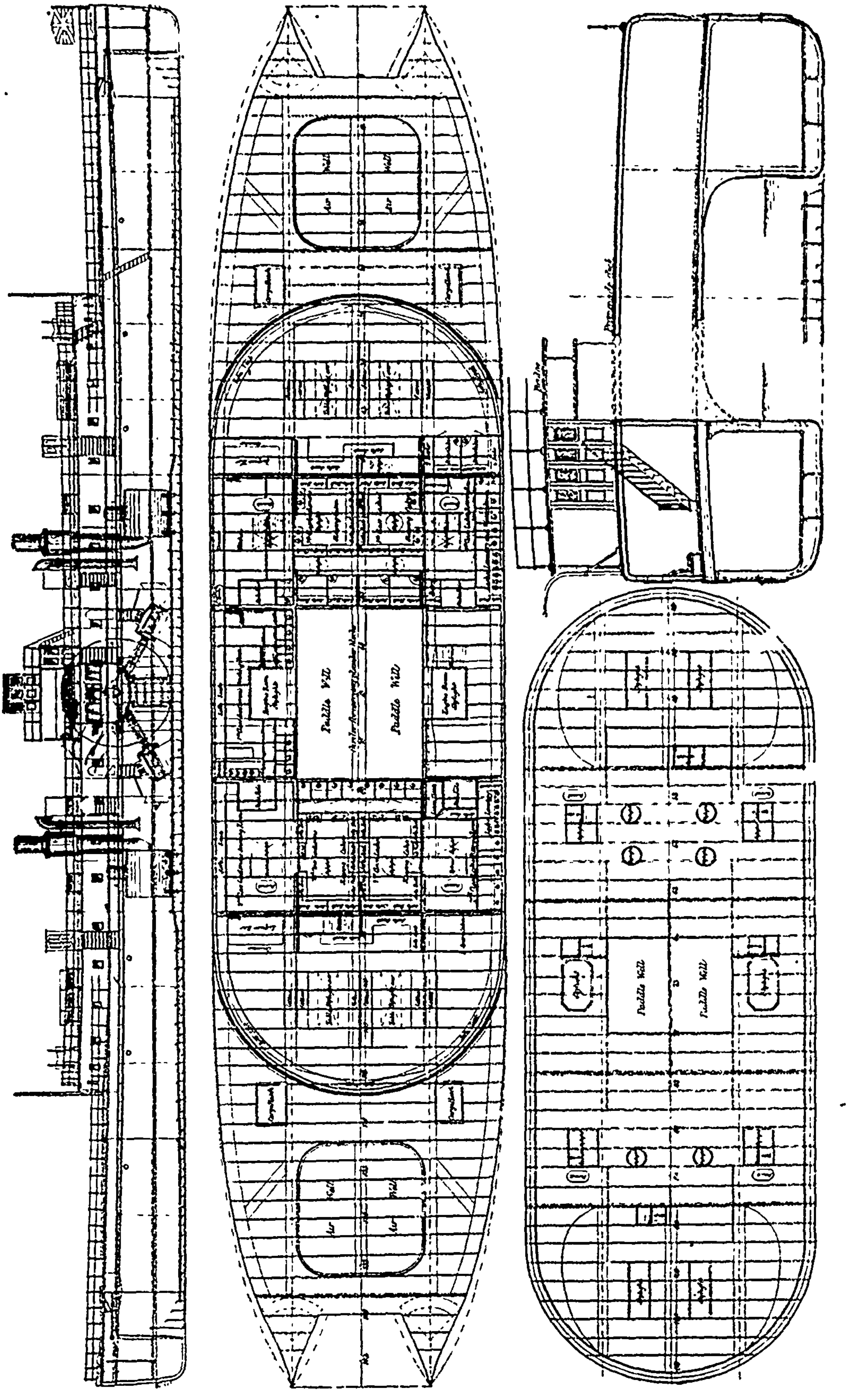
While, however, these explorations are certainly unfavorable to the opinion which would assign any considerable thickness to the coal formation in this region, or even to a belief in the occurrence of workable seams beneath that which has been so long known and removed near the surface in the Grand Lake district, it may yet be observed that the area over which the latter may be presumed to extend is itself a large one, and even supposing the thickness of the seam to be nowhere greater than is shown in the openings already made, it would still be capable of affording, with proper working, a very large yield of coal. From data given in the report it would appear that the entire area of the coal basin at Grand Lake, and over which the coal seam may be supposed to extend, is about 112 square miles, which, adopting 20 inches as the average thickness of the seam, and 79.4 lbs. as the weight of a cubic foot of coal, would give (with certain necessary deductions) a total possible yield of not less than 154,918,147.2 tons!

It may be added that the carboniferous soils which spread over so large an area in New Brunswick, are everywhere nearly horizontal, and as coal crops having nearly the same average thickness as those of Grand Lake have been observed at many widely different points, it may possibly be that these are all really portions of one single and continuous seam, in which case, after making the necessary deductions as before, the whole possible yield of coal for the New Brunswick coal-field, even supposing that no other deeper seams are found, will reach the enormous sum of 3,510,436,357 tons!—*Nation.*



THE GRASS EATING FISH.

THE VICTORIA REGIA HOUSE AT CHATSWORTH, ENGLAND.



THE DICEY STEAMSHIP

PRINCIPLES OF SHOP MANIPULATION FOR ENGINEERING APPRENTICES.

By Richards, Philadelphia.

Introduction.

In adding another to the many treatises relating to mechanics, and especially to that branch called mechanical engineering, it will be proper to explain that the purpose is to supply a want that none of the many text-books thus far seem to have supplied—that of assisting the engineering apprentice in forming a true estimate of that which he has chosen as a profession, and pointing out the means of study that will lead to his understanding the principles, as well as the routine, of a shop course.

Aside from the fact that no books have been prepared with an especial view of assisting apprentices, and adapted to the first stages of what we may call a mechanical education, there is the further fact that such books as are available treat of mechanical principles as consisting in mathematical formulæ and theoretical propositions only, overlooking the fact that such data are merely the symbols of mechanical principles, and not the principles themselves, and that a true understanding of mechanics is the result of a system of logical reasoning, which is only to be aided, and not supplanted, by rules, tables and formulæ.

A person may be a master of computations, or conversant with physics, and know little or nothing of practical mechanics, or may be a competent mechanic with but little knowledge of mathematical propositions, such as can be presented in books, and the great work of the apprentice is to connect and assimilate theoretical with applied mechanics.

It may be claimed that text-books can go no further in treating of applied mechanics than general principles will reach—a very true proposition if the writer of mechanical books has no power of dealing with the subject further than it is reached by theoretical deductions; but this furnishes no proof that the great share of a technical education, which consists in what may be called special knowledge, cannot be generalized and systematised the same as that part which is now explained on general principles.

Between physics, geometry, and mathematics, and their practical application to industrial processes, or, to state it more plainly, between theoretical principles, and the finished product of an engineering establishment, there is a wide space, filled in with intricate processes, with which text-books deal but sparingly, and sometimes not at all. This space has to be bridged over by the apprentice as best he can, and it is that part which calls for his greatest efforts.

He may, for instance, study the geometry of tooth gearing; the construction of trains of wheels and the principles that govern their action; he may learn the principles of cycloidal and epicycloidal curves, but between all this and a finished wheel are the processes of pattern making, founding, and fitting, either of which require as much or more thought and study than the geometry of gearing, which subject furnishes page after page in our text-books, yet the latter are almost silent on the shop processes named.

The same rule applies in most classes of machinery; in machine tools, for instance, the apprentice has only to open a modern work on the subject, and he will find tables, formulæ, and drawings to show the construction of machine tools, but seldom anything said upon the principles of their operation.

The apprentice, as soon as he enters the workshop, is at once brought in contact with machine tools of all kinds, and but little is gained in spending time in studying drawings and descriptions of them when the tools themselves are before his eyes, but connected with the operation of these tools are many intricate conditions that cannot be understood nor even conjectured by merely examining the machines, and much less from drawings of them. The conditions of operation, or principles of operation, are the points that the apprentice most needs to learn; what is meant by these principles of operation will appear in the course of these articles.

Referring again to the books which are available to an apprentice, they are too often filled with tables, rules, formulæ, and ready made computations, which, like a list of gear wheel combinations stamped on a lathe, tend to relieve the learner's mind of that which is most important for him to study. The apprentice who r[illegible]s to a table to select wheels for screw cutting will perhaps never learn to make the combinations mentally, and by using tables and rules to define mechanical questions, the principles may be entirely overlooked. Rules and tables have their places, and are merely records of what has been determined and proved by crucial experiment or by mathematical demonstration, but the less the engineering apprentice deals in them the more he is likely to know of the principles upon which such rules are founded. With books of an elementary character, until quite recently, the engineering apprentice has been no better supplied

When it is considered how strong first impressions are and how they cling to the mind, it is easy to conceive how important it is to lay a proper foundation on which to rear a mechanical education, and when we examine school books that treat of natural philosophy and mechanics, and compare them with modern science and modern practice, it must be conceded that they furnish a bad foundation indeed for the learner to build upon.

As a first lesson in what is called mechanics, the student is taught to compute the power of levers, screws, wheels, wedges, and other devices, which he is taught to call "mechanical powers," whatever that may mean; he is told that there are "three kinds of levers," and the terms used throughout are such as to confound power with mechanism, and prevent a comprehensive idea of force and motion, or the means of transmitting them. The student finishes such a study of mechanics with false conceptions of power and mechanism, which, as many will bear witness, cling to the mind for years, and may never cease to be a hindrance to acquiring a true appreciation of forces and the relations between power and mechanism.

A want of treatises that are especially adapted to the requirements of apprentices, is due in a great measure to the fact that practical engineers who have passed through a successful experience, and have gained that special knowledge which the apprentice most needs, as a rule have neither the inclination nor the incentive to write out the lessons that they could impart to others. The changes of mechanical manipulation are so frequent, and the apparent conflict that might arise between their opinions and established data would lead to adverse criticism, which such men do not care to invite; the result is, unfortunately, that the great mass of special knowledge gained by individual experience is lost, and mechanical text-books, of necessity, consist mainly in generalities that may be arrived at by theoretical deductions and inferences.

The purpose of these articles will be, in some degree at least, to supply this want of a medium between theory and practice, and to point out to the apprentice engineer that part of his education which may be termed special, and which must be acquired mainly by his own efforts; to urge upon him the value of analytical reasoning, about even the most simple matters, instead of depending upon rules, tables and formulæ.

It will also be attempted to show the relations between principles and practice, not between figures and practice; for it must continually be kept in mind that figures are but the symbols of principles; the plan of tracing every process in the workshop to some general mode of operation as an antecedent, will be urged upon the learner, as the only means of cultivating the habit of reasoning, which alone can lead to a complete knowledge of practical mechanics. The articles will contain no drawings, no figures or computations; these are already supplied in forms that leave nothing to be desired, and may be studied from other sources in connection with what is presented here.

The author, in preparing these articles for engineering apprentices, brings to his aid an experience of 25 years devoted to the construction of machinery and general engineering practice; and, as a considerable part of this experience has been devoted to the instruction of apprentices in applied mechanics and what is termed mechanical engineering, the plans of study which will be pointed out here are such as this experience has proved to be the most successful.

The articles have been prepared with a full knowledge of the fact, that what an apprentice may learn, as well as the time that is consumed in learning, are both to be measured by the personal interest that is felt in the subject studied, and that a strong personal interest on the part of an apprentice is essential to permanent success as an engineer. It is to be regretted that the difficulty of a statistical dryness and want of interest must always be a characteristic of any writing devoted to mechanical subjects. Some of the subjects treated here will be open to this charge, no doubt, especially in the first part, but it is trusted that the good sense of the reader will prevent him passing hurriedly over the first part to see what is said of casting, forging and fitting, at the end, and will cause him to read it as it comes, which will in the end be best for the reader, and certainly but fair to the writer.

(To be continued.)

PATCHOULY.

(From the *Journal of Applied Science.*)

Patchouly is at the present time one of the most widely known, if not one of the most popular, scents in England. Its odor is one, which once known, is not likely to be forgotten, and although opinions may and do differ as to its fragrance, it is very largely employed by perfumers, both by itself and in combination with other scents, which modify in some measure its somewhat overpowering smell. Patchouli, or Pucha-pat is the Hindostanee name of the plant from which the perfume is obtained, which is known to botanists as *Pogostemon Patchouli*. It belongs to the order *Labiatæ*, which furnishes us with so many of our aromatic plants, such as sage, thyme, marjoram, rosemary, lavender, mint, pennyroyal, etc. The patchouly is tall and shrubby, not unlike the garden mint in habit, with broad, egg-shaped, opposite leaves, about three inches long and thick spikes of small purplish-white flowers. It is a native of Penang, Silhet, and the Malay Peninsula, and is imported into England fron Hindostan and Bengal. In India it is a very popular perfume, being generally sold in the bazaars, besides being used in tobacco for smoking, and for scenting the hair of the women. It was not imported into England until 1844, when forty-six cases, some containing fifty pounds, others one hundred and ten pounds, were put up for sale at Garraway's Coffee House. The price asked was only six shillings a pound; but there were no biddings, which proves that its popularity is of but recent date. This lot was brought from New York, to which place it was said to have been taken from China. It flowered in Europe for the first time in the winter of 1844, in the greenhouse of a gentleman at Orleans; since then it has been in cultivation in many botanical gardens, and may usually be seen in the Economic House at Kew Some years ago, genuine Indian shawls could always be distinguished by the peculiar odor which they bore, the cause of which was long unknown. It was, however, at length discovered by the French manufacturers, that this odor was due to patchouly, and they imported the plant in order to give articles of home manufacture the same perfume. The smell of patchouly may also be detected in Indian ink, in the manufacture of which it is an ingredient. The dried leaves and tops are the parts imported, and these may be bought in the market in bundles of half a pound each. Dr. Wallich states that a native friend of his told him that the leaf is largely imported by Mogul merchants, that it is used as an ingredient in tobacco for smoking and for scenting the hair of women, and that the essential oil is in common use among the poorer classes of the natives, for imparting the peculiar fragrance of the leaf to their clothes. The sachets of patchouly which are sold in European shops consist of the herb, coarsely powdered, mixed with cotton wool, and folded in papers. These are simply placed in drawers and wardrobes to drive away moths and insects. The patchouly plant is in great favor with the Arabs, who use and export it more than any other nation They take up great quantities on their annual pilgrimage, and use it chiefly in stuffing mattresses and pillows. They believe it to be very efficacious in preventing contagion and prolonging life. It is also said to protect clothing from moths. The preparation of the herb is very simple, the tops - about a foot in length—being merely gathered and dried in the sun. It must not, however, be allowed to get too dry.

A DIAMOND saw is in operation at the Exhibition of the American Institute. The machine is the ordinary reciprocating saw machine; but diamonds form the cutting tools, in combination with the steel blade as a guide. The diamonds are set in "cutter blocks" at intervals upon the blade, and work horizontally as a true saw in the stone set beneath. While an ordinary saw cuts on an average 15 in. of brown stone in a day, the diamond saw will do as much in half an hour.

SMELTING ORE IN COLORADO.

Our illustrations on pages 334, and 335, represent some of the processes carried on at the smelting works of the Boston and Colorado Smelting Company, at Black Hawk, Colorado. We are indebted for these to *Harper's Weekly*.

Previous to the starting of this enterprise the ores of Colorado were treated only by the stamping and amalgamating process by which, especially from the richer ores, not more than half the noble metals were saved. By smelting, as conducted at these works, not only the gold and silver, but the baser metals, such as lead and copper, are extracted Since the commencement of operations over forty thousand tons of ore from the mines of Colorado have been reduced, yielding several millions of dollars in gold and silver.

The ore comes from the mine in large pieces, and first goes to the crusher, or Cornish rollers, where it is broken in pieces the size of pease. It is then sampled and assayed to determine its value. It then goes to the calcining floors. On these floors the ores are exposed to a gradually increasing heat, which obtained by moving the whole mass from the lower part of the floor toward the seat of the fire. The ores are charged on the part of the floor most remote from the fire every eight hours, a ton at each charge. In this operation the sulphur is converted into sulphurous acid, and escapes into the chimneys. The base metals are changed from sulphurets into oxides, when the ore is ready for the smelting furnace.

From the calcining floors the ore goes to the smelting furnaces. Of these the establishment has three, each having a capacity for smelting about twelve tons a day. The charges contain three tons, and remain in the furnace about eight hours at a full white heat. When brought to a perfectly liquid state the quartz and iron and other base metal form a slag and come to the surface; the copper and lead combined with sulphur, coming with them, the gold and silver separate perfectly from the slag, constituting what is known as matte and sink to the bottom.

The matte is reduced to an impalpable powder, and then taken to the matte calciners, where it is kept for several hours at a low red heat, and constantly stirred. Several chemical changes take place, and the silver is reduced to a soluble sulphate, while the gold is unchanged. This is one of the most difficult and delicate of operations. It requires the utmost skill and care to insure good results.

The calcined matte is put in tubs, shown in the upper part of our drawing. A continual stream of hot water filters through the mass, until the sulphate of silver is completely dissolved. The stream of water flowing from the tanks carries the silver into a series of other tanks, containing copper plates, whereon the silver is precipitated.

After this the silver is freed from all impurities by washing with acid, with the aid of steam, in the large conical tub shown in the drawing.

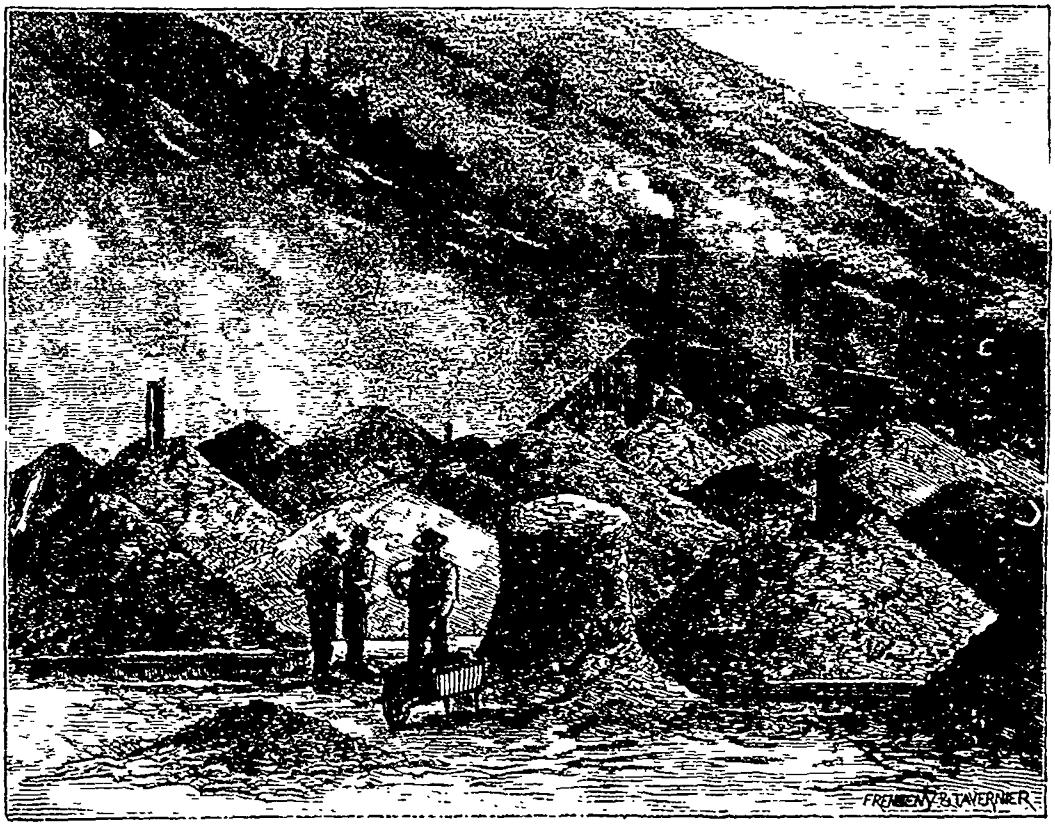
The mass remaining in the tanks after the silver has been washed out is then treated in small reverberatory furnaces for the extraction of the gold. The details of this process are too numerous to admit of even a partial description.

The pure precipitated silver as it comes from the tub-rooms is put into the drying-pans to evaporate the water. Then it is melted in black-lead crucibles by exposure to a white heat for two hours. When the silver is melted, the crucibles are handled by two men, as shown in the drawing, and the contents poured into moulds. Each brick weighs over a thousand ounces, and represents a value of about $1400 in gold

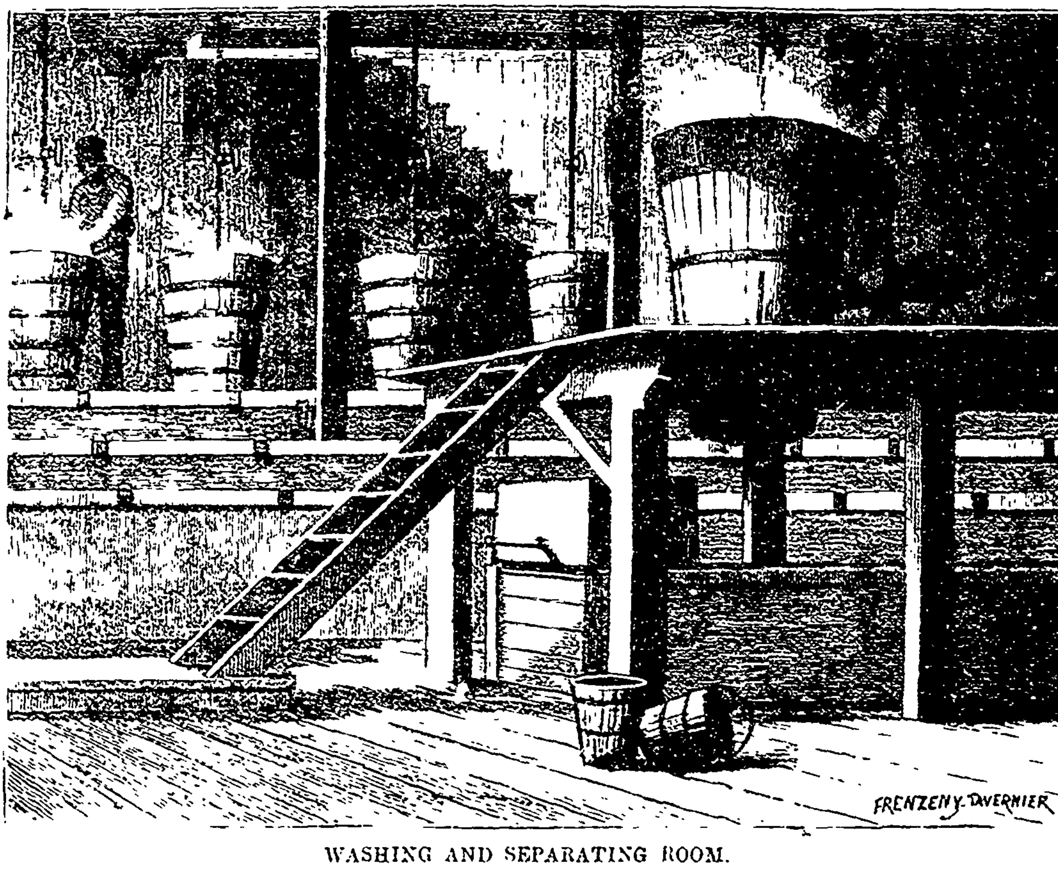
The New York Mint estimates the silver coming from these works at an average fineness of 995. The weekly shipments average nearly half a ton of fine silver, worth about $20,000, and gold of about the same value.

The bricks are turned over to Wells, Fargo & Co., who inclose them in leather cases, and so send them to their final destination.

THE Brighton *Ensign* says the dredging of that harbour has revealed a treasure that may at some future time be a mine of wealth to the people of that section—a deposit of the best quality of peat. It has been tested and has been found to burn well The deposit is extensive, and is believed to be very valuable.

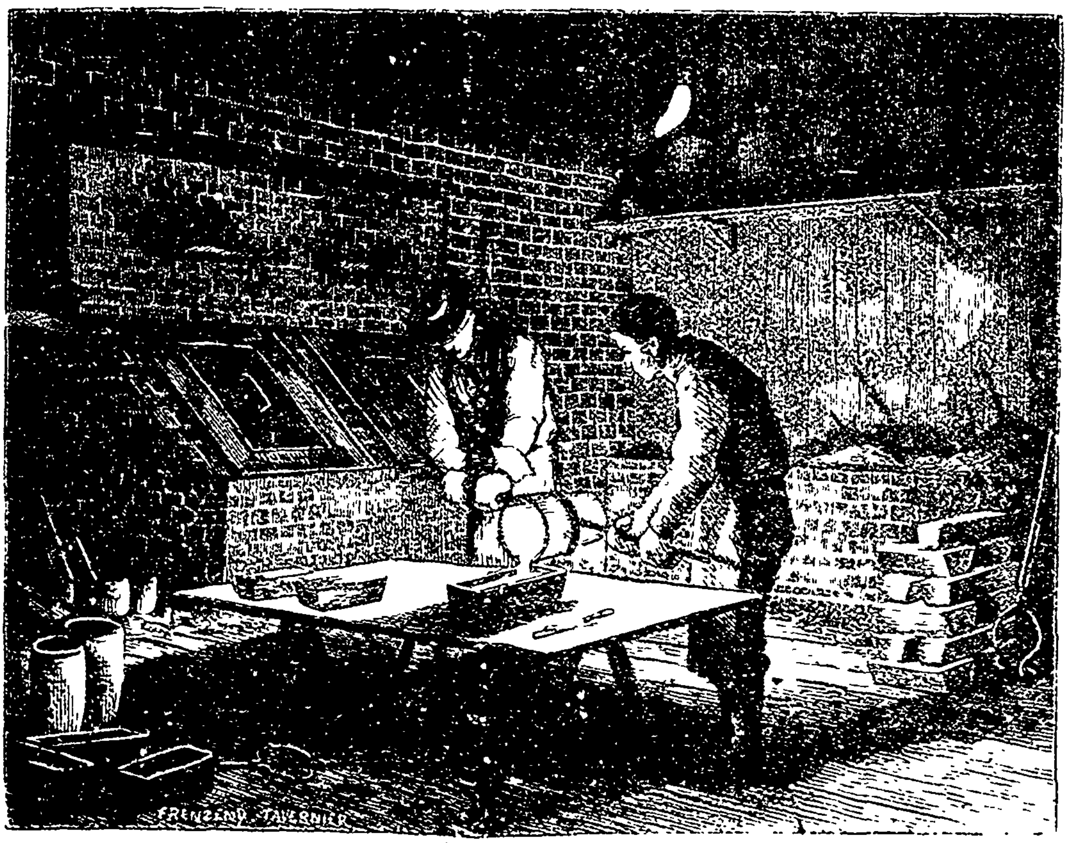


ROASTING THE GOLD AND SILVER ORE.



WASHING AND SEPARATING ROOM.

REVERBERATORY FURNACE.



CASTING THE SILVER BRICKS.

MECHANICS' MAGAZINE.

MONTREAL, FEBRUARY, 1874.

ILLUSTRATIONS :

CONTENTS:

PEAT IN THE PROVINCE OF QUEBEC

The total absence, in this Province, of coal measures and the rapid denudation of our forests have caused the question of fuel to become one of great importance. Nature, however, seldom leaves any part of her dominion utterly unprovided for and we find that we possess an abundant supply of very valuable fuel in our peat bogs. These bogs extend, at short intervals, from Niagara to Gaspé, it is said, and at a distance of from ten to twenty or thirty miles from the St. Lawrence. The Island of Anticosti, also contains an immense deposit, a hundred miles long. The fuel contained in these bogs is of a very valuable nature and the quantity is apparently almost inexhaustible. One of these deposits is situated at St. Hubert, a small village about 12 miles from Montreal, and it extends from the line of the Grand Trunk Railways, on one side to that of the Chambly road on the other. The general appearance of these deposits is that of a low-lying marsh whose water is coloured a darkish brown by the underlying vegetable matter. Men of experience on the subject profess to be able to tell pretty closely the quality of the subjacent deposit by the nature of the vegetable growth on top. Small tamarac trees with plenty of small berries, blueberries, &c., and a flower resembling a rhododendron denote a high quality of peat. Small birch trees, on the other hand, and flags, bulrushes, and long wild grass, tell of an inferior quality.

The deposit at St. Hubert has been worked for some five or six years by the Canada Peat Fuel Co. The works were originally established by Mr. Hodges, one of the Engineers of the Victoria Bridge. The machinery used in the Excavation and preparation of the peat was also invented by Mr. Hodges. Three of these huge machines are at work at St. Hubert. Each consists of a scow about eighty feet long, containing a twenty horse power engine, and floating in a canal twenty feet wide and from three and a half to six and a half feet deep. Our illustration on page 338, is a very faithful representation of one of these machines. The machine excavates the canal for itself by means of two immense augers which project from the front of the scow and cut their way into the turf. These augers are about eighteen inches long but of a diameter of ten feet each, and they work side by side. As they cut into the soft wet turf they throw it behind them on to a revolving band of buckets. These buckets convey it to the hinder part of the scow and drop it into a cylinder. In this cylinder it is mashed into pulp by revolving hook-shaped knives and then propelled forward by revolving vanes into what is called the distributor. This is a hollow cylinder, eighty feet long, projecting at right angles from the side of the scow. In its centre, and throughout its length revolves a shaft on which are auger-shaped vanes. These latter propel the mashed up pulp along the distributor, from which it falls through holes at distances of twenty feet apart, and from the end, upon the surface of the bog which has previously been prepared for its reception. Here it is spread out to a width of from 100 to 120 feet and a depth of eight or ten inches by men armed with scrapers, and by horses which drag through the pulp a board fastened by a rope at each end to the whipple-tree, (see illustration). The peat is now suffered to dry until a cut made on its surface will remain open, when it is scored across by two men who drag to and fro a revolving drum, whose circumference is furnished with circular knives about four inches broad, and distant from each other about seven or eight inches. As soon as the sun and wind have dried it so that it may be handled it is cut up with sharp spades into bricks eight inches long and carried off by boys and stacked on ladders and laths, when the drying process is more rapidly completed.

This is the complete process, and the average time required to turn out saleable peat is five weeks. The Company, however intends soon to add to each machine a compressor which will deprive the pulp of a very large proportion of its moisture. From this compressor it will pass through rollers and be turned out in a continuous band about eight by ten inches. This strap of peat will pass under a cutter, be divided into bricks and carried off on an endless canvas band from which it will be picked up and stacked by boys. By this improvement saleable peat will be turned out in fourteen days and the working season prolonged about three weeks or a month. The working staff of each scow consists of sixteen men, the fuel for the engine of such peat as is not good enough to send to market. The scow advances about 300 feet per day, which, at three feet to the ton gives a daily make of 100 tons of peat. The cost of manufacture is about $2 per ton and the profit varies from about $3 to $5 per ton. The total amount turned out by the Company at St. Hubert and at St. Bridgit, where they have another machine at work is about 18,000 or 20,000 tons per annum. This peat varies in its quality like coal and wood, but all of it has been and is successfully used in locomotives and for domestic purposes Some of the peat first turned out was much grumbled at on account of the quantity of ashes which remained after consumption, some indignant consumers estimating the product of ashes at from a ton and a quarter to a ton and a half per ton of peat consumed, ignoring the fact that *ex nihilo nihil fit*. On the other hand much of that now produced leaves scarcely any residue behind, most of the ash passing up the chimney in the form of an almost impalpable powder. Perhaps the most cogent argument in favour of the fact of its popularity is that although much enquired for in Montreal, there is not a pound of it to be procured. It has all been bought up at prices varying from $5, to $7 per ton according to the varying prices of coal and wood. Its use has, as yet, been mainly confined here to culinary purposes and for fuel for locomotives but it is extremely propable that before long, peat will be made to serve a most important end in manufacturing operations, enabling us to utilize our large and valuable iron deposits.

At a recent meeting of the Royal Dublin Society, a highly important report on the value of peat as a fuel in Siemens' Gas Furnace, was received from Dr. Reynolds the Society's Professor of Analytical Chemistry, who says, "I have much pleasure in being able to report that the application of 'Siemens' Regenerative Furnace' to the economical combustion of rough, air-dried peat in great manufacturing operation, has proved eminently successful in this country. When I venture to draw attention to this important practical matter in a letter presented to the Council at the commencement of the 'fuel famine' in 1872, theoretical considerations chiefly led me to the conclusion that Siemens' apparatus was best suited for the purpose. The Great Southern and Western Railway Company, however, acting upon the suggestion and advice of its distinguished engineer, Mr. Alexander Macdonnell, have since erected a Siemens' furnace at their fine works at Inchicore. This furnace has now been more than two months in full operation, rough and poor peat being the only fuel employed. Notwithstanding the low quality of the turf used, the degree of heat obtainable is so great that the melting point of steel can be easily reached. This furnace has hitherto been regularly employed in forging large quantities of iron at Inchicore; and Mr. Macdonnell informs me that the quality of the iron turned out from this peat-fed Siemens' furnace is superior to that forged in the common air-furnace fed with the best coal. Still more important is the remarkable result which has been arrived at by Mr. Macdonnell, namely, that 5½ tons of rough turf suffice to forge one ton of iron in the Siemens' furnace, whereas six tons of good coal or about twelve tons of good peat must be burned in the common air-furnace in order to produce the same effect. Therefore, a manufacturer using a Siemens' furnace can obtain rather more heating effect from one ton of peat, costing 14s., than another using only the air-furnace can derive from one ton of coal at 28s. It is calculated that at least £3 10s. per ton of iron forged is saved at Inchicore by the use of Siemens' furnace fed with peat. Results such as these need no comment. I would only, therefore, venture to express the hope that manufacturers may now profit by the example and experience of the Great Southern and Western Railway Company, and may utilise some of the immense power which the invaluable labours of Sir Richard Griffith long since proved to be stored up in the peat bogs of this country."

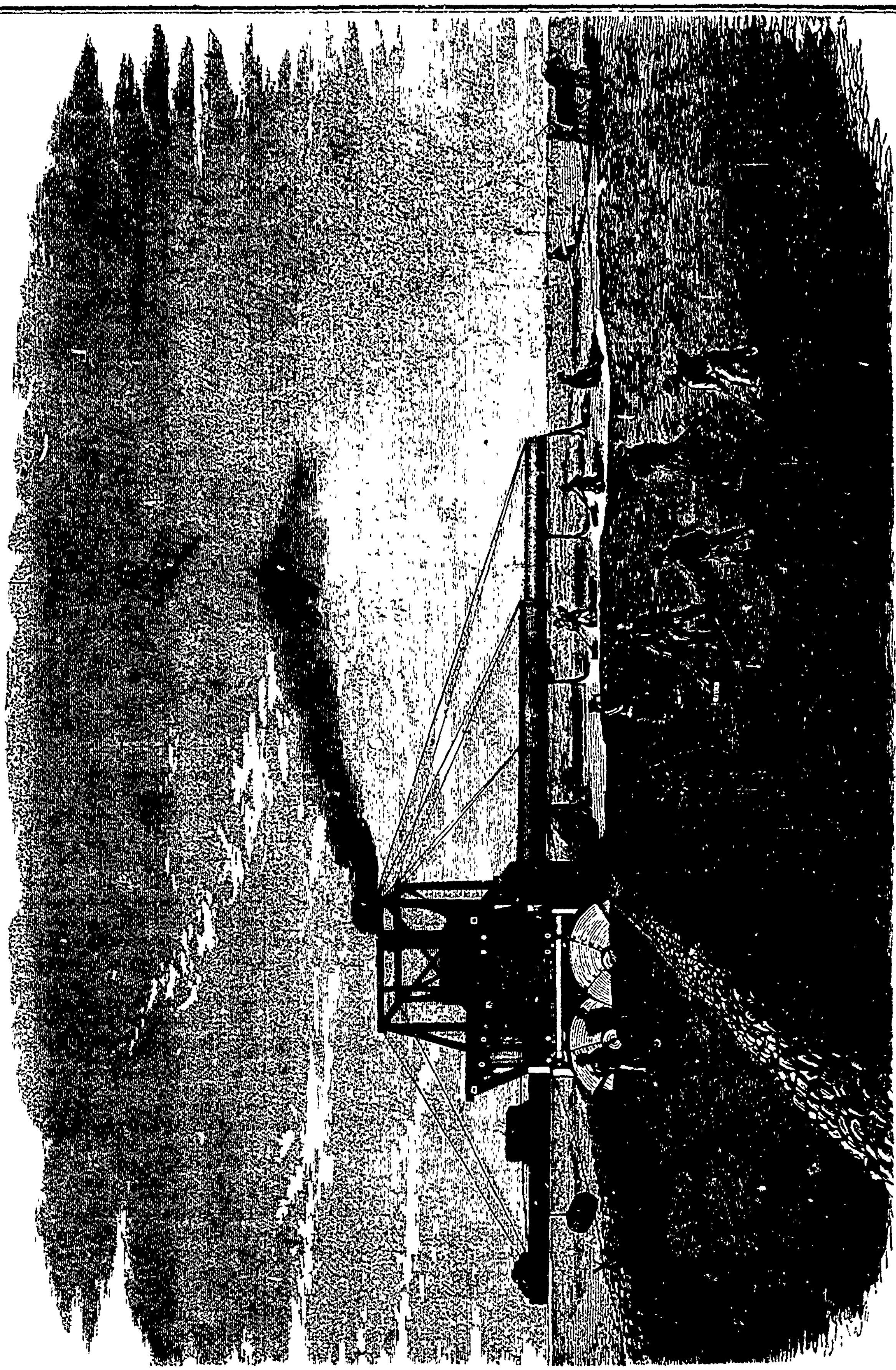
Peat is, indeed, attracting attention almost everywhere just now. The Western United States are looking to it to supply them with fuel and on our recent visit to the works at St. Hubert we were informed that the officers of the Company are constantly receiving inquiries from both hemispheres as to the most economical methods of production. Much of the information contained above has already appeared in a New York daily—in fact it would seem that part of the series of peat deposits mentioned should be along the Northern portion of that State. Our Canadian peat works, important as they are, however, promise before very long to become of much greater importance and if they also enable us to turn out the iron we so much need in the extension of our railroads and for other purposes, they cannot fail to give an immense impulse to the general industry of the country.

News from the Stickeen mines is somewhat contradictory. First a correspondent writes that things are prosperous and the claims paying well, but that all the good claims are taken up. Then in about a month it is stated that about a hundred disappointed miners have arrived at Olympia, who say that the Stickeen mines are the worst sell ever got up on the Pacific coast and that hundreds of men are in the mines without a dollar or a pound of provisions. The *California Mining and Scientific Press* expresses itself on the subject as follows:—

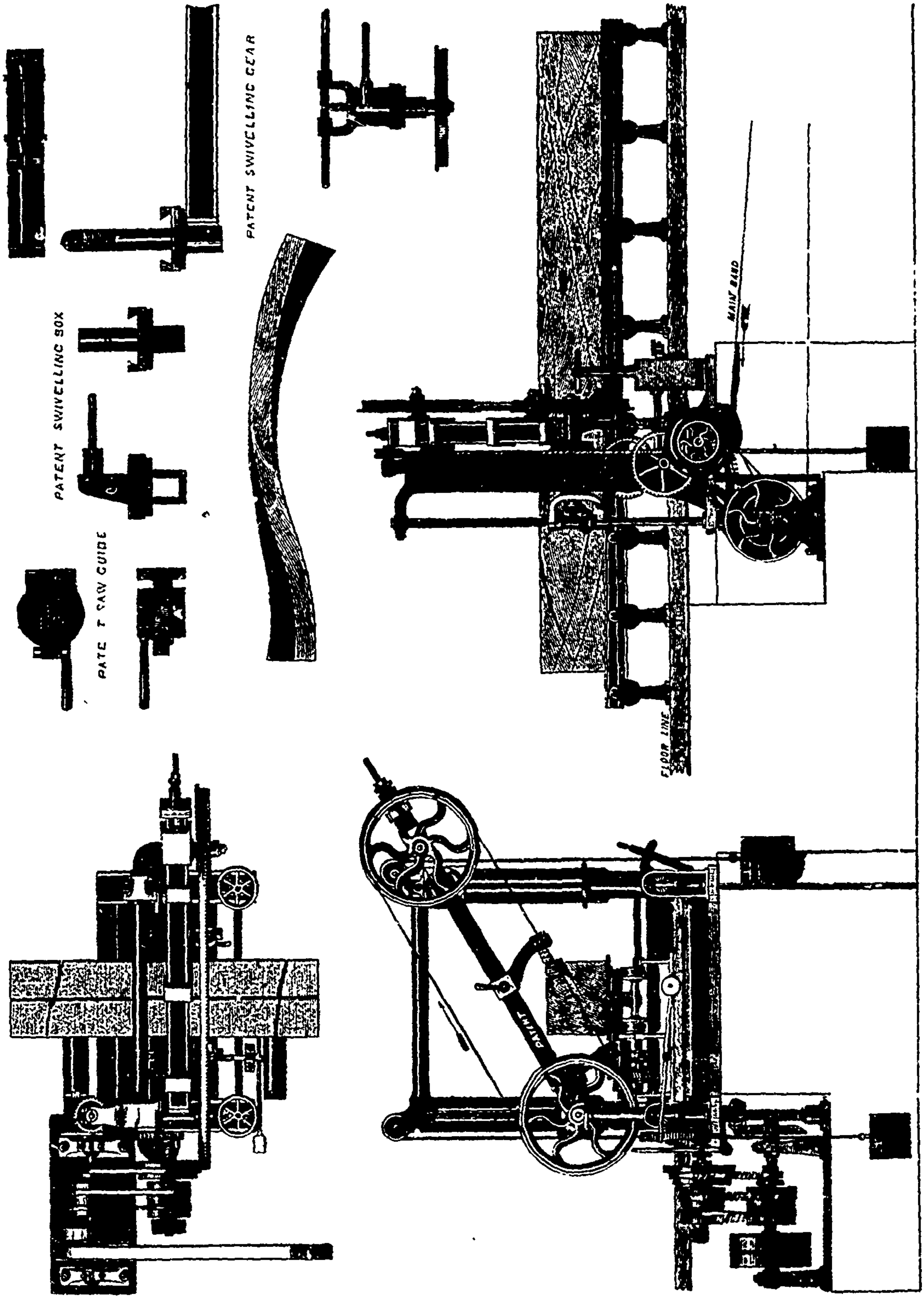
"It seems as if repeated bitter experience would prevent most prospectors going to these periodical "excitements" without at least money enough to get back again; more especially when the mines are in as inhospitable and distant a district as the Stickeen river country. The long winters were enough to deter most men, but the stories of fabulous richness — always prevalent about new mines — led many others to try their fortunes in the snowy regions of Dease's lake. It is probable, however, that some of the men who went to these mines must have made something, for a month or so ago a correspondent wrote that all the claims worth anything were taken up. We suppose that the late arrivals at the mines, most of whom expected a good claim immediately, must have been disappointed in seeing all the available mining ground already located; and fully realizing by that time the rigour of the climate of the region, they made up their minds to return. Of course such men will give the country a bad name, as those who are lucky will give it a good one. Many enthusiastic prospectors will not take the words of other parties about new mines but must see for themselves, and in so doing they often get "bit" badly. It is strange, but nevertheless true, that all the mining "excitements" in British Columbia and that region have turned out badly, and a large proportion of the men who went to the different localities, returned poorer but wiser men."

In view of the great increase just now taking place in the number of American inventions introduced into Europe the so far as possible universal assimilation of patent laws is becoming a question of moment to American patentees, especially when we take into account the loose and unsatisfactory nature of the patent systems of some of the European nations. The subject is being energetically considered in England where a deputation from the Associated Chambers of Commerce lately waited on the Foreign Minister urging his attention to the subject of the assimilation of the patent laws of England and the United States, which would be but a preliminary step to the assimilation of those of other countries. Lord Derby felt inclined to encourage the step but doubted whether the Americans were willing to co-operate. Since then it has been proposed to form a deputation of the Americans in London, representing patent interests, who should wait on the Foreign Minister and assure him of the interest felt in the United States in this movement. The London members of the Executive Committee of the Vienna Patent Congress also have the matter in hand and it is said that they propose to press it to an early conclusion.

A number of Pullman cars were shipped last fall from Montreal to be introduced on the English railroads. The cars in due time made their appearance on the Midland Railway and are said to have caused "quite a sensation." A trial trip was made, from Derby to London a distance of 129 miles, with two cars carrying a party of Engineers. The train was timed very fast so as to ascertain how much the cars would shake about, and all other trains were shunted for this one.



HODGE'S PEAT MAKING MACHINE.



SAW FOR CUTTING BENT TIMBERS.

The train left Derby at 2.30 P.M., passed Trent at 2.40, 9½ miles; arrived at Wigston at 3.7, 33½ miles; left there at 3.12, stopped at Bedford at 4.0, 79½ miles; left at 4.3, arrived at London at 5 P.M., 129 miles; running time 142 minutes; but this does not show the speed, as the three stops and three starts took six minutes. Speed was reduced to twenty-five miles an hour over thirteen junctions, which each took a good minute, leaving the time as 123 minutes for 129 miles, which averages over a mile a minute all the way. In one case, on a level piece of line, sixteen miles was run in 13½ minutes, about 75 miles an hour, and twenty miles was run in 19 minutes. The cars ran as steady as tables at 75 miles an hour.

The English journals speak in very favourable terms of the cars especially as to the arrangements for private rooms, lavatories &c. and also remark on the novelty of the facility afforded for passing from one end of the train to the other. Some of the cars have been sent over from England to the continent where they are to make a "grand tour," passing over the entire continent on the different railways.

A second attempt is about to be made to carry a car-load of live fish across the continent. An aquarium carefully fitted up for the purpose will leave Charleston, N. H., on the 3rd of June next for San Francisco where it will arrive about the 10th.

The salt water fishes on the list to be taken are as follows: Lobsters from Massachusetts bay; oysters from same place; scup from Martha's Vineyard; striped bass, New York Harbor; tautogs, Martha's Vineyard; salt water eels, same place; king fish, weak fish and blue fish from New York harbor.

The fresh-water fish to be taken are black bass, glass-eyed pike and horn-pouts, from Lake Champlain; eels, from the Hudson river; catfish, from New Jersey; Shad from the Hudson river; red minnows and alewives, from Massachusetts.

Most of these fish will be undoubted acquisitions, but we imagine the catfish and horn-pouts might be dispensed with. It is to be hoped that this attempt will be more successful than the one made last year when the car was wrecked and all the fish lost.

The derivation of the designation of an affection of the eyes very commonly known as Daltonism (colour blindness) is, as many of our readers are doubtless aware, from the name of the great philosopher, the propounder of the atomic theory, who was attacked by it. Properly speaking it is simply incapacity on the part of certain people to judge of colour, or more accurately, of certain colours. Dr. Favre has communicated to the Congress at Lyons the result of the researches, which, as chief physician of the Paris and Lyons Railway Company, he has made on the subject, the object being to determine what influence this disease or affection may have on the general safety of travellers. According to this report, amongst 1,196 different individuals examined from 1864 to 1868, 13 cases of red-colour blindness and one of green were found. Again, amongst 728 subjects examined between 1872 and 1873 he testifies to 42 of colour blindness more or less developed. He further estimates the number of people in France suffering from this malady at nearly a million, and gives as the most common causes of it, wounds, typhoid fever, syphilis, &c. The danger of such a disease existing, and possibly in some instances without the knowledge of the subject or his employers, is one which deserves attention, for although we cannot point ourselves to any instances in which errors have been made through it, nevertheless Dr. Favre, as we understand him, is able to do so, and we quite agree with him when he says that the only effectual preventive of the dangers which may possibly accrue from such a malady is a periodical optical inspection of all men who have to deal with coloured signals, a mistake in the use of which might lead to such disastrous results. We recommend inquiry on this subject to locomotive superintendents and traffic managers.

TWENTY-FIVE TON GUNS.

(From *The Engineer.*)

The engravings on pages 342 & 343 are very carefully executed cuts of the 12-in. gun of 25 tons, as mounted on board the Hotspur, on a carriage of special construction designed by Capt. Scott for the Hotspur. The general mechanical principles introduced by Capt. Scott are embodied in all his naval carriages. In each case the height of the slide is increased, and that of the carriage is reduced to a minimum, and the centre of gravity of the gun and carriage is thus brought near to the sliding surfaces of the platform. In each case the gun itself is let well down into the structure of the carriage. Then, again, the brackets in all the Scott patterns consist of double plate iron with cast iron "frames" or distance pieces between them. Further, the general arrangements of the rear trucks and bearing surfaces and the bow compressors are the same, nevertheless the movements required in a broadside carriage are so different from those of a turret carriage that the construction and gear are quite different.

For example, the turret revolving renders training and training gear superfluous in its guns, whereas it may be seen that a platform with training gear constitutes an essential element in the gun and carriage before us (*vide* F G LL). By the handles FF the mitre wheel G is made to revolve, which is in this case not on the same shaft with the pinion running in the racer rack H, but on one passing above it and acting with additional lever power, the carriage by this means being made to train on its trucks, which run on the smooth racers. The special brake worked by the handwheel I is employed to nip the rear racer—so as to prevent the pitching of the vessel from accidentally training the gun—in addition to the ordinary brake. The entire training angle is about 35 deg. on each side of the centre position. The bow compressor M is suspended in the usual manner, and made to act on wedge-shaped iron plates, which when the screw is forced home by the handwheel N, and the pawl allowed to drop into the teeth as shown, are in a condition to bite whenever the carriage is down on its surface bearings, in fact, in the firing position, but are released whenever it is lifted on to its front and rear trucks. The peculiarity of this compressor consists in the fact that the compressor bars or plates, with one exception, are on the inside of the slides.

Other modifications exist in this carriage, with a view to the end of clearing the outside of the platform of gear which it is considered might be in the way of the detachment, and tend to cause difficulty, even if it did not give rise to accidents. Hence in the running in and out gear, the spur wheels with their driving pinions are placed upon the inner sides of the girders, the latter passing through and resting in metal bearings in the webs. This spur wheels are not upon the shaft of the chain wheels, but each upon a spindle of its own to the front of the latter, and upon each spindle is a pinion gearing into a spur wheel upon the chain wheel shaft. The arrangement gives an increase of power as compared with the 10-in. slide. There is a ratchet and pawl on the outside of the platform girder shown at O in fig. The Scott Hotspur carriage resembles other broadside carriages in the training gear, nipping gear, and elevating gear, and in the actual application of the eccentrics and rear rollers The last-mentioned, however, are worked by hydraulic jacks in the last patterns. The principal peculiarities of the Hotspur pattern are as follows. The well—or portion fitting down between the sides of the slide—is not formed by the inner bracket plates, but is built up of pieces of plate and angle iron, so as to leave room between the sides and the slide for the compressor plate and bars which are placed upon the inner side of the slide. The eccentric shaft is made in three parts, connected by couplings. The rollers are brought into gear by a capstan head arrangement on each side (at AA), with a pinion working on a toothed arc The capstan head is place outside the cheeks of the carriage, not, as in most patterns, on the inside. The spindles of the elevating gear are supported in metal brackets upon the top of the cheeks of the carriage at B B, instead of passing through the latter. The levers of the nipper gear C are fitted with tackle by which the two running-up chains are drawn into the clutches fixed beneath the carriage. The following special fittings also exist: Metal brackets for the breeching rope in front, one in each side, two outside holding down clips D D upon each bracket, and in rear, extending from bracket to bracket, a piece of angle iron E upon which to rest the wood tangent scale when used.

It can hardly escape notice that this carriage, having no arrangement for compound or muzzle-pivoting, requires a greater vertical height in its port than the turret pattern, although 9 deg. elevation and 7 deg. depression only are provided, as compared with 13 deg. elevation and 6 deg. depression in the turret 10in. carriage. In any comparison of the two designs, however, we must take into account not only the different objects to be fulfilled, but also the fact that in a measure the gear shown in our engravings corresponds only in part to that of the turret carriage, and in part to that of the turret itself. To expose the above carriage to the fire of shells would seem an act of barbarity of the same character as that of exposing a steam engine or clock train to the same treatment This, however, is not ordinarily done on service. The carriage is much more likely to be injured by its own gun than by that of an adversary Hence the soundness of Capt. Scott's principles of design with the low centre of gravity and low application of the shock of discharge, which, as far as practicable, abolish the twists and blows caused by the mechanical couples which arise when the shock of discharge is given to a gun at a considerable height above the sliding surfaces of its carriage. In this respect this carriage compares favorably with the turret pattern, although in originality and completeness the preference must be given to the latter, especially in its aspect of the medium through which the gun is laid.

The quarter gun of a centre battery has a second port and set of racers, and a so-called water pivot—strictly speaking, a hydraulic lift—provided to enable it to be bodily transferred from one set of rails to another, in a manner analogous to that of a railway engine. In the cut beneath the sponge and rammer, is shown the cover of the opening through the deck into the shell-room below, through which opening the projectiles are raised ready to hand, being carried on board filled and fuzed. In the same cut is shown a Palliser projectile suspended in front of the muzzle of the gun. The chains seen crossing the sill of the port are those by which it is closed and opened.

THE SECURING OF WATER PIPES AGAINST FROST.

Mr. J. A. Calantarients, surgeon, Scarborough, has patented a simple but ingenious method of preventing water pipes from being burst by frost. Water, in freezing, expands about a twelfth of its bulk, and within that limit the expansive force exerted is so enormous as to overcome the resistance of any pipe or vessel yet constructed. Mr. Calantarients solves the difficulty by passing through the water pipes an indiarubber tube of such diameter that the space inside is a little more than equal to the increase in volume of the water by freezing. There is thus secured in the inside of the pipe a space equal to the difference of volume between water and ice — the proportion being 1,083 to 1,000 — so that when the water freezes and expands it occupies the space thus reserved for it instead of exerting its force on the pipe. The indiarubber tube is always kept full of air, so that when the water freezes it finds at every point the necessary space to occupy, for by compressing the tube it displaces the air and takes its place. Again, when the ice melts the air-tube expands, ready to be acted upon by another frost. The air is supplied from a reservoir, which is acted upon by the water-pressure, so as automatically to put the air-tube under an exactly corresponding degree of tension. By heating the air in the tube the water in the pipes can be thawed. This application is peculiarly useful in the case of water-closets, and in preventing the supply of cold water to engine-boilers becoming interrupted by frost. Not less important is that the invention can be applied to preventing the explosion of kitchen-boilers.

There is little doubt that we have here a cheap but effective remedy against a fertile and long-standing source of discomfort and damage Incidentally, security against the bursting of water-pipes during frost will likewise facilitate their more convenient disposition throughout a house, and permit the use of much lighter and consequently cheaper kinds; while it has been proved, by repeated experiment, that the invention retards the freezing of water in pipes, and that a frost which will close unprotected pipes has no effect upon those containing air-tubes.

Tilsonburg is going to vote on a by-law for the introduction of the Waterous system of water-works, to cost $13,000, on the 27th inst.

DOMINION NEWS.

The Brockville *Enterprise* says:—The Canada Central Railroad is at once to be extended to Pembroke. At Renfrew the Kingston and Pembroke will amalgamate and use the one line through to Pembroke.

Work has commenced on the Northern Colonization Railroad at Lachute, where the contractors complain exorbitant prices for the right of way are being demanded. The Company has been interviewing the Government with a view of getting permission to build the Gatineau Bridge 40 feet instead of 60 over low water mark.

Mr. Bulkley, C. E., who has recently returned from England, has made all requisite arrangements for the development of the Harewood coal mine, Nanaimo. Men are engaged at work tunneling.

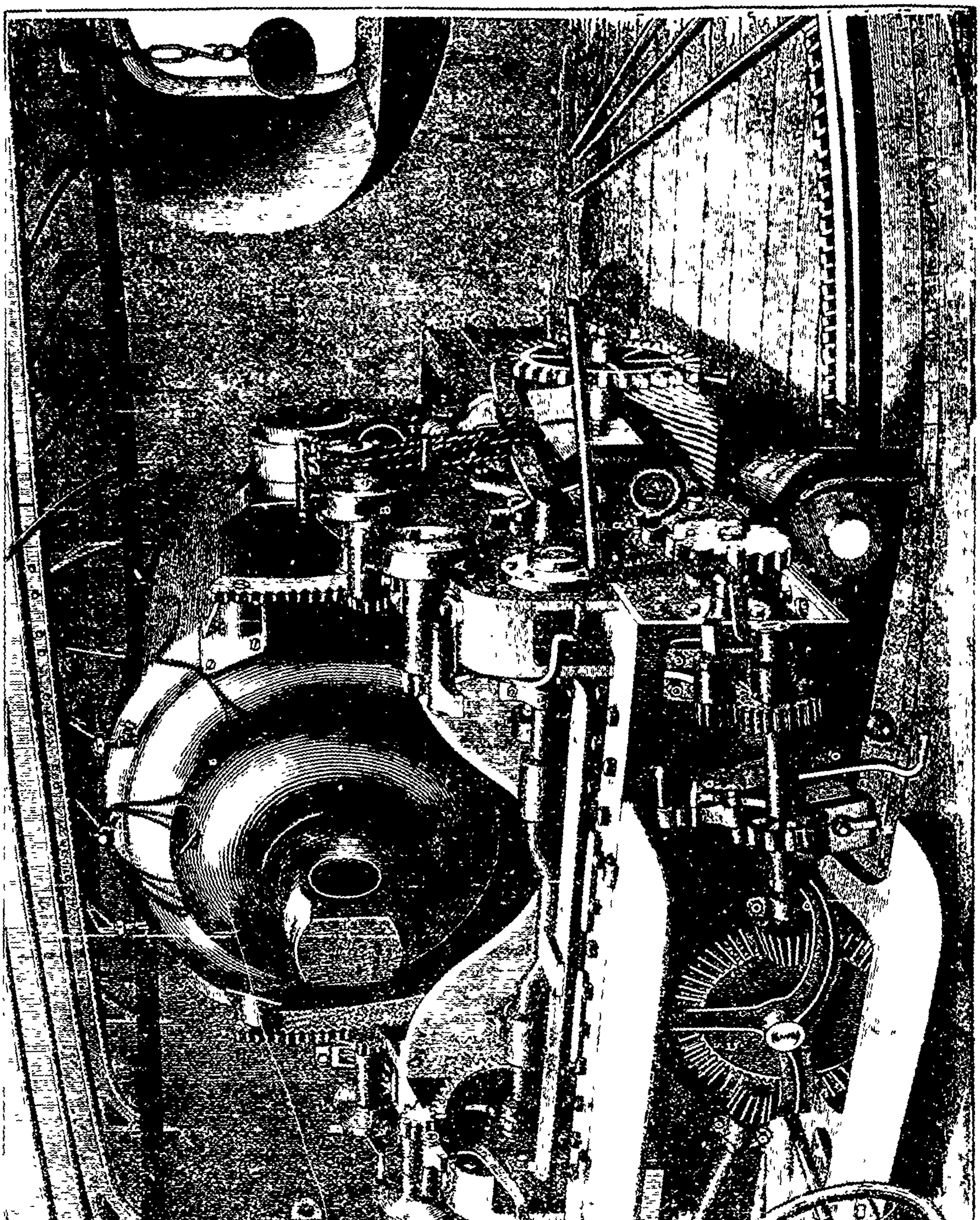
The plan of the proposed water-works for the town of Port Hope consists in the placing of two rotary pumps, two double turbine wheels, so arranged that either wheel will drive either pump, with fourteen hydrants distributed over the principal streets of the town, and necessary pipes and et ceteras

The Yarmouth, N. S, *Herald* says a brick of native gold weighing 27¾ ounces, the produce of the gold mines at Cranberry Head, was shown us yesterday by Capt. Coxetter, proprietor and manager of the mine. This lump is worth over $600. Capt. C. expects a yield of 80 to 100 ounces per month from the mine, with the aid of between 20 and 30 men. We are glad to learn that the prospects are so encouraging.

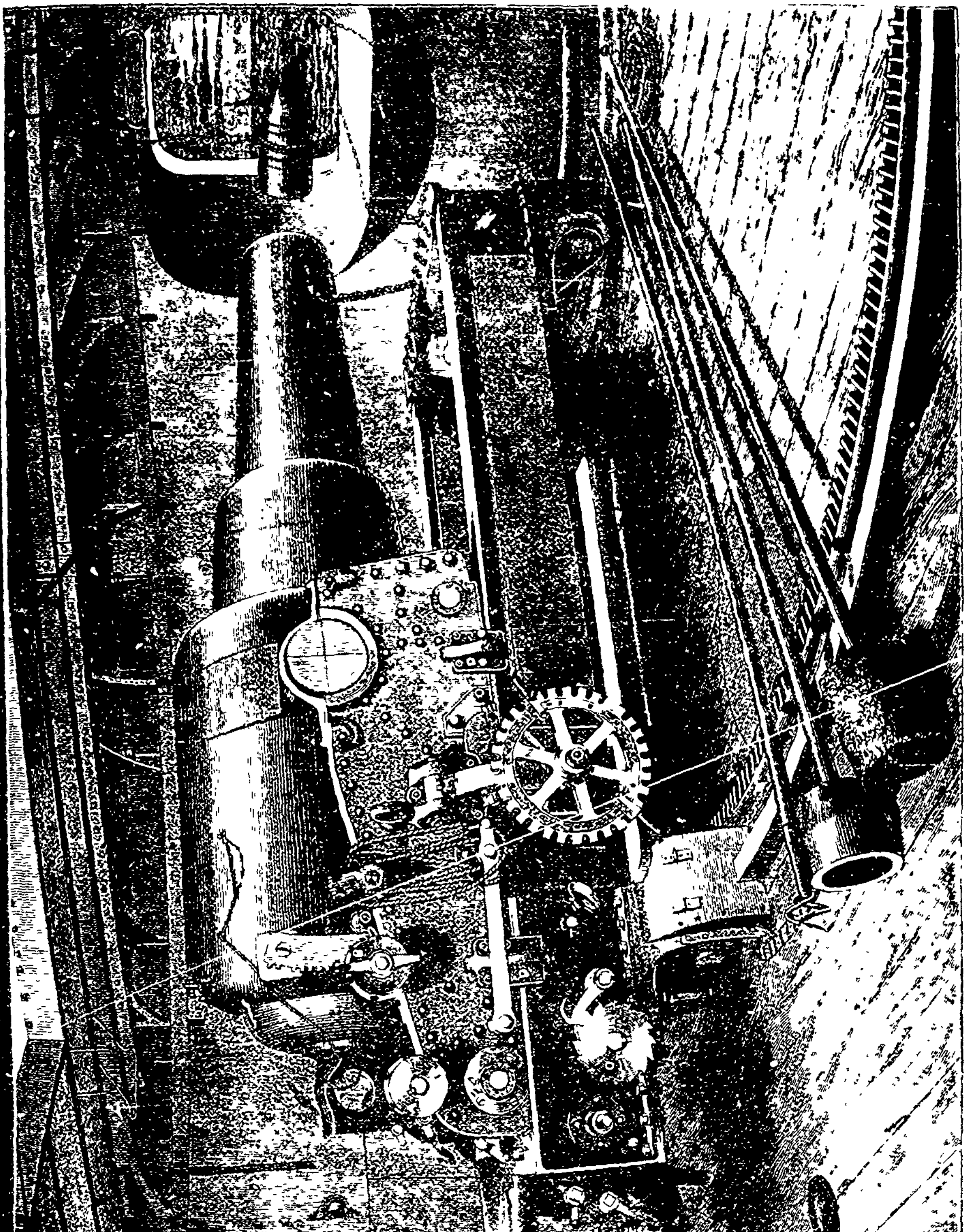
The first car for a line between Toronto and the oil regions at Parkerbury, Virginia, has been built at Port Hope, to the order of Stock & Webster, Toronto. It is meant to be fitted with a large iron tank 25 feet long by 5 feet in diameter. At each end movable head blocks are placed, so that the tank when placed upon it can be firmly fastened by bolts, thus avoiding the possibility of its shifting from its proper place upon the car, and as the trucks are on the anti-friction principle the oil can be carried steadily, avoiding the unsteady motion of the ordinary truck.

According to the annual report of the Welland Railway the expenses, for 1873 were $1,970.08 less than for 1872, while the amount of traffic, and consequently of the receipts, was largely increased during the last year over the previous one, the net profits, after deducting running and other expenses, amounting to $39,025.46. Over 3,000,000 bushels of grain were shipped over the road in 1873, being over 223,000 bushels more than during the previous year. Over 37,000 barrels of flour were carried over the road last year, being 10,000 barrels more than for 1872. Very satisfactory arrangements have been made with the Great Western Railway Company for running over a portion of the line. The cost of changing gauge, replacing rails, and other necessary work, was only $10,000. The local traffic of the road, both in passenger and freight shows a very considerable increase.

Depression in the Coal Trade.—Our latest advices from the Reserve and Lorway Mines are:—That twenty-two pair of cutters and a number of over ground workmen have been discharged, amounting in all to some 60 men, on account of the depression in the coal trade. A large contract the company had to fill in Montreal, of 76,000 tons, has been cancelled, buyers preferring to pay the amount of bond they were under to receive the coal than to take it and sell at such a disadvantage as the low price of coal in the market would force them to do. The bank at the Reserve contains some 40,000 tons, while at the Emery, where work is still going on, and we hope it may be continued, about 20,000 tons of the black diamonds are in bank. We sincerely hope this stoppage of the extensive works heretofore carried on at the Reserve Mines is only temporary, and that our coal prospects will brighten up at once. The determined push of the proprietors of these mines cannot be questioned, but wealthy corporations feel no more inclined to fight against untoward circumstances with daily loss of capital than do individuals. We look forward with hope that the "Reserve" will soon be in full blast again.—*North Sydney Herald.*



TWENTY-FOOT GUNS



TWENTY-FIVE TON GUNS.

RAILWAY MATTERS.

An American Tunnel.—It is proposed to excavate a tunnel, 4000 ft. long, through King's Mountain, Kentucky, for railroad purposes.

The Pennsylvania Railroad Company propose to reduce their force of brakemen, in consequence of having provided nearly all their trains with patent air brakes.

The distance pierced at the close of January on the St. Gothard Tunnel was 4403ft. Rather more progress has been made on the northern than on the southern side.

A Washington paper says that the United States Patent-office will soon be buried out of sight by models and specifications, as they are pouring in at the rate of over 600 a week.

Speaking of the Southern Kentucky Railroad, the Lexington *Herald* says:—"The bridge over the Kentucky river on this road will be the highest on the continent. It is 275ft. above low water, and has a span of 1236ft. The towers, erected by John A. Roebling years ago, cost 100,000 dols., and rise 365ft. above low water. Nine bids have been made to construct the bridge, eight for the truss plan and one for a suspension bridge as originally contemplated."

The United States newspapers have a characteristic story about a Virginia railroad that was made to pay 25 dols. for killing a rooster. The engineer said that he spoke to the gentleman with the whistle as kindly as possible, but when the fellow dropped one wing on the ground, raised his good eye heavenward, and commenced whetting his spur on the rail, forbearance ceased to be a virtue, and he let into him with thirteen freight cars, and forwarded him to his happy scratching-ground by lightning express.

A correspondent of the *Chicago Tribune* proposes to carry grain from the West to New York by means of a wire cable, to which would be attached bins 5 ft. long and capable of holding two bushels each. At distances of 10 miles would be stationed engines of 150 horse power, to be used in working the endless cable, the operations of which would be precisely like the ordinary elevator, except that it would carry its load horizontally instead of lifting it. The inventor thinks that by this process wheat can be moved from Chicago to New York at a cost of 10 cents per bushel, after leaving a margin for repairs and interest on cost of construction.

The great iron bridge of the Chicago, Alton, and St. Louis Railroad Company, crossing the Mississippi river at Louisiana, Mo., was completed on the 23rd Dec., 1873. This bridge consists of nine spans, ranging from 160 ft. to 260 ft. in width. The draw, which is 444 ft. in length, is the longest in the world. The total length of the bridge is 2,052 ft., and in and of it are 5,000 cubic yards of masonry, 50,000 cubic yards of rip-rap, 250,000 cubic yards of earth embankment, and its superstructure is all iron.

A Russian engineer named Sakhovsky has invented an apparatus—a kind of differential gauge—of very simple construction, which is said to have been found to work admirably at the Moscow terminus of the Nijni Railway, and on several other lines. The apparatus consists of a beam about 5 ft. long, provided at one end with an articulated lever, on the shorter arm of which is a stud that presses by means of a spring against the inner face of one of the rails, and at the other with a fixed stud; the beam is drawn along the rails by a man by means of shafts, or it may be attached to a truck. As the gauge proceeds along the line the deviations from the normal width between the rails is shown by the longer arm of the lever, which moves against a dial plate. The apparatus costs only eight roubles, and its superiority over the common gauge is striking, especially as regards the rapidity and continuity of the action. The directors of the Nijni and other lines have adopted the invention, which we believe is patented. Such a gauge run along a line every morning might prevent many an accident.

A Great Railway Project.—One of the most stupendous enterprises ever attempted by audacious man is the construction of the Peruvian Railway, which will connect the Pacific Ocean with the valley of the Amazon. This nineteenth century is full of marvels in the way of what is called engineering science—fuller, perhaps, of monumental works of that description than all the centuries which have gone before it since the fall of the Roman empire. But neither the Suez Canal, which cuts the narrow strip of sand that has obstructed the commerce of the world for ages, nor the Mont Cenis Tunnel through the Alps has presented such appalling obstacles as those which confronted the builders of a railway at an elevation of 17,000 feet above the level of the sea. There is really no parallel to this triumph of scientific faith, and it is matter for a legitimate patriotic pride that the men who have conceived and are now carrying out the work should be our countrymen. To form some faint idea of the mechanical and natural difficulties which the construction of this transandine railway presents, it may suffice to say that thirty bridges and viaducts, 3,000 feet in length, and thirty-five tunnels 15.000 feet in length, were required in a single locality. To grade the road, as far as completed, one hundred and forty million cubic feet of rock and earth had to be removed. The work, which was begun in 1870, has cost already about $33,000,000, and will probably cost that much more when finished in 1876. One of its wonders is the great viaduct, the highest in the world, which is 580 feet long and 300 feet high in the centre. The height of the three iron pillars which support it is respectively 166 feet, 183 feet, and 253 feet. From, 8,000 to 12,000 labourers, mostly Chilians and coolies, are working on the road night and day.

A committee of gentlemen in St. Louis, U.S., appointed to examine the matter of fireless locomotives on street railways, submit the following comparative figures:—(1) Summary of operating expenses per year for street railways with 22-horse cars and 200 horses:

	dols.
Feed and grooming 200 horses	32,850
Depreciation of horses	4,600
Depreciation of cars	3,000
Ordinary repairs of cars	1,000
Repairs of harness, shoeing, medical attendance	4,000
Wages of conductors and drivers	29,200
Repair of street (three-mile road)	1,800
Total	76,450

(2) For street railways of the same carrying capacity, operated with the fireless locomotive:

	dols.
Fuel and attendance for 2 boilers	14,725
Depreciation on 16 locomotives and 2 boilers	3,800
Depreciation of cars	2,400
Ordinary repairs of cars	800
Ordinary repairs on 16 locomotives	3,000
Wages for drivers and conductors	23,360
Extra wear and tear of rails	2,000
Total	50,085

Difference in favour of the fireless locomotive for twenty-car railway, 26,395 dols., a saving of 33 per cent.

Last year the Union Pacific Company began the boring of six artesian wells in the arid districts, in order to obtain supplies for locomotives, which had been in part supplied by water trains. The first well is at Separation, 724 miles from Omaha, and the last one is at Rock Springs, 832 miles. Another is in progress at Red Desert. The well at Rock Springs is 1145ft. deep; the bore is 6in. in diameter. In all the wells it was necessary to tube a great part of the way. At Rock Springs the water rises from the depth of 1145ft. to 26ft. above the surface, and discharges 571 gallons per hour, and at the surface 960 gallons. At Point of Rocks, twenty-five miles east, the well is 1000ft. deep. The water rises only to within 17ft. of the surface, whence it is pumped, but the supply is abundant, and the quality of the water is the best of all the wells. The next well is at Bitter Creek, twenty-one miles east of Point of Rocks It is 696ft. deep. It yields by pumping 2160 gallons an hour, and at the surface it flows 1000 gallons an hour. Next, to the east, is the well at Washakie, thirty-three miles distant. It is 638ft. deep, and at 15ft. above the surface it flows 800 gallons an hour. At Creston, fourteen miles east, the well is 326ft. deep, and an ample supply of water is obtained At Separation the well is 1103ft. deep and water comes within 10ft. of the surface, which by pumping yields 2000 gallons an hour. In some of the wells the water has 280 grains of salt in solution, and the incrustation is considerable, but altogether the wells have been a success, and it is said the cost of running water trains since the wells have displaced them would have paid for the wells.

SAW FOR CUTTING BENT TIMBERS.

The machine we illustrate on page 339, was specially designed for Messrs Saumda Bros., ship-builders, London, Eng. The mode of working is as follows:—The log previously lined off on each side to the required shape, is placed on a travelling carriage, which is self acting, and moved past the saw at a rate varying from 18 in. to 4 ft. 6 in. per minute, according to the hardness of the wood and the amount of curve and twist. A man is seated on each side, at the hand wheels in front of each column. Each keeps his eyes on the line marked on the wood, and, by turning the hand wheel, raises or lowers his saw pulley,* so as to cause the saw to enter or leave the wood exactly in the right place. On each side of the wood, and as close to it as possible, is placed a guide through which the saw passes. This is held in a friction ring and the workman by gently lapping the handle can twist the saw to make it easily follow the curved cut. The sketch, which is from the *Engineer*, shows a curved and twisted piece which was cut on all four sides in about 45 minutes.

If a log has to be only cut to a curved form without a twist in it, both lifting screws are coupled together by means of a lever on the right hand side of the machine, so that by turning either hand wheel both saw pulleys rise and fall simultaneously; in the case of a log with one regular twist from end to end, by reversing the lever one saw-pulley rises simultaneously as the other falls.

IMPROVED SCREW BLOCKS.

This apparatus, illustrated in the engravings on page 346 takes as regards the three cardinal qualities of power, safety, and economy, a high place among hoisting machines, numerous and ingenious in many cases as these are. Simplicity in construction and mode of operation are invaluable qualities in all mechanical appliances, and these also are possessed in a high degree by the blocks in question. Their simplicity of structure will be seen at once by a reference to the woodcuts.

Various modifications of the apparatus may be employed. Under the first, the block consists of a rope or chain pulley, on the axis of which is fixed a pinion, gearing into an intermediate pinion carried on an arm within the block, which again gears into a circle of internal teeth in the hoisting or load wheel. When the load has been raised, or it is desired to sustain it at any height, there is a loop on the framing of the block into which a link of the chain or the rope may be laid. By another modification a tangent screw is carried upon the axis of the rope or chain pulley, and gears into a worm wheel on the axis of the hoisting or load wheel, the two axes being at right angles or parallel to each other—but it is preferred in practice to construct the worm wheel and load wheel in one piece, for greater simplicity. Then, as the pulley is brought round, the hoisting or load wheel is rotated by the action of the tangent screw on the teeth of the worm wheel. Under a third modification, the chain or rope pulley is carried upon a trundle, preferably with four teeth, which are arranged in pairs at right angles to each other, and gear into the teeth of a wheel carrying the hoisting or load wheel. There is thus obtained a continuous lock of the pulley, one of the teeth of the wheel on the hoisting or load shaft being at all times situated between one pair of the trundle teeth or pins. By a fourth modification of the apparatus, the pulley is fixed on the hoisting or load shaft, the hoisting apparatus itself consisting of an arrangement of pins placed in a slight degree eccentric to the axis of the shaft, and over which the hoisting chain passes. Lastly, under a fifth modification, an eccentric is placed on the shaft of this chain or rope pulley, over which two or more straps are placed, each being provided with an arm which passes through guides near its outer end. These arms extend across the block, and by the rotating action of the eccentric are alternately brought to act on an internal set of teeth formed in the hoisting wheel. By the action of the eccentric these arms are caused not only to enter between the teeth of the wheel, but their outer ends passing through the guides move simultaneously as through an arc, and so rotate the hoisting or load-wheel; and as one or other of these arms is always in gear with the teeth of the hoisting or load wheel, a continuous lock of the block is obtained.

Fig. 1 of the engravings represents a front elevation of the second modification of the improved blocks; and Fig. 2 a side elevation. Under this arrangement the framing of the block consists of two straps connected by ties at the top and sides. A chain pulley round which the hand chain passes is situated at one end of the shaft, which rotates on bearings formed in the side ties. A tangent screw, formed on the shaft, gears into a worm wheel which is formed on one side of the hoisting or load wheel, which in its turn is carried on a shaft supported in bearings formed in the lower part of the straps, the two shafts being at right angles to each other. Then, as the chain pulley is pulled round by means of the hand chain, the hoisting or load wheel is turned by the action of the tangent screw in the teeth of the worm wheel. The side tie next to the chain pulley is provided with two arms which project outwards and are curved round at their extremities to form loops, which act as guides for the hand chain.

The apparatus may also be used for steering ships, in which case the hoisting or load wheel is fixed on the rudder post, and the rope or chain wheel on the steering shaft. Among the special advantages claimed for the screw blocks are these—That they are perfectly self-sustaining, because, owing to the threads of the screw being constantly in gear with the teeth of the load wheel, but at right angles to the direction of the lift, it is impossible for the load to slip or run down; that they are about thrice the power of any yet invented; that their construction is the extreme of simplicity, hence there is no liability to derangement; and by reason of the maximum of leverage and minimum of friction, an unusually light chain—relatively with the weight to be lifted—can be used; and this chain being of a long-link make avoids the hitherto common occurrence of stretching the links. The blocks have also a double lift, so that only a single length of load chain is required for any height of lift; and they can be suspended from the jib of an ordinary crane, and the hand chain operated by a winch handle, thus forming a valuable machine for heavy hoisting operations. With extensive experiments already made, it has been found that with a two-ton block one man can lift 35 cwt., but with good management 2 tons.

NEW PETROLEUM MOTOR.

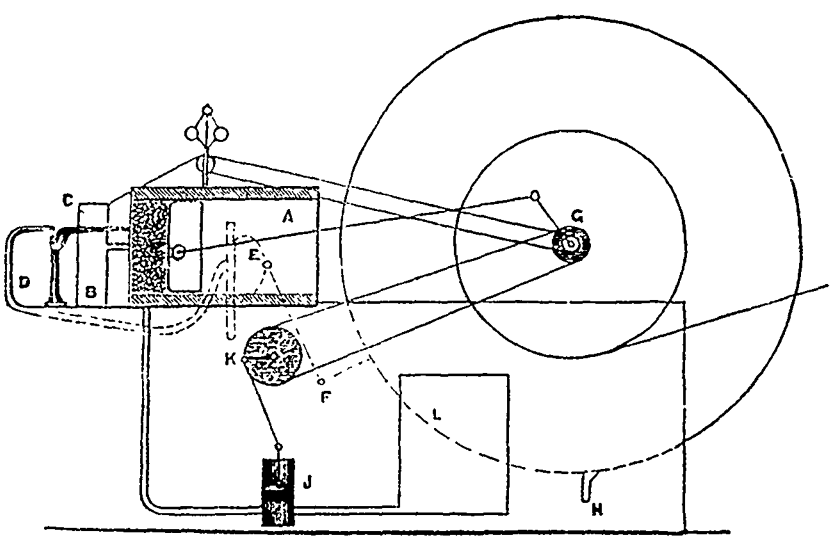
A cheap and handy small-power motor for small industries has long been a great desideratum. A motor has recently been constructed at Vienna which seems to promise well to supply this need. Its first application to sewing machines is said to have given such good results as to call forth a large number of orders.

The annexed cut (which we copy from the *Revue de l'Industrie*) will give some idea of this motor.

The principle of the machine is similar to that of a horizontal simple-action steam-engine, with this difference—that the force of explosion of petroleum is substituted for the expansive force of steam.

In the bottom of the cylinder A (which has a double envelope) are three valves. The central one, furnished with a very fine sieve, brings into the cylinder the petroleum from a special receiver B. The left one admits at the proper moment, the flame C, which is forced, in intermittent fashion, against the orifice by pressure of air.

The petroleum, introduced in a state of extreme division, can thus be inflamed; an explosion ensues, the effect of which is to close the two valves and drive the piston forward. The piston has a hinge joint, by which oscillates a rod connected directly with a crank. The shaft carries, on one side, a transmitting pulley; on the other, a flywheel. A tappet H acts on a bent lever F, which produces at each revolution of the flywheel, pressure on a caoutchouc bellows E. The air inclosed in the latter is carried by a tube D, to the flame of gas or petroleum C, which is elongated for an instant, like that of a blowpipe, and causes the explosion.



NEW PETROLEUM MOTOR.

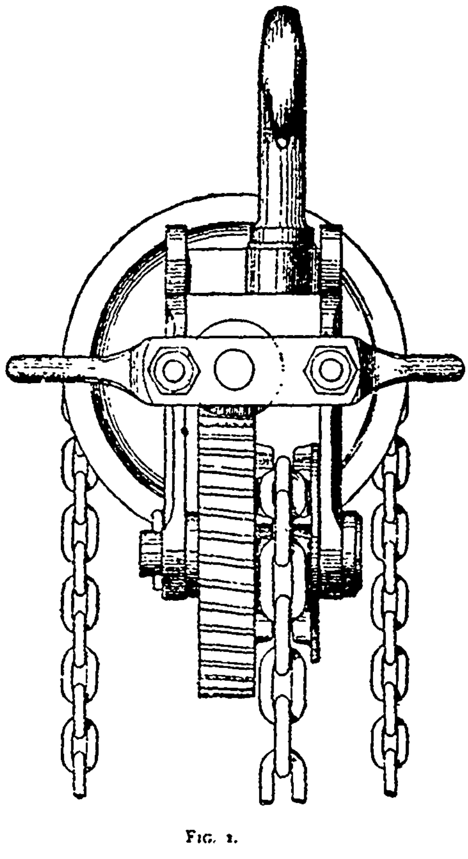


FIG. 1.

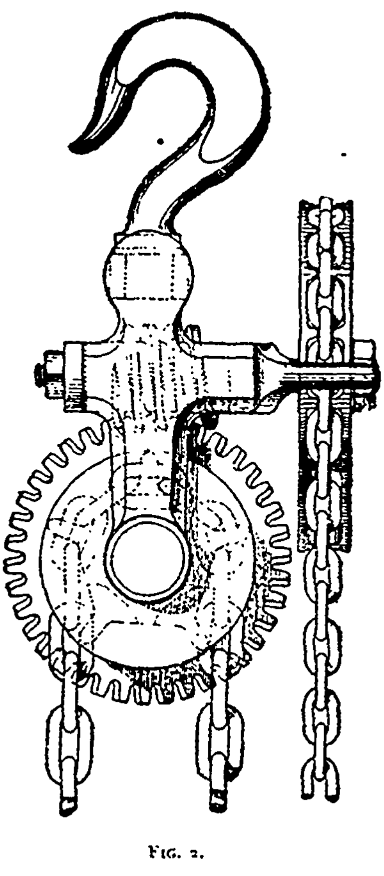


FIG. 2.

IMPROVED SCREW BLOCKS.

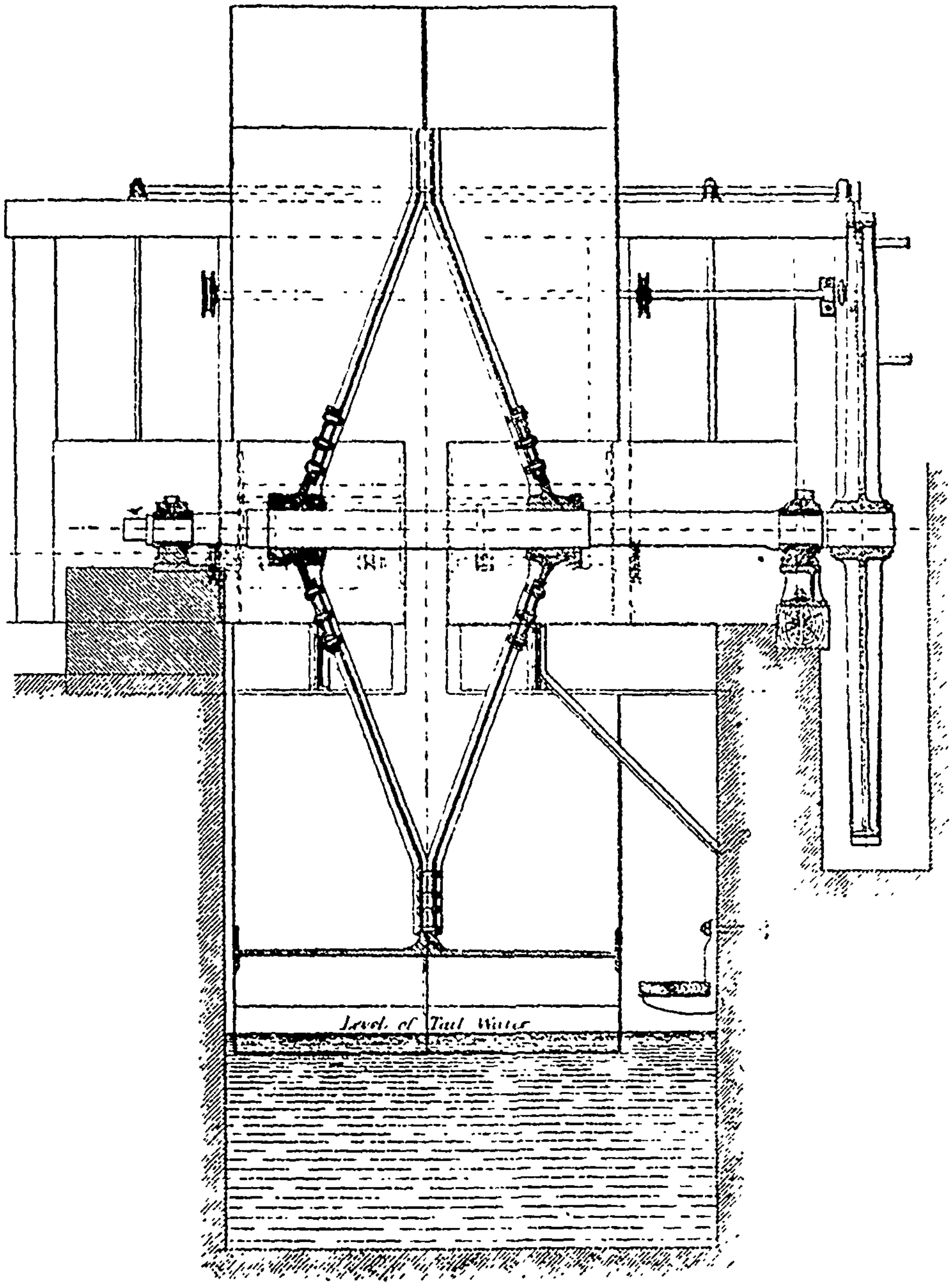
The petroleum is introduced into the cylinder simply by atmospheric pressure, and in consequence of the vacuum which the piston makes in advancing. The impulsion of the flywheel brings the piston back again. The air is constantly renewed in the bellows E by a tube K.

To cool the cylinder, a current of cold water is made to circulate between the envelopes; being pumped from the receiver L by the pump J.

Above the cylinder is fitted a governor which regulates the supply of petroleum, by a combination of levers. The smoke produced by combustion of the petroleum escapes by the orifice of the third valve, and goes off by a chimney. The movement of the valve is determined by an eccentric on the shaft.

The whole machine rests on a metal plate fixed on a stand of wood or masonry. All that is necessary to set it going is to open a cock and to light the lamp C.

The petroleum motor is constructed with forces of from 1



WATER WHEEL WITH INTERNAL ADMISSION.

to 3 horse-power; for a machine of $\frac{5}{4}$ horse-power the price is 3,500 fr., including the foundation-plate and the water-pump. The expense of mounting is small.

The following advantages are alleged:—

1. Absence of all danger through ignorance or malice
2. Inutility of legal authorisation for fitting up.
3. Instantaneous starting and stoppage.
4. Little noise; very limited occupation of room.
5. Slight expense.

A Woodstock man named Codville has invented a seed-sowing machine, which, it is claimed, will deposit the finest grass seed or the coarsest grain at the rate of 150 per bushels day with perfect regularity.

STRAUB'S WATER-WHEELS AT THE VIENNA EXHIBITION.

Before describing these exhibits we may state briefly the leading principles by which the design of water wheels should be governed. Whether the water acts chiefly by its weight or by its impulse, it is always necessary in order to reduce as much as possible the loss of effect, that the jet of water when first coming into contact with the buckets should not strike against but glide along them. Realising this condition, and considering that the resultant of the velocity of the jet of water and of the negative surface velocity of the wheel should be parallel to the tangent of the bucket-curve, it is obvious that this tangent must occupy a position within certain limits, as the surface velocity is given. After the water has been thus delivered to the wheel with the smallest possible loss of head, it should be allowed to escape along the tail race freely and without much waste of power. The most usual way of accomplishing this is by providing a sudden drop at the end of the breast into the tail race, the wheel being then not in contact with the tail water. It cannot be denied that this arrangement is one of the simplest for effecting the free discharge of the water, but at the same time it is a disadvantageous one with respect to the performance of the wheel, as the whole height due to this sudden drop is lost. In order to get over this difficulty, the tail race is sometimes made to join the breast tangentially, and in order to prevent the tail water from acting objectionably as back water upon the buckets of the wheel, its velocity is made equal to the circumferential velocity of the wheel. In order to prevent the water from being lifted by the ascending buckets, the latter should be of such a shape that the tangent to the curve of the bucket assumes a vertical direction at the point in which this curve cuts the surface of the tail water. This condition is fulfilled if the shape of the bucket, as far as it is immersed in the water, is the evolute of the circle, the centre of which is the centre of the wheel, and the periphery of which touches the surface of the tail water. In a wheel constructed in this manner, it is obvious that every part of the bucket is moving in a vertical direction when cutting the surface of the water in the tail race, whence disregarding the friction between the water and wheel, no loss of head occurs whilst the water is being discharged.

In his wheels exhibited at Vienna Mr Straub endeavoured to improve the construction as much as possible, and he bestowed special care on the design of the curve of the buckets, whence he got a larger circumferential velocity. However, the manner in which the deepening of the tail race of the breast wheel is effected as shown in the vertical section of that wheel in our illustration on page 351, does not appear to be one capable of being readily justified, and does not even effect the object which leads to the adoption of the sudden drop so frequently used, the water surface not being lowered. Besides, the mode of deepening adopted by Mr. Straub has a detrimental influence, as it causes the tail water to move with a less velocity than the wheel, whence the buckets have to overcome a resistance which increases with the square of the difference between the surface velocity of the wheel and the speed of the water moving through the suddenly enlarged area of the tail race.

The breast wheel exhibited at Vienna, and illustrated in our engraving, was of a type suitable for a height of fall of from 0 3 to 4 metres (say 1 ft to 13 ft), and for a quantity of water per second of from 0 3 to 6 cubic metres (10.6 to 212 cubic feet). Mr. Straub states that the real effect of these wheels is between 65 and 75 per cent. The wheel exhibited at Vienna, was, with the exception of the buckets and the two bosses, made entirely of wrought iron, the object being to make the wheel less heavy, and to reduce as much as possible the loss of power through friction between gudgeons and bearings. The principal dimensions of the wheels are as follows: Diameter over all, 16 ft 8¾ in ; width, 5 ft. 10¼ in., diameter inside buckets, 9 ft 7⅝ in. The curves of the buckets are struck with a radius of 3 ft 3 in , the centres being situated on a circle touching the outer edges of the floats. The shaft is 8 in. in diameter through one of the bosses, and 6⅛ in. through the other; while the bearings are 7¼ in. diameter by 9¼ in long, and 6¼ in diameter by 7⅝ in. long respectively. The shaft carries at one end a spur wheel 11 ft. 0¼ in. diameter, and having 160 teeth, this wheel gearing into another 3 ft. 0⅜ in. diameter, and having 44 teeth. The two other wheels, which transmit the motion to the shafting, are 6 ft. 10⅝ in. and 2 ft. 10¾ in. diameter, and have 140 and 58 teeth respectively. All the details of this wheel, as will be seen from our illustration, are worked out exceedingly well. The regulating sluice delivers the water above its upper edge, which is rounded off in order to avoid contraction and irregularities in the motion of the jet. In our illustrations the sluice is shown full open.

The second water-wheel exhibited by Mr. Straub at Vienna, and illustrated on pages 350 and 351, represents the system known by the name of Millot's, and is characterised by the internal admission of the water. This system illustrates another endeavour to get over the difficulty of the relation existing between the delivery of the water to and its discharge from a wheel of ordinary construction, a difficulty which is especially felt when the level in the tail race is very variable. In this wheel of Mr Straub, however, this dependency of the inlet upon the discharge or *vice versâ* is entirely eliminated, and one part of the bucket may be formed in accordance with the conditions for a correct admission, whilst the other part may be shaped according to the rules for a proper discharge of the water. It cannot be denied that the first cost of such an arrangement is greater than that of a wheel of the ordinary construction, but it is urged that the final results obtained with such a wheel are also much in excess of what is generally expected. Mr. Straub claims for a wheel of this kind, and for a height of fall of 3 metres (9 ft. 10 in) and a quantity of water of from 0.1 to 0.7 cubic metre (3.5 to 24 7 cubic feet) per second, a useful effect of as much as 88 per cent. We cannot, however, help regarding this performance as much over-estimated. As regards the design of this wheel, we may finally state that both Mr. Straub and Mr. Millot claim to be the inventors, but it appears to be difficult to decide to who a this right belongs. The wheel shown at Vienna had 54 buckets, and its internal and external diameters were 13 ft. 10½ in. and 18 ft. 5⅞ in. respectively. Its width was 6 ft. 11 in., and it was worked at a speed of five revolutions per minute, the head being 9 ft. 7¾ inches and the water supply 15¼ cubic feet per second. The shaft was 7⅞ in diameter through the wheel bosses, and the bearings were 5⅞ in diameter by 9⅞ in. long, and 5⅜ in. diameter by 8¼ in. long respectively, the bearing next the spur wheel being, of course, the larger of the two. The spur wheel fixed on the main shaft was 11 ft. 0¼ in. diameter with 160 teeth, and drove another wheel 3 ft. diameter.—*Engineering.*

PERPETUAL MOTION

It is strange, in these more modern days of scientific enlightenment, to hear again revived the old search after the unattainable in mechanics. One would as soon think of hearing it seriously announced that the old alchemists' exploded notion of the transmutation of metals had become sober fact. We have, however, been considerably amused by the self-delusion of an inventor who has gone so far as to spend years of his life and much money upon a machine which he claims will utilise gravity as a continuous motive power, and thus, by a proper arrangement of parts, produce perpetual motion. But this is not all. In self-deluded inventors in this direction, there has, at all times, been sufficient precedent and plenty of companionship. This inventor has, however, got so far as to read a paper explanatory of his machine before the society of civil and mechanical engineers, and has not been yet, as far as we know, disabused of his erroneous notions. In addition, when our inspection and opinion were boldly invited, many names, both of scientific and mechanical men, were adduced by way of bias to ourselves, as not having at any rate spoken unfavourably upon the model and the theory.

This but serves to show, in our opinion, how rarely practical mechanical knowledge is as yet combined with sound theory, or mere theory with really practical knowledge. We must say that we have never seen a machine more ingeniously devised to mislead both the inventor and the public if possible. It is for that reason that we give special notice to the disabusing, to the best of our power, both of the present inventor and of others who may at any time be so foolishly inclined as to wish to risk their time and money on such an *ignis fatuus*. The special deceptions of the invention are these:—To the practical man the motion of the rising and falling beam are so complicated that he is simply confused thereby. And to the merely theoretical man, the introduction of an entirely new complicated and ingenious mechanical motion prevents him from comprehending clearly the simple theoretical action of the machine. The inventor, too, most carefully refrains from saying much or anything about "perpetual motion," which would doubtless decide the point against him off-hand with any scientific mind. He merely prominently claims to increase the power of any small auxiliary force by the action of gravity on a weighted beam. The machine is primarily this:—A heavy beam is supported through a smooth slot upon two-geared cranks, which are so geared that they rotate one within the other, so to speak. This is a very novel and eccentric mechanical motion, and a very praiseworthy part of the invention. The action of the cranks causes the beam to be moved out of the centre alternately, so that the beam is placed in such a position that it tends to fall alternately on opposite sides, and must be moved from its lowest to its highest position by the action of what is termed a slight auxiliary force. It is thus claimed that by virtue of the geared cranks or rolling centres there is always a certain proportion of gain in the work done by the overbalancing of the beam, as compared with the auxiliary force required to what is termed "rock" the beam. The effect is claimed to be produced by utilising the force of gravity. The claim is almost plausible at first sight, complicated as it is by the inventor's talk of rolling centres and their wonderful power, and more especially since the downward motion of the beam is very direct and observable. The action of the auxiliary force, on the other hand, takes place whilst the upward motion of the beam is produced by an inclined plane, and is not so obvious. In this way a nice mare's-nest, in our opinion, has been devised by the unfortunate inventor, and for anybody who may be foolish or ignorant enough to waste time or money on it.

And now to demonstrate our opinion on the matter. Analyse the force that is sought to be utilised, the attraction of matter. It is not a body in motion, such as the air or that of rivers. It is not a pressure which can be confined, and directed such as steam. It is not a force which is being continually generated and given off, such as the sun's heat. But it is simply an attraction, never more or less under similar circumstances. How, then, can it be utilised as matter in motion, overcoming resistances — i. e., generating heat? It must, in such case, lose a corresponding portion of its energy, and to be kept constant must be continually receiving accession of strength. This, we know, is not the case. The only case we know of in which attraction of matter usefully affects matter in motion is the case of the planetary systems In these the motion is neither produced, accelerated, nor retarded by gravity, but simply governed, and any resistance encountered would undoubtedly produce a corresponding retardation.

The potential energy of any mass on the earth's surface is exactly estimated in foot-pounds by the product of its weight into its distance from the earth's surface; and no more can be obtained from it except an equivalent of any work which may be done upon it. Magnetism will rank with gravity as a constant attraction, which cannot be utilised to set matter in constant motion. So-called magnetic engines are simply the utilised effect of chemical combination of acids and bases, caused to produce an intermittent force in electro-magnets. The force of electro-magnetism is simply the mechanical equivalent of the work done to produce the rotation of coils before the poles of a magnet. This is sufficient at once in our mind to stamp the inventor's claim as an impossibility.

To analyse the motion of the machine itself. Suppose the beam to start in its highest possible position, a slight motion of the fly-wheel causes the supporting centres to shift, so that the beam overbalances and falls heavily on one side, completing thereby half a revolution. Now, at this point the inventor lays great stress upon the leverage of the falling weight. But it is not a question of leverage at all. The work done by the descending beam is measured exactly by the weight of the beam, multiplied into the vertical distance through which the centre of gravity of the beam has fallen. Now, in the second half-revolution, if the beam has to be returned to its original position, by whatever complicated motions it may be effected, the work to be done will be exactly measured by the weight of the beam, multiplied into the vertical height through which it has to be raised. The deduction is obvious There can be no possible gain in such a machine, but merely a loss equivalent to the frictional resistance. The deception may arise in this way.—The weight is very heavy, descending through a small vertical distance; the rise is by means of the wedge principle, in which a small effort, through a long distance, will effect the replacement of the beam in its original position; but the work is not lessened. The production of perpetual motion does not, at first sight, appear as the object of the above-described machine, and, as we have before said, the inventor purposely keeps such a claim in the background, as it would of itself be sufficient, with many minds, to show its impossibility.

Perpetual motion would, however, be a logical consequence of the utilisation of an unlimited and ever-constant force, such as gravity or magnetism. For instance, in the above machine with a single beam, there is the dead point, so to speak, in which the auxiliary force is required to complete the revolution. But if the work done by that falling weight be in excess of the work done by the auxiliary force, two or more beams might be easily so adjusted on the same shaft that one beam or other should always be falling. Hence perpetual motion would ensue. This would be at once the simplest and cheapest mode of testing the working of the theory, instead of building, as the much to-be-pitied inventor has done, a single beam machine with auxiliary engine to work it. It is surprising that any man could be so foolish as to go to such expense without first obtaining a practical result with a model. In this case this practical result would, we feel sure, support our opinions.—*Iron.*

HOW TO MAKE COARSE WOOD LOOK LIKE POLISHED MAHOGANY.

The following process is recommended in *Wiederhold's Trade Circular.*—The coarse wood is first coated with a coloured size, which is prepared by thoroughly mixing up in a warm solution of one part of commercial glue in six parts of water, a sufficient quantity of the commercial mahogany brown, which is in reality an iron oxide, and in colour stands between so-called English red and oxide of iron. This is best effected by adding in excess a sufficient quantity of the dry colour with the warm solution of glue, and thoroughly mixing the mass by means of a brush until a uniform paste is obtained, in which no more dry red particles are seen.

A trial coat is then laid upon a piece of wood. If it is desired to give a light mahogany colour to the object, it is only necessary to add less, and for a darker colour more, of the brown body-colour. When the coat is dry, it may be tested, by rubbing with the fingers, whether the colour easily separates or not. In the former case, more glue must be added until the dry trial coat no longer perceptibly rubs off with the hands. Having ascertained in this way the right condition of the size colour with respect to tint and strength, it is then warmed slightly, and worked through a hair sieve. After this it is rubbed upon the wood surface with the brush, which has been carefully washed. It is not necessary to keep the colour warm during the painting Should it become thick by gelatinising, it may be laid on the wood with the brush, and dries more rapidly than when the colour is too thin. If the wood is porous and absorbs much colour, a second coat may be laid on the first when dry, which will be sufficient in all cases. On drying, the size colour appears dull and unsightly, but the following coat changes immediately the appearance of the surface. This coat is spirit varnish. For its production three parts of spirits of wine of 90° are added in excess to one part of red acaroid resin in one vessel, and in another ten parts of shellac with 40 parts of spirits of wine of 80°. By repeated agitation for three or four days, the spirit dissolves the resin completely. The shellac solution is then poured carefully from the sediment, or, better still, filtered through a fine cloth, when it may be observed that a slight milky turbidity is no detriment to its use. The resin solution is best filtered into the shellac solution by pouring through a funnel loosely packed with wadding.

When filtered, the solutions of both resins are mixed by agitating the vessel, and letting the varnish stand a few days. The acaroid resin colours the shellac, and imparts to it at the same time the degree of suppleness usually obtained by the addition of Venetian turpentine or linseed-oil. If the varnish is to be employed as a coat, the upper layers are poured off at once from the vessel. One or two coats suffice, as a rule, to give the object an exceedingly pleasing effect. The coats dry very quickly, and care must be taken not to apply the second coat until the first is completely dry

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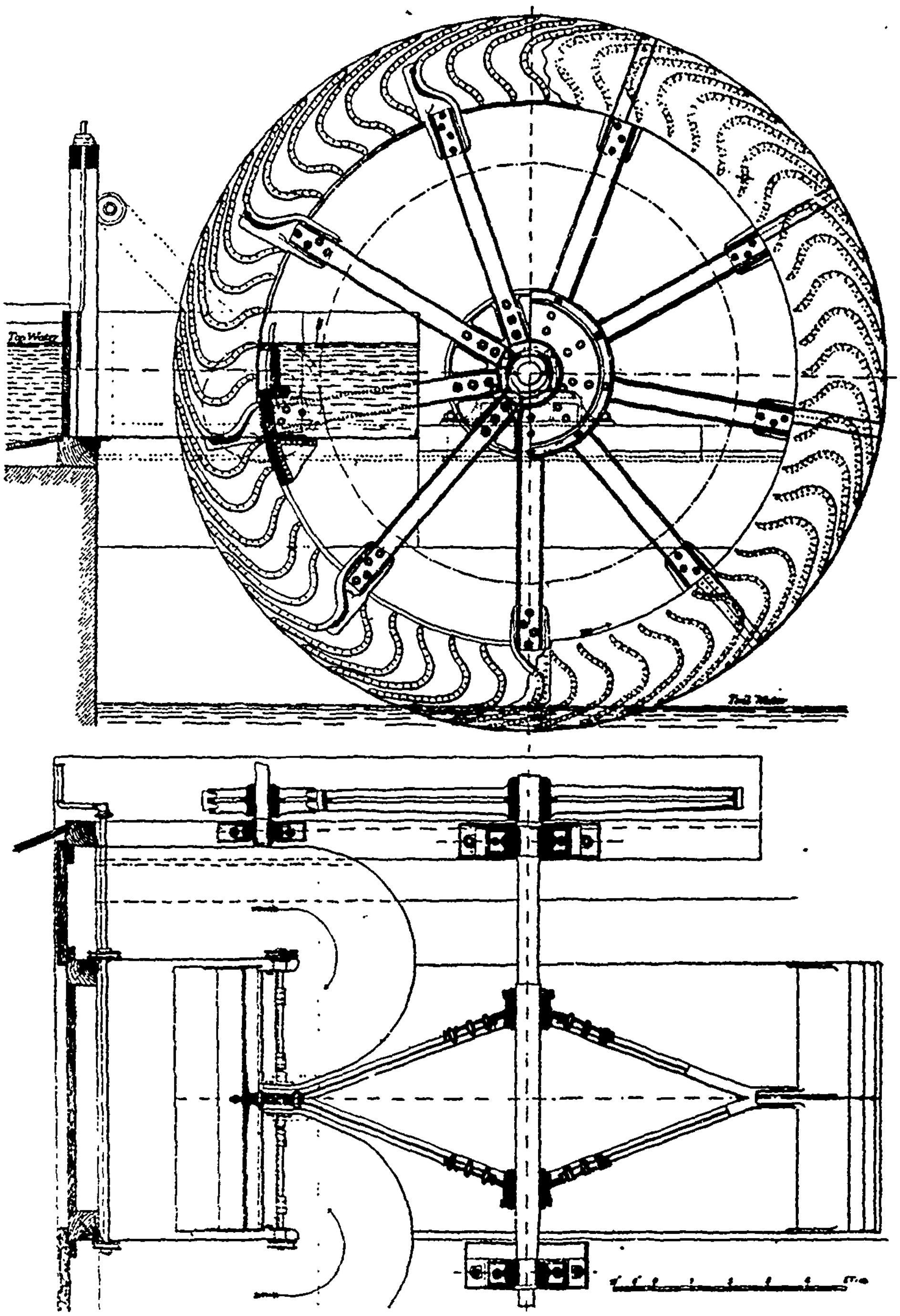
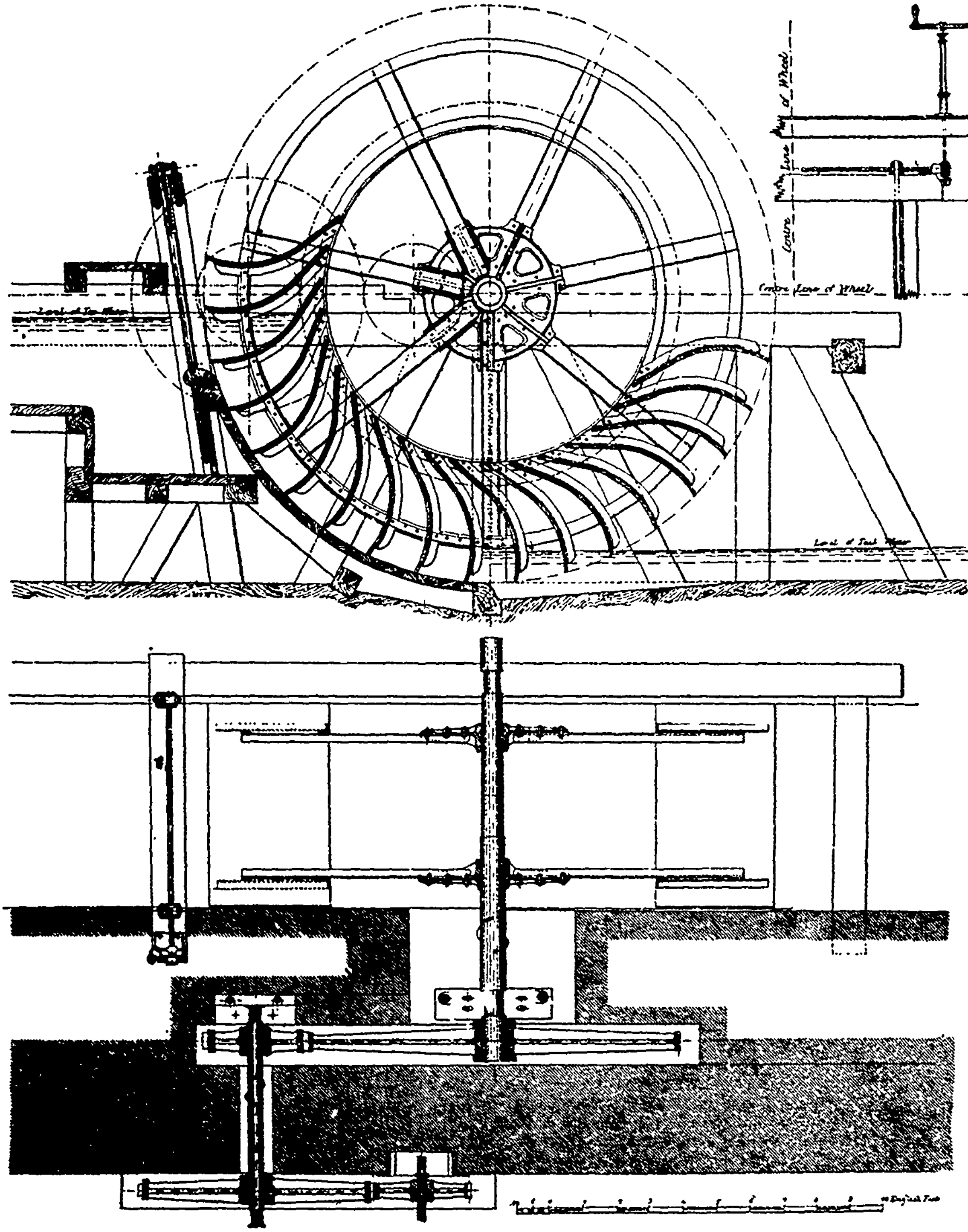
The *Daily British Colonist* says:—"The S.S. California arrived in Esquimalt at 12 30 o'clock last night, from the North. She reports things as very lively at Cassiar, and the miners making from $12 to $30 a day to the hand. There are between 700 and 800 men at the mines. Weather mild, river expected to be open about 1st May; Sylvester, of Barnard's Express arrived in three and a half days from Buck's Bar on the ice, with about $7,000 in dust for Martin & Co.'



STRAUB'S WATER WHEELS.

BOILER INCRUSTATIONS AND BOILER EXPLOSIONS.

We hear much discussion now-a-days upon fuel economy in almost every possible way, but it seems to us that boiler incrustation scarcely obtains the consideration due to its importance, in our opinion, as a source of fuel waste in boilers. It is well known, as a practical fact, that boilers are much better generators of steam when newly put down, than after the lapse of some little time. This is, without doubt, owing to the double deposition of soot in the flues, and a calcareous deposit on the heating surface of the boilers. The flues may usually be swept out without much trouble, but the perfect cleaning away of a hard cement-like skin upon the inside heating surface is one of the most difficult things to thoroughly effect. This scale is an almost perfect non-conductor of heat, and where the heating surfaces may be covered with a scale a quarter of an inch



STRAUB'S WATER WHEELS.

thick, as we have personally frequently seen, the non-evaporative power of the boiler becomes no longer a matter of surprise.

Most of the present numerous feed-water heaters seek to prevent this deposition by separating the insoluble precipitates in the preliminary heating before entering the boiler. This no doubt serves most effectually to diminish incrustation, but that it is thereby totally prevented we do not believe. Also, there are many cases where boilers are without these separators, either from the impossibility of their application, inconvenience, or perhaps prejudice. However this may be, there is, as a fact, as much as fifty per cent of the whole boiler power in use, without any separator, depositing rapidly thick calcareous deposits, and the other fifty per cent, though with the best-fitted appliances, still deposit this scale more or less.

In addition to the economic loss by reason of calcareous deposit, "scale" is, without doubt, one of the most fruitful causes of boiler explosions. The water cannot get free access to the heated plate, which thereby is considerably over heated and rapidly deteriorated. A weakening of the flue plates ensues, they gradually collapse, without giving any sign, till the final disastrous explosion. To meet this constant annoyance to all users of steam power, there are in the market a large number of "boiler compositions" of various characters, and the very variety is another proof of the large demand there is for a preventive to boiler incrustation.

To the general run of "boiler compositions" there are many practical objections The principal of these are, that often the composition, being of an acid character, seriously injures the boiler plate itself. Others cause the boiler to prime very badly. Again, many engine makers find that the steam generated in boilers using anti-incrustation compositions seriously injures the wearing faces of the engine; and thus, justly jealous of their reputation, specify that their engines shall not be supplied with steam from boilers using anti-incrustation compositions. We thus see that the present existing boiler compositions, though in much demand, are getting themselves a bad reputation in practical use.

We may here just notice an anti-incrustator, which seems to be very successful, and highly recommended in Europe, as being without the usual drawbacks to the ordinary boiler compositions. This substance is very well known and simple. It is glycerine. This is a body which is soluble in water in all proportions. It has a very high boiling point — 285 deg, and remains, therefore always in the water, not tending to cause "priming," or to pass off without doing its work in the boiler

Glycerine, under certain conditions (precisely those which are to be found in boilers) forms easily soluble salts with the salt of lime, and especially with the sulphate of lime. If the salt of lime be in excess, the precipitate takes a gelatinous form, which is eminently calculated not to adhere to the metal surfaces. Further, this gelatinous form of precipitation, preventing adherence, is also so far useful, that it prevents the carrying over, with the steam, of any hard solid precipitated matters. These pulverulent precipitates, which may be produced by other compositions preventing adherence, are in ordinary cases carried over by the steam into the engine, and there cause the serious damage, before referred to, on the working faces. This composition claims the following advantages:—1st. Increase of solubility of the sulphate of lime 2nd. Formation of a compound, soluble with sulphate of lime. 3rd. If any precipitate at all, a gelatinous one, preventing adherence. 4th. The arresting of all other solid particles from being carried over by the steam.

A series of experiments having been made, it has been found that a pound of glycerine is sufficient to prevent incrustation for every 3,000 to 7,000 lb. of coal consumed, which is a wonderfully small amount The glycerine should be inserted about once in three weeks or a month, and the boiler be cleaned through the mud-hole doors at the same intervals We think that the above advantages recommend the trial at least of such a simple body as glycerine, as an anti-incrustator, to all users of steam-power.

The method in use in the London Custom-house for the determination of alcohol in fusel oil, consists in shaking the liquid to be tested with an equal volume of water, and allowing it to stand twelve hours, at the expiration of which time it is found separated in two layers, the fusel oil being at the top. The specific gravity of the lower layer is taken, and from this the amount of proof spirit is calculated. This, Dr. Ulex says, leads to very false results, since crude fusel oil contains also æthylic, propylic, butylic, and amylic alcohol, which are variously soluble in water. He recommends the separation by fractional distillation and the use of saturated solutions of sodic chloride. He places 100 c. c. of the fusel oil to be tested in a retort, and distils off 4 c. c., and shakes this with an equal quantity of a saturated salt solution. If, on standing, one-half or more of the liquor is fusel oil, we may be sure it contains less than 15 per cent. of proof spirits, which renders it free of duty in England If less separates, shake some of the liquor with an equal quantity of brine, allow it to stand; after separating distil the spirit from the salt solution and determine

GRINDSTONES.

Premising that the grit is of the right kind for an axe or scythe, a good grindstone will be set to run smoothly and perfectly true, its face will be neither hollow nor round, and the water supply fresh and not more than the occasion The water trough being often made a part of the frame or bed, should be provided with an outlet for water, that the stone may not be left standing to soak therein, by which one side becomes softer and heavier, from which cause it runs with irregular speed, and wears unequally. Water is indispensable to protect the temper of the tools, and to keep the grain of the sandstone clean from the small particles of sand and steel detached by friction.

In applying the tool to be ground, the pressure must be varied in proportion to the width of the tool; and the effect will be very much varied by the direction and speed of the stone, being more when moving toward than from the tool. In the latter case, however, the edge is more liable to catch, and thereby to damage both itself and the face of the stone, while in the former, a wire-edge is thrown up as soon as the bearing or convexity of the tool is ground off, and only an experienced hand may safely practice it. Stop short of this point, and finish by changing the angle of contact of the tool with the stone. But in grinding chisels and plane-irons, when the edge is formed by one plane and one bevelled side, there is a kind of traverse motion to be kept up, with contact over the whole of both surfaces which preserves them nearly straight and plane. The finishing edge, as of finer tools, seen on new razors, knives, &c., is brought out by a finer stone, where the tool is held at a more obtuse angle.

The difficulty of applying a rest to a portable grindstone (as to a lathe) exists in the uncertain wear and unequal use of its surface, by which the true cylindrical form is soon lost. To avoid this, a lateral motion must be given to the tool, utilizing the whole face of the stone, which is especially necessary in applying the face of a common or a broad axe, as well as a plane-iron; and, as may be apparent to any one, in grinding carpenter's gauges, a cape-chisel, or, indeed, any metal-worker's tools.

With one who has had but little practice in setting tools, the common error is in not holding them flat enough to the stone (whether grindstone or oilstone), and thereby producing a convex side, and at the same time being liable to "check" the stone and turn the tool—perhaps worse, wound himself. For this, practice is the only remedy. With a little ingenuity a rest is always possible to be applied, but the efficiency is in most cases doubtful. Better trust to the wrist and right hand as a movable chuck, while the fingers of the left hand placed on the upper face of the tool will control its pressure and be the guide-rest. Don't forget to leave the stone out of water, as well as to dry the tool, if not even to oil it when laid aside.

The grinding or setting of a cutting-tool may be simple enough; yet there is but one way of doing it perfectly, that the cutting edge formed by a definite angle of two surfaces shall be exactly reproduced. There is a knack in perceiving when this edge has come, and in not overdoing, or producing the turned or wire edge, which practice only can acquire. From a knife this can be removed by drawing across the thumb-nail; from other tools by rubbing across a piece of soft wood. But a greater difficulty from repeated sharpening is to avoid in time the formation of two convex surfaces, which would be better if flat, or even concave slightly, as when the tool is new. Even a new axe is never convex all the way to the edge, but within a sixteenth of an inch of the edge takes from each face a special bevel, which is the edge.

Straight-edged tools, like chisels, when being set on the oil-stone, are best held in such a manner that the motion of the hands is nearly at right angles to the line of the cutting edges. Concave faces are produced by stones shaped for the purpose, but they do not come within common use. —*Country Gentleman.*

Pure glycerine should not produce when locally applied, a burning sensation, which it always does when the fatty acids are not all extracted. But even absolutely pure glycerine, when undiluted, is a water-extracting body. It should therefore, when used as a cosmetic, or for medical application, be always diluted with water.

MISCELLANEOUS

The Portland Company (locomotives and machinery), established in 1846, have been more favoured than some others in keeping their full force at work through the winter. They do a large variety of work, which enables them to keep busy when dull with others. The locomotives and cars built during last season were almost wholly for exportation.

The first patent issued in the United States of which there is any record was granted to Samuel Hopkins, on July 31st, 1790, for making pot and pearl ashes. The second was to James Stacey Sampson, on August 6th, 1790, for making candles; and the third and last for the year 1790 was to Oliver Evans, for making flour and meal. The latter bears date December 18th, 1790.

The new Atlantic cable will be laid in June, the starting point from this side being near Valentia. The other end will be beached on Newfoundland, carried across to Nova Scotia, and thence to New Hampshire. Messrs. Mitchell and Co., of Newcastle, have nearly completed the building of a steamer of 5000 tons burden, specially designed for the laying of the cable. The vessel will be launched on the 17th intant.

The following is given as a reddish brown paint for wood: The wood is first washed with a solution of 1 lb. cupric sulphate or blue vitriol in 1 gallon of water, and then with ½ lb. potassium ferrocyanide or prussiate of potash dissolved in 1 gallon of water. The resulting brown cupric ferrocyanide withstands the weather, and is not attacked by insects. It may be covered, if desired, with a coat of linseed oil varnish.

Locomotion in Constantinople is, under certain circumstances accompanied by a pleasing excitement beyond that caused by the actual journey. All persons using the tramway company's cabs receive from the driver a printed slip bearing a number, and every two months a lottery is drawn, the winning numbers gaining various prizes. At the last drawing the prize of £20 fell to the lot of the lucky owner of No. 51,547. This lottery is, says the *Levant Herald*, not only an amusement to the public, but it enables the company to exercise a control over the pecuniary honesty of their drivers, as the books from which these numbers are drawn have counterfoils with corresponding numbers, and persons who use the cabs have an interest in preserving the tickets given to them.

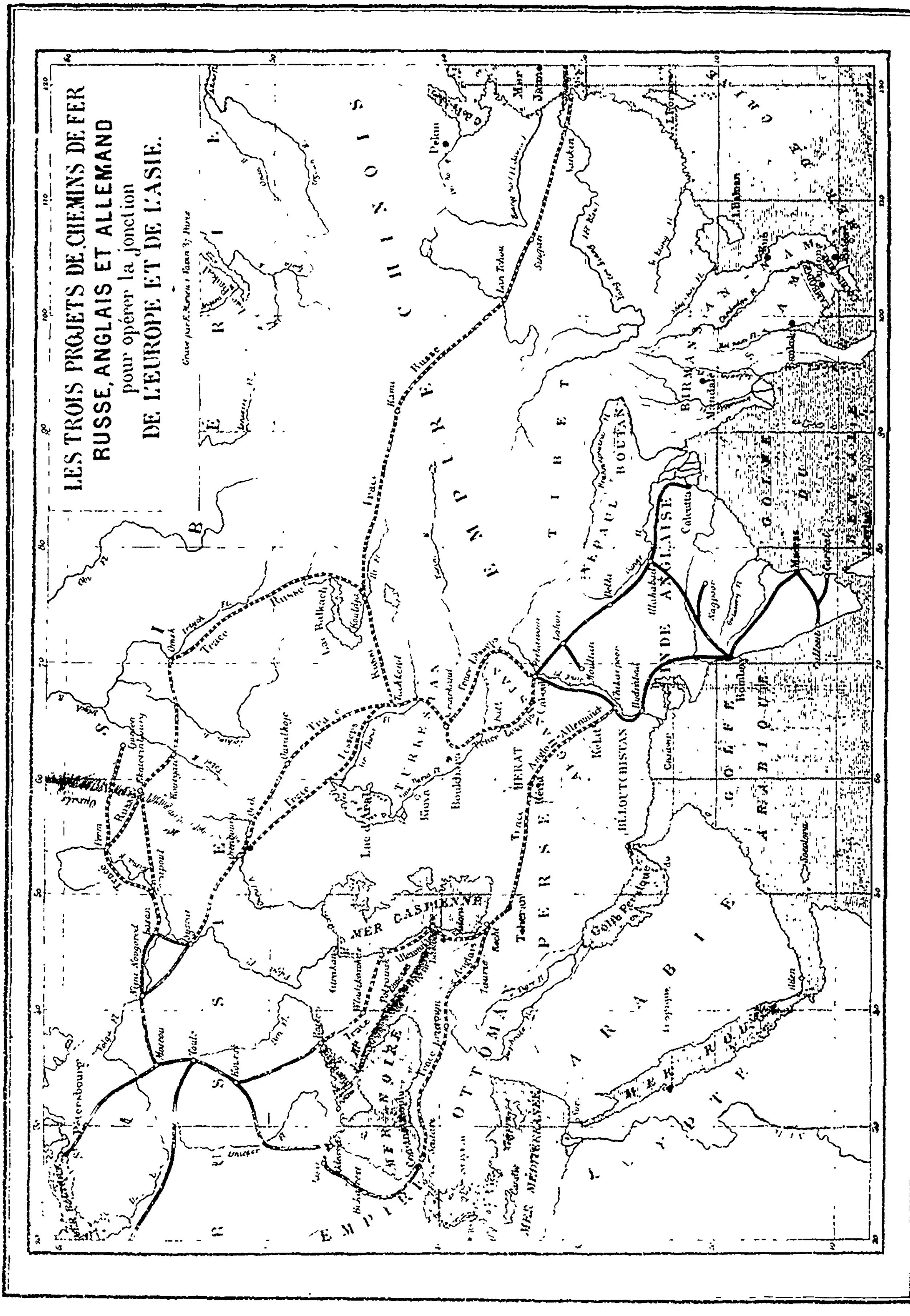
A Precious Vase.—The famous onyx vase, which Geneva feared had disappeared from the treasures of the late Duke of Brunswick, has at length been found. The executors were examining the contents of a case of jewellery when their attention was attracted by two vases of gilded metal, which seemed to be of little value. But, on examining these, it was found that one of them was much heavier than the other, and a joint in the stem had allowed some threads of flannel to pass. A longitudinal division was found to run down the whole length of this vase, which thus appeared to be merely a case for concealing something else. On the slit being widened, there appeared an onyx vase of marvellous beauty, in form like a tall urn, its slightly swelling body adorned with drinking scenes and women in long robes conducting animals in chains. Material and workmanship made this vase a wonderful masterpiece. It is known to antiquaries as the "Vase of Mantua," and is regarded by them as a Semitic production, nothing less than the holy vial employed in the consecration of the Hebrew kings.

The Charlottetown *New Era* says:—The Island Railway is being constructed rapidly and Main Trunk and branches to Tignish and Souris will be completed according to contract on the 9th of September next. We understand that the contractors are prepared, at a fortnight's notice, to hand over the railway between Charlottetown and Summerside, which passes through a fertile and beautiful country, and gives great promise of being more than self-sustaining. Many persons thought that too much land had been taken for railway stations, especially in country places. But it was observed during the excursion on the 29th ult., that many of the stations were not large enough for the business of the localities surrounding them. There is freight along the line at present for the summer's work, and by the time the fall's shipments are ready, there will be a "regular jam" on the railway, unless the Dominion Government at once take the road and open it for freight and passenger traffic.

Dr. Von Pettenkofer, in a careful study of the subject of the warmth of clothing, recently published, has pointed out that the permeability of stuffs to air is a condition of their warmth. The *London Medical Record* gives the following abstract. Of equal surfaces of the following materials he found that they were permeated by the following relative quantities of air, the most porous, flannel, such as is used ordinarily for clothing, being taken at 100:—Flannel, 100; linen of medium fineness, 58; silk, 40; buckskin, 58; tanned leather, 1; chamois leather, 51. Hence, if the warmth of cloth depend upon the degree in which it keeps out the air from our bodies then glove kid must be 100 times warmer than flannel, which every one knows is not the fact. The whole question, then, is resolved into that of ventilation. If several layers of the same material be placed together, and the air be allowed to permeate through them, the ventilation through the second layer is not much less than through the first, since the meshes of the two form a system of continuous tubes of uniform diameter, and the rapidity of the movement of the air through these is effected merely by the resulting friction. Through our clothing, then, there passes a stream of air, the amount of which, as in ventilation, depends upon the size of the meshes, upon the difference of temperature between the external and internal atmosphere, and upon the velocity of the surrounding air. Our clothing, then, is required, not to prevent the admission of the air, but to regulate the same so that our nervous system shall be sensible of no movement in the air. Further, our clothes, at the same time, regulate the temperature of the contained air, as it passes through them, so that the temperature of the air between the clothing and the surface of our body averages 84 deg. to 86 deg. Fah. The hygroscopic property of different materials used for clothing essentially modifies their functions. This property varies with the different materials; wool, for instance, takes up more water than linen, while the latter takes up and gives off its watery contents more rapidly than the former. The more the air is displaced by water from the clothes, the less will be their power of retaining the heat; in other words, they conduct the heat more readily, and hence we are quickly chiled by wet garments.

PROPOSED RAILWAY ROUTES BETWEEN EUROPE AND ASIA.

Our last page contains a map of the English, Russian, and German railway routes for connecting Europe and Asia, after the plan presented by M. de Lesseps, to Baron Schwartz-Zenbron, Director-General of the Vienna Exhibition. The Eastern terminus of the existing railway system of Russia is at Syzran, a town on the Volga, situated at a distance of about 280 miles from Orenburg. From this point M. Lesseps takes his projected line across the bare, unwatered steppes which lie between Orsk and Kasalinsk, and so, on to Cabul and Peshawur. This route, however, the Russian engineers state to be impracticable. It has further been strongly objected to by the four Powers most interested in the opening of railway communication between the two continents, viz., England Russia, Germany and Austria, each of which is desirous of adopting the route which will best serve its own interests. The English route takes Scutari as its starting-point, cuts across Asia Minor, by way of Erzeroum and Tauris, to Teheran, thence almost due east to Herat, and south-east to Chickarpoor, where it would join the line from Hyderabad to Peshawur. The length of this route would be about twelve hundred leagues. The proposed line is, however, objected to by the other Powers. The German route starts from Rostow, on the Sea of Azov, runs through the provinces of Caucasia and Circassia, and following the western coast of the Caspian Sea joins the English line at Teheran. This project meets with as little favour from Russia and Austria as the purely English line from Scutari. That proposed by the Russian Government takes a totally different course. Its starting-point is Nijni Novgorod, whence it branches out eastwards and south-eastwards, by way of Kasan, Sarapour, Perm, and Ekaterinenburg, to Kouldja, the capital of the district annexed by Russia three years ago. From Kouldja, which lies in the fertile valley of the Ili, the road would follow an almost straight line through Chinese Tartary to Shanghai. A second Russian line would form a loop from Syzran to Tashkend, and thence to Kouldja.


LES TROIS PROJETS DE CHEMINS DE FER
RUSSE, ANGLAIS ET ALLEMAND
pour opérer la jonction
DE L'EUROPE ET DE L'ASIE.
EMPIRE CHINOIS
TIBET
NEPAUL
BOUTAN
INDE ANGLAISE
BIRMAN
TURKESTAN
PERSE
BELOUTCHISTAN
ARABIE
EMPIRE OTTOMAN
MER CASPIENNE
MER NOIRE
MER MÉDITERRANÉE
MER ROUGE
GOLFE ARABIQUE
Golfe Persique
Calcutta
Bombay
Madras
Téhéran
Hérat
Omsk
Pékin
Moscou
Constantinople
Aden
Trace Russe
Trace Anglaise
Trace Allemande