important consideration; and, lastly, the lamps are completely enclosed in glass lanterns. So important are these facts that several insurance offices, we are told, have offered to insure factories lighted by electricity at lower rates than usual.

The electric light requires no long preparations; the necessary machines and lamps can be set up in a few hours; all that is required is to keep the grease boxes of the machines full, and to clean the latter daily. The electric light does not affect the temperature of the factory, and consequently does not dry the air, and the fact of its not altering colors has caused it to be adopted by dyers, among whom are M. Gunydet pére and fils, of Roubaix, and MM. Hannart fréres, of Wasquehal.

The expense of the electric light is given as follows: The cost of a machine with lamp, giving light equal to 500 carcel jets, is about £92, and these will represent from 50 to 70 gas jets, according to circumstances. The power required is equal to two horse steam power, and the cost of the carbon points, as already stated, is 18 centimes per hour for each lamp. When the power is that of water the cost is inconsiderable, and when that of coal has to be taken into account for the steam engine, it amounts to 20 centimes per hour, bringing the total up to 38 centimes per hour, and lubrication is set down at about 2 centimes more, while the wear of the machine is regarded as *nil*. Taking for basis that an electric lamp only replaces the minimum number of gas jets, namely 50, it is seven times cheaper than gas, motive power not included, and four times cheaper, taking the cost of driving as estimated above. These facts compose a strong case, and the success which has been obtained is easily ascertained. A perfect light as regards colors, which neither injures the eyes of the workpeople, nor renders factories unhealthy, while immensely reducing the risk of fire, and which saves 75 per cent on the cost of gas lighting, is a desideratum which requires no recommendation.—*Textile Manufacturer.*

How Cable Telegraph Lines are Worked—Electrical Induction.

In overland lines the current traverses the wire suddenly, like a bullet, and at its full strength, so that if the current be sufficiently strong the instruments will be worked at once and no time will be lost. But it is quite different in submarine cables. There the current is slow and varying. It travels along the copper wire in the form of a wave or undulation, and is received feebly at first, then gradually rising to its maximum of strength, and finally dying away again as slowly as it rose. In the French Atlantic cable no current can be detected by the most delicate galvanoscope at America for the first tenth of a second after it has been put on at Brest; and it takes about half a second for the received current to reach its maximum value. This is owing to the phenomenon of induction, very important in submarine cables, but almost entirely absent in land lines. In submarine cables, as is well known, the copper wire which conveys the current is insulated from the sea water by an envelope, usually of gutta percha. Now, the electricity sent into this wire induces electricity of an opposite kind to itself in the sea water outside, and the attraction set up between these two kinds "holds back" the current in the wire and retards its passage to the receiving station. It follows that with a receiving instrument set to indicate a particular strength of current, the rate of signaling would be very slow on long cables compared to land lines; and that a different form of instrument is required for cable work. This fact stood greatly in the way of early cable enterprise, Sir William (then Professor) Thomson first solved the difficulty by his invention of the "mirror galvanometer," and rendered at the same time the first Atlantic Cable Company a commercial success. The merit of this receiving instrument is, that it indicates with extreme sensibility all the variations of the current in the cable, so that, instead of having to wait until each signal wave sent into the cable has traveled to the receiving end before sending another, a series of waves may be sent after each other in rapid succession. These waves encroaching upon each other, will coalesce at their bases; but if the crests remain separate the delicate decipherer at the other end will take cognizance of them and make them known to the eye as the distinct signals of the message. The mirror galvanometer is at once beautifully simple and exquisitely scientific. It consists of a very long fine coil of silk-covered copper wire, and in the heart of the coil, within a little air chamber, a small round mirror, having four tiny magnets cemented to its back, is hung, by a single fibre of floss silk no thicker than a spider's line. The mirror is of film glass silvered, the magnets of hair spring, and both together sometimes weigh only one tenth of a grain. A beam of light is thrown from a lamp upon the mirror and reflected by it upon a white screen or scale a few feet distant, where it forms a bright spot of light. When there is no current on the instrument, the spot of light remains stationary at the zero position on the screen; but the instant a current traverses the long wire of the coil, the suspended magnets twist themselves horizontally out of their former position, the mirror is of course inclined with them, and the beam of light is deflected along the screen to one side or the other, according to the nature of the current. If a positive current, that is to say a current from the copper pole of the battery, gives a deflection to the right of zero, a negative current, or a current from the zinc pole of the battery, will give a deflection to the left of zero, and *vice versa*. The air in the little chamber surrounding the mirror is compressed at will, so as to act like a cushion and "deaden" the movements of the mirror. The needle is thus prevented from idly swinging about at each deflection, and the separate signals are rendered abrupt and "dead beat," as it is called. At a receiving station the current coming in from the cable has simply to be passed through the coil of the "speaker" before it is sent into the ground, and the wandering light spot on the screen faithfully represents all its variations to the clerk, who, looking on, interprets these and cries out the messsage word by word. The small weight of the mirror and magnets which form the moving part of this instrument and the range to which the minute motions of the mirror can be magnified on the screen by the reflected beam of light, which acts as a long impalpable hand or pointer, render the mirror galvanometer marvelously sensitive to the current, especially when compared with other forms of receiving instruments. Messages have been sent from England to America through one Atlantic cable and back again to England through another, and there received on the mirror galvanometer, the electric current used being that from a toy battery made out of a lady's silver thimble, a grain of zinc, and a drop of acidulated water.—*Good Words.*

PRACTICAL MECHANISM.

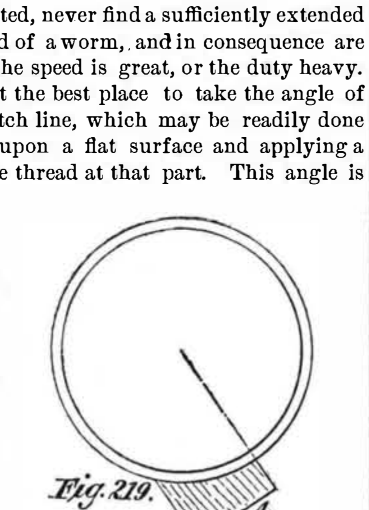
BY JOSHUA ROSE.

NEW SERIES—NO. XXXI.

PATTERN-MAKING.—WORM WHEELS.

A worm wheel is a spur wheel somewhat modified to suit the different conditions under which it has to work. The rim is made concave to suit the curvature of the worm; the teeth have also to be set at an angle corresponding to that of the thread. These modifications add much to the difficulty of constructing the pattern. The hollow curvature of the rim makes it necessary to have a pattern in halves, or at least the rim with the teeth must be so divided that the teeth must spring at a certain inclination. In consequence of these complications the spaces between the teeth of worm wheels are mostly cut from the solid metal by machinery.

The construction of the body of the wheel separate from the teeth is a comparatively easy matter, and has been made, we trust, sufficiently clear in the remarks upon the construction of pulleys and sheaves in halves, or with a divided rim. Having turned the body, let the two parts of which it is composed be held together temporarily by screws; pitch off the rim into the number of divisions required. We have now to consider the inclination it is proper to set the teeth at. It may be of some use at this point to reflect upon the conditions governing the working of a wheel in a worm. On account of the curvature of the wheel, its teeth, in traversing the worm, rise and fall and come into contact with all parts of the thread; but the angle of the thread changes according to its distance from the center, the obliquity being greater at the bottom of the thread than at the pitch line, where it is greater at the top of the thread. Therefore the teeth of the wheel, however well fitted, never find a sufficiently extended bearing upon the thread of a worm, and in consequence are rapidly worn away if the speed is great, or the duty heavy. It will now be seen that the best place to take the angle of the thread is at the pitch line, which may be readily done by placing the worm upon a flat surface and applying a bevel to the side of the thread at that part. This angle is drawn on the rim through the several divisions by fitting a piece of wood around it for a short distance, this piece to be cut of the required angle. The arrangement is fully shown in Fig. 219. Fit and glue the blocks to the rim at this angle, using the piece, A, as a guide, each tooth being formed of two pieces meeting at the center.



Place the wheel in the lathe and turn to the required shape, line off the teeth on both sides and across the top, and shape to a template. A cheaper kind of wheel is often used for light duty by making the rim straight instead of concave.

Ancient Mode of Embalming the Dead.

Herodotus and Diodorus tell of three modes of embalmment prevalent in Egypt. The first was very costly, answering to about $2,000, exclusive of such gems, jewels, and gold as love and prodigality might lavish upon the dead; the second, $300; the third within the reach of all. As to the extent to which gems and jewels were wound up in the cerecloth to deck the dead, there is the instance of the queen lately found at Thebes, whose ornaments were shown in our Exhibition of 1860. They are now in the Pasha's Museum. Their intrinsic value alone, that is, to break up and melt down, is several thousand pounds. It is curious in reading the two historians' accounts of the Egyptian embalmer to observe in divers matters the foreshadowing of the modern undertaker in his ways. The different degrees of woe were then as now sounded according to the depth of the purse. Just as it is now, when the furnisher will undertake for you any gradation of sorrow from the simple elm coffin and pauper funeral up to the flourish and parade of plumed hearse, weeping mutes and prancing steeds, so with the Egyptian. Only the manner was different. When a bereaved mourner, they tell us, went into one of these Egyptian shops, the functionaries would show him different models in wood highly and artistically finished, or otherwise, to represent the mummy and coffin. There were painted patterns of mummies in their multi-colored cases to choose from. The various costs, according to pattern, were then stated. The customer choose his model, and the bargain was struck. He then went home and sent back the dead body, and the body remained with the embalmer until the whole process was completed. The number of days requisite for embalming was, as we gather from both historians, seventy or seventy-two, and this tallies with the Scripture account (Gen. l. 3); for doubtless the immediate process only occupied part of the time, the rest being given to the ritual of mourning. The processes for embalming are related very categorically. In some things they hardly commend themselves to our present sentiment of what is respectful to the dead. The chief secret seemed to consist in certain chemicals injected into the veins and body; in certain washings and steepings in natron, and in the filling-up of the cavity of the body with myrrh and other balsamic substances and spices. The brains were drawn out through the nostrils. Sometimes the face and hands were gilt. Certain jewels were laid on the breast under innumerable swathings of linen. And then a kind of pictured shell received the body—a sort of close-fitting case made to open and shut lengthwise after the fashion of a violin case. But when the mummy was sent home—what then? The family did not immediately part with it. On the contrary, they often kept their dead relative for a long while, guest in his own house. A room was set apart. The mummy, standing upright as in life, was enshrined in a kind of painted cabinet—a tabernacle starred over with innumerable hieroglyphics, and protected with great painted scarabæi and multicolored cherubim, with their overshadowing wings spread athwart the chest. Hither, then, at intervals, the family would come to hold communion with the dead. They would bring fresh lotus flowers to enwreath their silent relative, or strew about the ground blossoms of asphodel and papyrus. Numberless paintings in the tombs of Egypt picture this affecting scene—a mother and her children kneeling in circle with the dead in their midst, or a wife with plaintive face and dishevelled hair embracing the placid-looking mummy of her husband. Listen to what Diodorus says: "A clever embalmer," he writes, "would send back the body perfectly preserved, even the hair of the eyelids and eyebrows remaining undisturbed; the whole appearance so unaltered that every feature might be recognized. The Egyptians, therefore, who sometimes keep their ancestors in magnificent apartments set apart, have an opportunity of contemplating the faces of those who died long before them, and the height and figure of their bodies being distinguishable, as well as the character of the countenance; they may enjoy a wonderful gratification, as if they lived in the society of those they see before them."—*Sunday at Home.*

Award of the Lavoisier Medal.

The Lavoisier medal of the Societé d'Encouragement pour l'Industrie Nationale has just been given to an Englishman, Mr. Walter Weldon, F.R.S.E. In presenting it M. Dumas congratulated Mr. Weldon upon having cheapened every sheet of paper and every yard of calico made in the world; and at the same meeting at which the presentation took place Professor Lamy stated that, whereas at the date of the introduction of Mr. Weldon's invention, seven or eight years ago, the total bleaching powder made in the world was only about 55,000 tons per annum—it is now over 150,000 tons per annum; and that of this vast quantity fully 90 per cent is made by the Weldon process. The Lavoisier Medal has been awarded only once before, namely, in 1870 to M. Henri Sainte-Claire Deville. The only other recipients of this Society's "Great Medal," which bears different effigies according to the class of service for which it is given, are Ferdinand de Lesseps, Boussingault, Jaques Siegfried, Henri Giffard, and Sir Charles Wheatstone.

Pivot Teeth in Dentistry.

Among the best of the inventions in the way of pivoting is a device of Dr. Bonwill's. The root being cut down, the pulp-canal is reamed out greatly in excess of the size of the pivot that is to occupy it. A pivot made of platinum wire, upon which a screw is cut, is next fitted into the canal, and firmly packed into place through the use of amalgam. When this amalgam is set, the tooth—the pivot hole running through it—is placed upon the pivot, and is screwed solidly into place by means of a delicate nut, made of gold. It will be understood, of course, that the fitting of the tooth in position has been done at the time of setting the pivot into the root. This operation, when well accomplished, holds a pivot tooth so firmly in place that it may be used with the utmost freedom in mastication.

THE authorities in charge of Fairmount Park, Philadelphia, have decided to use a portion of that domain for educational purposes, and have asked the co-operation of the Pennsylvania Horticultural Society. It is proposed to begin with the hardy perennial and Alpine plants, and form as complete a collection as is possible. Every character of soil and location is readily obtained, even for the aquatic plants.