

to what, in steam engine practice, is known as the "angularity of the connecting rod." The figure shows the crank and rod d.s. connected. The crank is exactly at right angles to the center line, having passed just half the distance from side to side, or one quarter of a revolution; the rod, too, is shown as having passed just half way along the slot, and while the rod, if running down, would touch the center of the circle, it will by no means reach the crank pin. This "angularity" makes a distortion in all parts of the figure.

The first thing that presents itself to the mind after a consideration of these points, is to devise some apparatus by which both ends of the connecting rod shall move at the same rate of speed, and where when one end is at half stroke the crank shall be at half stroke also. This may be done by an adaptation of what is called the slotted cross-head in combination with the connecting rod. The slotted cross-head is used upon steam engines to avoid the use of the connecting rod. It usually consists of a T-shaped piece, in the horizontal portion of which there is a slot in which the crank pin works. The upright portion travels in a slot to confine it to a straight line. By fastening a connecting rod upon the lower portion of the T and allowing the crank pin to pass through a slot in the end of the rod, we have a machine which at first sight, appears to draw perfect ovals. For convenience of working, it is best made by using a square frame working in guides, with a slot for the crank pin in one end. The solid lines in Fig. 6 show an apparatus of this kind. When this instrument is made with a rod four or more diameters long, the figures drawn by any point upon the rod are so nearly accurate that they may be used as true ovals in all ordinary work.

Both ends of the rod have the required motions; when the crank pin is at right angles, the frame, and of course the back end of the rod, has moved through just half of its travel. Stopping here in our reasoning, we should at once be led to conclude that a true oval or ellipse was formed. Such, however, is not the case. The figure is an "egg oval," with the large end reversed and the point toward the crank. The reason for this is found in the fact that from the point A to B the rod introduces a small and independent angularity of its own, which, as the back end is moving with the crank, produces a reverse effect upon the figure which it draws. Even with this fault the instrument is a somewhat useful one, as it is much more easily made than a pair of trammels, and will do reasonably accurate work, as we have said.

The instrument, by the addition of another cross-head for the pencil to work in, can be made to draw perfect ellipses. It then becomes much more complex and difficult to make, as well as to manage, and it can hardly be said to be a practical machine. The dotted lines in Fig. 6 show how the extra cross-head may be applied. It is fastened across the frame at the middle point of any ellipse that may be desired, and the point of the pencil is compelled to travel in the slot. This cross-head may be made to fasten in any desired position upon the frame. With this arrangement the point which describes the ellipse has exactly the same longitudinal motion as the crank and the angularity due to its distance from A. If the guides G G G are connected over the top of the machine and the crank attached to a cross-piece below it, it would not be an unhandy instrument, in either of the forms we have described, for drawing large ovals on working drawings, etc. It must be remembered, however, that in its first form it only produces a very close approximation to the ellipse.

THE PARIS INTERNATIONAL ELECTRIC EXHIBITION.

The plan of the forthcoming electrical exhibition at Paris is being rapidly matured by M. Berger and M. Cochery. There will be several electric railways, including a line starting from the Place de la Concorde, and traversing the Champs-Élysées on a viaduct, then entering the Palais de l'Industrie and terminating at the grand staircase in the western extremity of the nave. During part of its course it will also run through an artificial tunnel lighted by electric lamps. Messrs. Siemens Brothers will probably construct it, and the cost is expected to lie between 200,000 and 280,000 francs. The basement of the palace will be reserved for large machinery such as dynamo-electric machines and prime movers while the galleries of the first floor will be devoted to the innumerable applications of electricity which have been made in recent years to polite and common life. Apartments will be fitted up with call-bells, telephones, fire-alarms, etc., and illuminated by electric lamps, in such a manner as to display to best advantage the merits of these contrivances. For the electric light, provision has been made to supply 800 horse-

power of energy, and it is estimated that this will enable no less than 600 lamps to be lighted simultaneously.

We observe that a proposal has been mooted in America to hold an international electrical exhibition there in 1882. Steam-power will be furnished at a fixed rate.

Applications for space by those intending to send objects to the Paris Exhibition will be received until March 31st. There will be no charge for space.—*London Engineering.*

THE ELECTRIC LIGHTING OF MINES.

At one of the sessions of the American Institute of Mining Engineers, in Philadelphia, the Edison system of electric lighting, as applied to mining, was described by Mr. A. O. Moses. The method adopted is very simple. Wires run direct from the dynamo-electric machine to the different workings, supplying light to the shaft on their way. Each lamp may, if desired, be immersed in water, or may be protected from fracture by a coarse wire screen; the connections can all be made under water, and thus lamps may be put in or out of circuit without the slightest danger from the electric spark.

Far too much importance, the speaker thought, has been attached to the consequences that may arise from leading wires into mines for conveying electricity, notably by such a high authority as Mr. Preece, the English telegraph engineer, but his deductions are not sustained by facts.

One of the most important advantages of the electric light in coal mines is in obviating the necessity of hermetically sealing up old or temporarily abandoned workings. Another is their prompt availability at times when light is of the most vital importance, when many lives may be in jeopardy after explosions, and dangers are multiplied on every hand, when everything depends upon immediate and vigorous action; then the weakness of all lamps that require to be fed with air asserts itself.

PHOTOGRAPHS IN NATURAL COLORS.

The announcement is again made that a process has been discovered for taking photographs possessing all the brilliancy and delicacy of the natural colors, and an exhibition of pictures thus naturally colored has just been held in London. According to the reports, the colors are produced by the action of light alone in the camera, and owe nothing whatever to the artist's brush. In the photographs exhibited, the coloring appeared to be quite true to nature, and delicate tones and shades were clear to the view. The flesh tint was exact to life, and full justice was done to gorgeous regimentals. The protruded tongue of a dog in one of the photographs possessed the exact color of nature. Some of the guests, says the *English Mechanic*, inspecting this collection, and not fully acquainted with the character of the latest invention, took it for granted that the work was done by skillful, artistic hands on ivory and other material, and could scarcely believe their eyes when informed that the color, as much as the form and outline, was produced by the light of day. Careful investigation, however, would then show that human handicraft was not in it; for there were touches and effects which nature's pencil of light could alone accomplish. The contention is that photographs colored by artists, however clever, must be more or less "monotonous, hard, untrue to nature, and to the originals."

The process was discovered, it is said, by a French scientist, but has since undergone improvement by the proprietor of the process in England. If the new system proves an unqualified success, the reward will not have been reaped without much labor in the past, for numerous attempts have been made to induce the sun-pencil to fix colors in the picture it draws in the camera; but chemical and mechanical difficulties have stood in the way. In the new process colors are said not only to be faithfully produced, but protected from the action of light by being passed through a boiling solution, of which gelatine forms the principal ingredient, and that some of the photographs so treated have been exposed for months to the sun without being in anywise affected by the ordeal. Unfortunately, the process is yet unknown, as it is likely to be for some time to come.—*Manufacturer and Builder.*

FREEING BENZINE FROM OFFENSIVE ODOR.—According to Mr. Fairthorne, benzine may be freed from all offensive odor by shaking it up well with quicklime—about 3 ounces to the gallon.