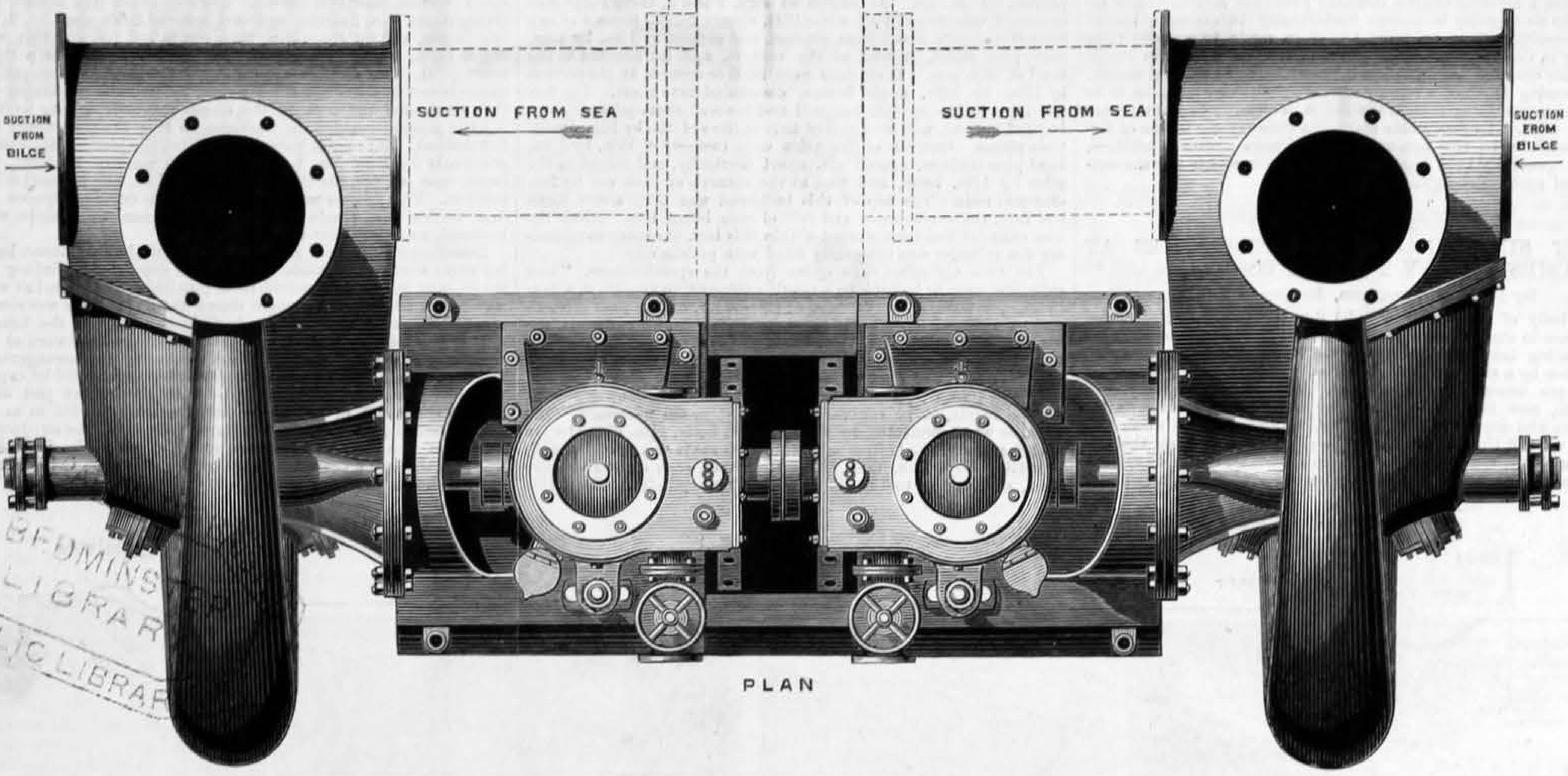
CENTRIFUGAL PUMPING ENGINES, S.S. SERVIA.

MESSRS. J. AND H. GWYNNE, HAMMERSMITH, ENGINEERS.

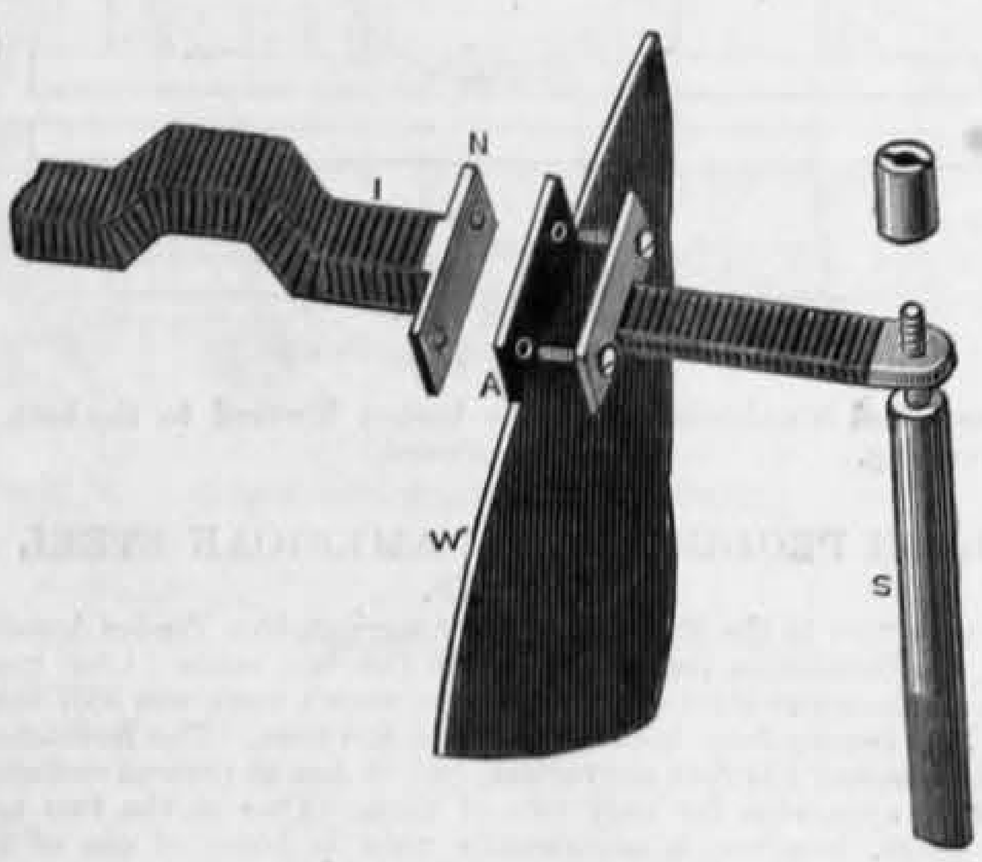


PLAN

IN our last impression we gave a front elevation and side view of centrifugal pumping machinery, made by Messrs. J. and H. Gwynne for the s.s. Servia. We now complete our illustrations of these engines by the plan of them above.

THE EDISON LIGHT.

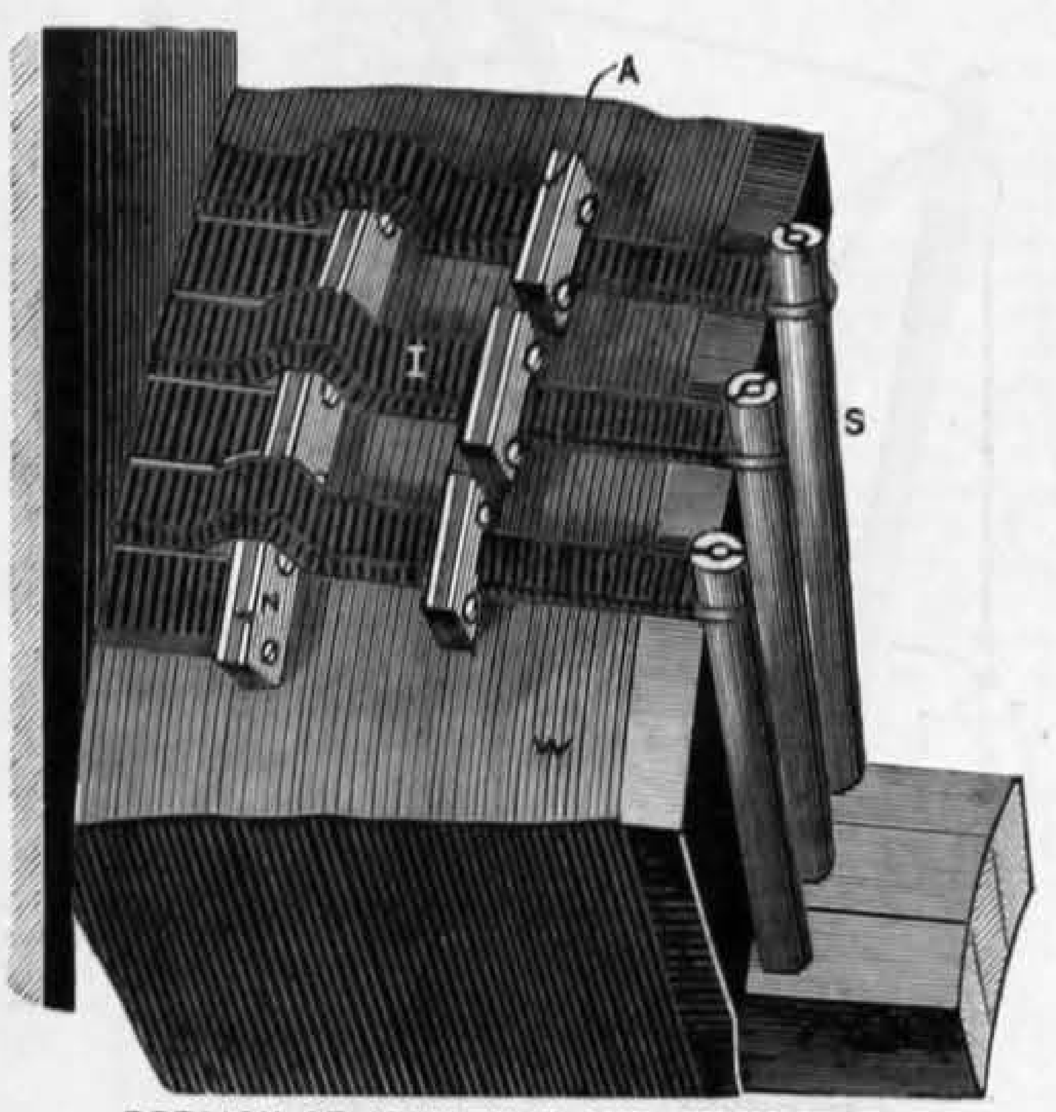
ACCORDING to our promise of last week, we give on another page a perspective view of the Edison machine as it stands at 57, Holborn. This machine differs somewhat from those shown in the plans given at pp. 5 and 28, inasmuch as it is larger. The dynamo machines shown in the illustrations referred to have six field magnets, whilst the machine at Holborn has twelve. The smaller machines are more symmetrical, but less effective, and in future the number of field magnets will be still further increased, probably to sixteen, in order that the upper and lower parts of the machine may be made to match. The total weight of the machine at Holborn is 22 tons; this includes the weight of the magnets, which as we have said are twelve in number, the armature, the Porter-Allen high speed engine, the blower and accessories, the whole of which rest upon a substantial casting of iron in one piece. We might mention that the lack of symmetry, and the smallness ot some of the parts, was the result of the machine being partly completed on the old lines before it was decided to add the additional field magnets.



DETAILS OF ARMATURE.

The dynamo machine proper consists of the cast iron field magnets, the resistance of which varies from 1·95 to 2·13 ohms each. These magnets are connected in series of six, the series respectively having a resistance of 12·23 and 12·22 ohms. The two series are connected in multiple arc, the aggregate resistance of the field magnets being thus reduced to 6·11 ohms. The magnets are wound with No. 10 wire—Brown and Sharpe's gauge. The poles are massive pieces of cast iron. These enormous magnets have excited considerable attention from time to time, and a good deal of adverse criticism has been made upon them, but Mr. Edison strongly maintains the wisdom of a large investment in iron which is cheap, and which allows him a large dividend in the utilisation of energy. The armature consists in the first place of a steel shaft 6in. in diameter, over which is fitted a wooden cylinder 12·5in. external diameter. On the central portion of this compound cylinder a large number of thin discs of sheet iron are slipped, the discs being separated from each other by sheets of tissue paper of similar diameter. There, are, however, eight intermittent iron discs of $\frac{1}{4}$in. thickness to give the necessary strength, and the whole is bolted together by eight bolts, each 1in. diameter and 44$\frac{9}{16}$in. in length. These iron discs form the core of the armature. Copper discs of a somewhat larger diameter than the iron discs are placed at each end of the built-up core. There are fifty-three of these discs each 26$\frac{5}{8}$in. diameter ·102 B and S gauge, with alternate discs of prepared paper for insulation ·015in. thick. These copper discs have each two lugs on their circumference, to which the armature rods are connected. In the details shown in our drawings W indicates the copper disc, A the lug, I the armature rod, S the connection to the commutator. We show the arrangement both when the connections are made and when disconnected.

The copper rods I, used by Mr. Edison to take the place of the usual windings of wire, are 106 in number, ·634in. on the face, narrowing slightly to the inside face, the edges being rounded; they are $\frac{1}{2}$in. thick and average in length 52in. These rods are wrapped by machinery with prepared paper, the layers of paper being each coated with a special insulating material. The rods are separated from each other at every foot of their length by peices of vulcanite fibre encased in mica, and also by an air space of ·38in. Every alternate rod is connected through a radial copper rod with the commutator. The blocks of the commutator are fifty-three in number, and taper in a similar manner to the armature bars, are bevelled at the ends and separated by strips of mica. The diameter of the commutator K is 12$\frac{3}{4}$in. At the back of the radial bars, and acting as a facing to the copper discs, is a mahogany disc $\frac{1}{2}$in. thick. The complete armature is wound with steel wire, with double mica insulation underneath; this wire is intended to counteract any centrifugal action. The bar upon which the brush holders are fastened is shown at H, the brushes are connected with the main conductors C through levers as shown, and can be changed as regards position in the commutator



PORTION OF ARMATURE AND COMMUTATOR.

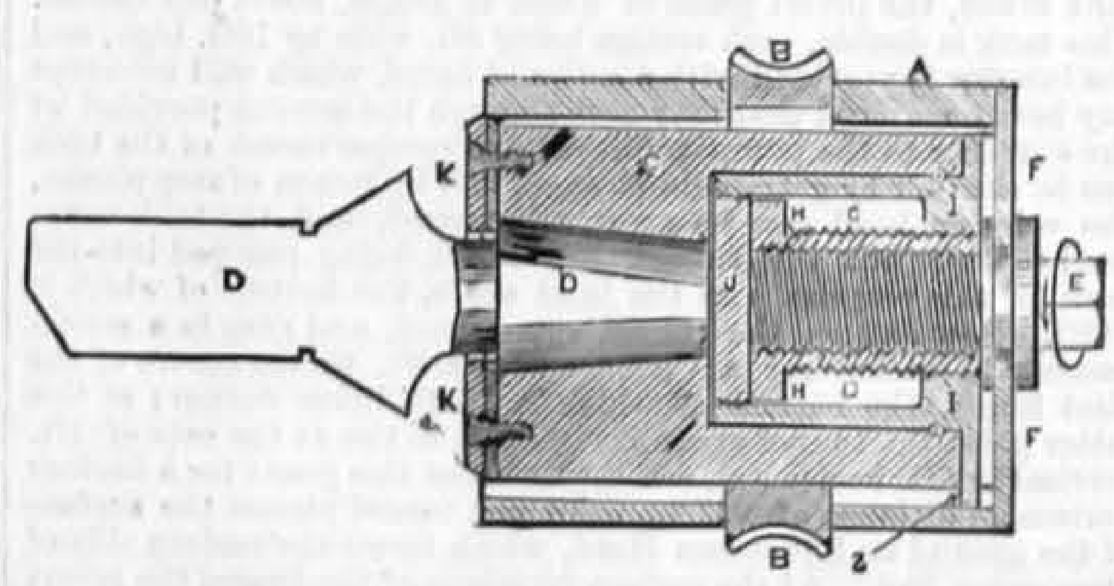
as required. The drawing shows clearly how this is done. So careful has the inventor been to consider everything connected with the machine, that to prevent oxidation the threads of the radial bars, the lugs on the armature, bars, discs, screws, and other contacts are lightly plated with gold. This perfection of contacts, together with the large sectional area of the armature rods, ensures low resistance. In the machine at Holborn the resistance is as low as ·0049 ohm, whilst we are told that in another machine, now *en route* for London, the resistance is but ·0032 of an ohm. This second machine is to be erected at 57, Holborn, in order, as Mr. Johnson says, that if an accident happens to one machine the other may take over the work. Either machine will be capable of supplying the current at present required, and the intention seems to be to take ordinarily half the required current from each machine, the whole current being taken from one machine in case of necessity only.

The engine is of 40-horse power nominal, working up to about 125-horse power indicated. The cylinders are 11in. diameter, with 16in. stroke, the cut-off taking place at about half stroke. The engine is connected direct to the shaft of the armature, which revolves at the rate of 350 revolutions per minute. This machine is intended to supply the current for 1000 Edison lamps of 16-candle power each, and is the largest machine hitherto erected. The new machine has been tried with 1360 lamps, running for fifteen hours per day for several consecutive days. Taking the figures as above given, the Holborn machine with an expenditure of 125-horse power, gives 16,000 candles, or 128 candles per horse-power. In the engraving, A A show the channels by which air is driven to circulate around and keep cool the commutator.

Besides the illustrations relating to the dynamo machine given this week, we also give sectional diagrams showing the various sizes of conductors which Mr. Edison uses in his installations. The conductors used of course vary with the current to be carried. We would particularly call attention again to the street and house connections illustrated last week. It is easy to calculate the diameter, &c., of the wire of a given metal that will carry a given current without fusing. As a safety appliance Mr. Edison uses a piece of fusible conductor of such a size that it will conveniently carry the current ordinarily required, but should at any time a greater current attempt to pass per unit of time, the conductor fuses and is broken, offering an infinite resistance to the passage of the current, and obviating danger of fire by over-heating the wires. On Wednesday last the dynamo machine and lamps at Holborn were shown in action to a number of gentlemen, as was also a fusible conductor. A hundred lamps had been arranged in circuit with a fusible conductor calculated to carry current sufficient for fifty lamps only. The experiment was successful—the metal was fused—and the lamps, and we may suppose the woodwork, saved from the effects of a too large current. We may also state here that on Tuesday evening the concert-room at the Crystal Palace was lighted up by the Edison light, in the presence of the honorary council and other gentlemen specially invited.

A SMALL DRILLING APPARATUS.

THE following description of a small machine for drilling the holes in the cheeks of the locomotive frames in the Altoona Works of the Pennsylvania Railway Company, we take from the American *Mechanical Engineer*:—The size—about 1$\frac{5}{8}$in.—and the position of these holes make them very awkward to get at The machine designed by Mr. S. M. Vanclair will, however, drill a hole in five minutes. Its feed mechanism is constructed to give a length of feed equal to twice the length of the feed screw. Its construction is shown in Fig. 1, in which A A represents a cylindrical bearing, which has means whereby it may be fixed between and to the pedestal jaws, and affording a bearing to the sleeve C which is driven by the worm wheel B, having the feather *d*, which fits in a spline in C. The drilling and countersinking tool D has an ordinary taper stem



fitting into C. F is a feed screw threaded into a sleeve G, which is also threaded into the sleeve I at one end; F F is a collar made in two halves, screwed to A, and affording journal bearings to E.

The piece I has a feather at *i* which projects into a spline in A, so that I cannot rotate. Suppose that B is rotated by the worm—not shown—then C and D will be rotated, while E F G I and J will remain stationary. But if E be operated by a wrench then G will rotate with it—by reason of the friction between the two—and I, acting as a nut, will move endways within A and feed C, and therefore D to the cut. This action will continue until I has moved sufficient to cause the inside radial face of I to meet radial face H H of G, whereupon it will hold G stationary by reason of the friction of these radial surfaces; and E, on being operated, will cause G to act as a nut, and the feeding of C within D will continue. Thus the length of the feed is that due to the length of E within G, added to the distance between the radial face H and the inside radial face of I. K K is a collar put on in two halves, and holding a disc of leather to C to exclude dirt and chips from the bore of A.