Kjellin Steel Furnace.—In this the canal containing the molten steel forms a closed ring, and an electric current is induced in this ring without the use of any terminals, the ring forming the secondary of a transformer.

Electrolytic Furnaces.

In these furnaces the power of a continuous current to divide a fused chemical compound into two component parts is utilized, while the heating effect of the current is also needed to keep the contents of the furnace in a state of fusion. Most chemical compounds can be decomposed in this way, but some behave like the metals and alloys,

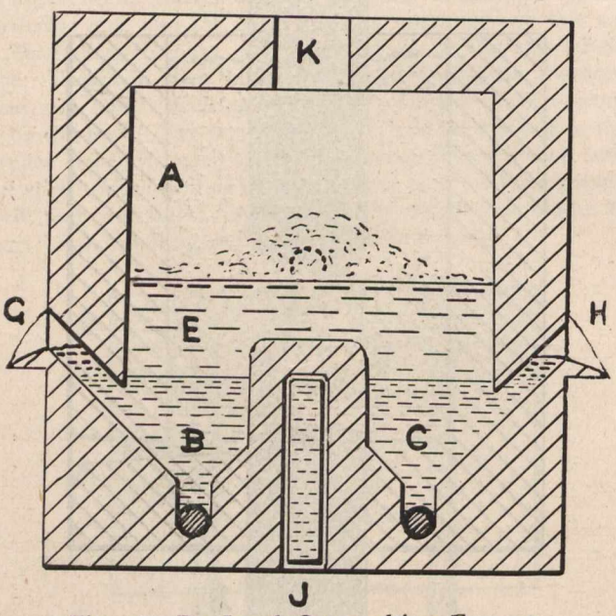


Fig. 18.—De Laval Ore-smelting Furnace.

and carry the current without suffering decomposition. Mixtures of two or more compounds are often employed, as this facilitates the passage of the current and renders the charge more fusible.

Example:—Furnace for Electrolysis of Fused Zinc Chloride (Fig. 19).

This consists of a chamber, A, containing the fused chloride, B. The positive electrode, C, is made of carbon, and dips into the electrolyte, while the fused zinc, D, resulting from the operation, forms the negative electrode, electrical connection being made with it at E. The passage of the current splits the zinc chloride into zinc, which collects at D, and chlorine, which is liberated at the electrode,

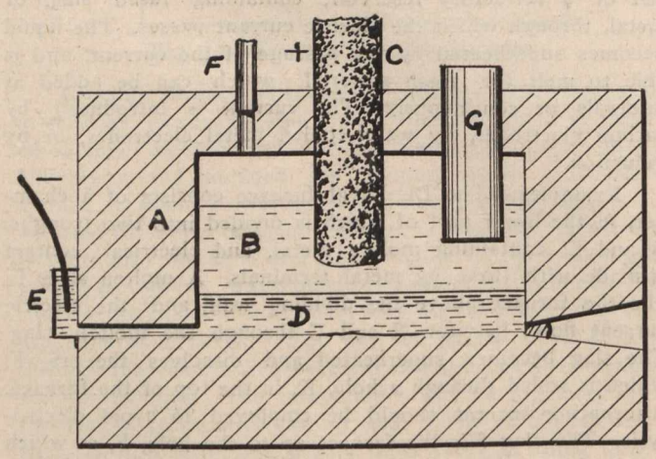


Fig. 19.—Electrolytic Furnace.

B, and is withdrawn from the furnace by the pipe, F. A cylinder, G, passes through the roof of the furnace and dips into the fused electrolyte, to enable fresh chlorine to be added without allowing the chlorine to escape.

Furnaces for the production of aluminium (Figs. 4 and 5) are also examples of electrolytic furnaces.

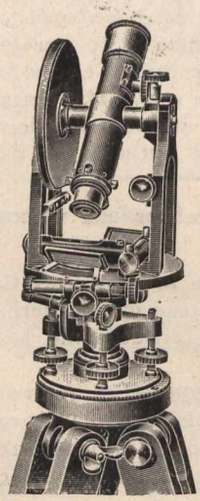
Recapitulation.

In this article only the main principles of the electric furnace have been set forth, leaving the discussion of theory and details of construction for subsequent consideration. The respective types of electric furnaces have, as far as possible, been systematically classified; for many furnaces cannot be placed in any one class, since they combine the features of two or more.

(*Continued.*)

A PROTECTED TRANSIT INSTRUMENT.

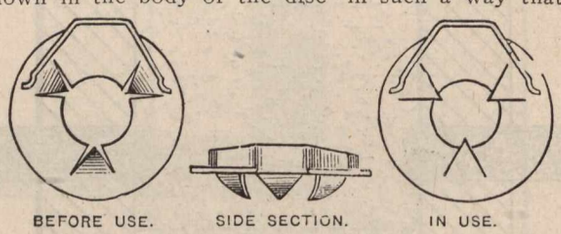
Every engineer who has had to use surveying instruments in mines or in difficult country knows how much trouble, dirt, and dust, and wet can cause. Messrs. J. Davis and Co., Limited, of Derby (represented in Canada by Messrs. Peacock Brothers, Montreal), have brought out a transit instrument specially designed for surveying in gold mines. The principal feature in this is that all the circles, verniers, draw tubes, and screws are protected by metal covers, the verniers being read under glass. The telescope is 7½ in. long, and has a 1 in. aperture, the eye-piece being "18 diameters and inverting." Both the object glass and eye-piece are protected with mud, rain, and dust guards. There is a 4 in. graduated level under the telescope. The horizontal circle is 4 in. in diameter, and is provided with a double row of figures from 0 deg. to 360 deg. The vertical circle is also 4 in. in diameter. The instrument is made either in gun-metal or aluminium, weighing in the former metal 18 lb. 7 oz., and in the latter 15 lbs. 4 oz., the weight of the legs in each case being included. The instrument is wonderfully compact, the intention is excellent, and the reputation of the makers is sufficient guarante that it has been successfully put into practice. The accompanying engraving gives a good idea of what the instrument is like.



The Davis Protected Transit.

THE "FASTNUT" WASHER.

The number of devices that have been designed to lock a nut upon a bolt is legion, and great is the variety in construction of such devices, which have a common object. A device of great simplicity in construction and general applicability as to use has been put on the market by a company trading under the name of Fastnut, Limited, of 60, Aldermanbury, London, E. C. One form of the device is illustrated in the adjoining diagrams, which show the shape of the device before use both in plan and side section and a plan of the device in use. It consists of a circular dics of metal having three inwardly projecting pointed discs punched down in the body of the disc in such a way that the



points of the tongues, owing to their bent form, are without the circle which coincides with the round hole through the centre of the washer. When, however, the tongues are flattened out by the pressure of the nut they extend inward beyond the central circular hole so as to become jammed against the thread of the bolt in such a manner as to firmly grip the bolt. Upon the periphery of the washer is mounted a pair of spring arms, the ends of which are bent slightly to form engaging corners, which will engage on to the angles of the nut and maintain it in position on the bolt. This device has been used for a number of purposes, and judging from the copies of the testimonials we have seen, has been most successful. Amongst the users may be mentioned the Underground Electric Railway of London, where an extend-