^{ago}, and for a light of 16 candles more current is required than is used in some other lamps for the production of 20 candle power. power. On the other hand, it is very evident that the com-paratively low state of incandescence of the Edison filaments is conducive to long life. Which system then is the more econ-omical is the other state of the event of the econ-Omical in the long run, that in which the electrical energy is reduced to the long run, that in which the electrical energy is reduced to 21 watts per candle power with a probable duration of 400 cf to 21 watts per candle power with a probable duration of 400 to 500 hours, or even less, as the life of the lamp, or that J to 500 hours, or even less, as the life of the lamp, or that demanding 3½ to 4 watts per candle power with a certainty of the lamp lasting over 1,000 hours?

The cost of incandescence lamps is not so small as to be overlooked as an item in the working expenses of an electric lioke: lighting installation; indeed, at the present prices any excessive number of failures forms a most serious consideration.

This matter has been brought forward with a view of obtaining, if possible, some degree of information for our readers as to whether the structure of the filament has been sufficiently investigated by the manufacturers of incandescence lamps from the long life point of view.

Unless the filaments can be made to last, when taking $2\frac{1}{2}$ waits per candle power, as many hours as they did before the reduct reduction of current strength formerly necessary to produce a certain of current strength formerly necessary to produce a strength in the stre certain luminosity, the value of the latest improvements must be somewhat discounted.

Some statistician with time at his command might compile most interesting set of figures on the points enumerated above; certainly results of practical value to the consumer, at least, might be tabulated.-Electric Review.

DESCRIPTION OF THE FRANCKE "TINA" OR VAT PRO-CESS FOR THE AMALGAMATION OF SILVER ORES.

BY MR. EDGAR P. RATHBONE, OF LONDON.

In the year 1882, while on a visit to some of the great silver mines in Bolivia, an opportunity was afforded the writer of inspecting a new and successful process for the Treatment of Silver Ores, the invention of Herr Francke, a German gentleman long resident in Bolivia, whose acquaintance the writer had also the second had also the pleasure of making. After many years of tedious Working devoted to experiments bearing on the metallurgical treatment of the devoted to the second sec treatment of rich but refractory silver ores, the inventor has successfully introduced the process of which it is proposed in this paper. this paper to give a description, and which has, by its satis-factory many large to give a description, and which has, by its satishas paper to give a description, and which has, by hes call factory working, entirely eclipsed all other plans hitherto tried in Bolivia, Peru, and Chili. The Francke "tina" process is based on the system debased on the same metallurgical principles as the system de-scribed by the same metallurgical principles on those introduced scribed by Alonzo Barba in 1640, and also on those introduced into the same metallurgical principles as the same of the into the States in more recent times under the name of the Washon North Management of the States in more recent times under the name of the Washoe process.

It was only after a long and careful study of these two pro-sees and over iments on cesses and by making close observations and experiments on other plane this is that time been tried with more or other plans which had up to that time been tried with more or less success in Think up to that time been tried with more or less success in Bolivia, Peru and Chili—such as the Mexican emalgamation process technically known as the "patio" process, the improved Freiberg barrel amalgamation process, as used at Copiapo, and the "Kronke" process—that Herr by its means traction process, and the rich but refractory by its means treating economically the rich but refractory silver orea silver ores, such as those found at the celebrated Huanchaca of the process in Potosi, Bolivia. In this description of the process the writer will endeavour to enter as far as possible into the writer will endeavour to the final repossible into details having a practical bearing on the final re-sults; and separation of the this view will commence with the actual separation of the ores at the mines.

Ore Dressing, etc.

This consists simply in the separation of the ore by hand at ninesting by women and boys with the mines into different qualities, by women and boys with small hamman the trainer that known as "cobbing" small harmers, into different qualities, by women and object of this separation is twofold : firstly to separate the object of this separation is twofold : firstly to separate the rich parts from the poor as they come together in the same line of parts from the poor as they come together in the same lump of ore, otherwise rich pieces might go un-detected. detected; and secondly to reduce the whole body of ore coming from the mine secondly to reduce the whole body of ore coming from the mine to such convenient size as permits of its being fed directly into the stamps battery. The reason for this

 $(\mathcal{E}_{n_{\mathcal{G}}})^{\text{paper read before the Institution of Mechanical Engineers.-}$

separation not being effected by those mechanical appliances so common in most ore-dressing establishments, such as stone breakers or crushing rolls, is simply because the ores are so rich in silver, and frequently of such a brittle nature, that any undue pulverisation would certainly result in a great loss of silver, as a large amount would be carried away in the form of fine dust. So much attention is indeed required in this department that it is found requisite to institute strict superintendence in the sorting or cobbing sheds, in order to prevent as far practicable any improper diminution of the ores. According to the above method the ores coming from the mine are classified into the four following divisions :-

I. Very rich ore, averaging about 6 per cent. of silver, or containing say 2,000 ounces of silver to the ton (of 2,000 lbs).

II. Rich ore, averaging about 1 per cent. of silver, or say from 390 to 400 ounces of silver to the ton.

III. Ordinary ore, averaging about 1 per cent. of silver, or say from 150 to 200 ounces of silver to the ton.

IV. Gangue or waste rock, thrown on the dump heaps.

The first of these qualities-the very rich ore-is so valuable as to render advantageous its direct export in the raw state to the coast for shipment to Europe. The cost of fuel in Bolivia forms so considerable a charge in smelting operations that the cost of freight to Europe on very rich silver ores works out at a relatively insignificant figure when compared with the cost of smelting operations in that country. This rich ore is consequently selected very carefully and packed up in tough raw hide bags, so as to make small compact parcels some 18 inches to 2 feet long, and 8 to 12 inches thick, each containing about Two of such bags form a mule load, slung across the 1 cwt animal's back.

The second and third qualities of ore are taken direct to the smelting works ; and where these are situated at some distance from the mines, as at Huanchaca and Guadalupe, the transport is effected by means of strong but lightly built iron carts, specially constructed to meet the heavy and tear consequent upon the rou h mountain roads. These two classes of ores are either treated separately, or mixed together in such proportion as is found by experience to be most suitable for the smelting process.

On its arrival at the reduction works the ore is taken direct to the stamp mill. At the Huanchaca works there are sixtyfive heads of stamps, each head weighing about 500 lbs., with five heads in each battery, and crushing about 50 cwts. per head per 24 hours. The ore is stamped dry, without water, requiring no coffers; this is a decided advantage as regards first cost, owing to the great weight of the coffers, from 2 to 3 tons -a very heavy item when the cost of transport from Europe at about £50 per ton is considered. As fast as the ore is stamped, it is shovelled out by hand, and thrown upon inclined sieves of 40 holes per lineal inch ; the stuff which will not pass through the mesh is returned to the stamps.

Dry stamping may be said to be almost a necessity in dealing with these rich silver ores, as with the employment of water there is a geat loss of silver, owing to the finer particles being carried away in suspension, and thus getting mixed with the slimes, from which it is exceedingly difficult to recover them, especially in those remote regions where the cost of maintaming large ore-dressing establishments is very heavy. Dry stamping however prevents many serious drawbacks, some of which could probably be eliminated if they received proper attention. For instance, the very fine dust, which rises in a dense cloud during the operation of stamping, not only settles down on all parts of the machinery, interfering with its proper working, so that some part of the battery is nearly always stopped for repairs, but is also the cause of serious incon-venience to the workmen. At the Huanchaca mines, owing to the presence of galena or sulphide of lead in the ores, this fine dust is of such an injurious character as not unfrequently to cause the death of the workmen ; as a precautionary measure they are accustomed to stuff cotton wool into their nostrils. This however is only a partial preventive ; and the men find the best method of overcoming the evil effect is to return to their homes at intervals or a few weeks, their places being taken by others for the same periods. In dry stamping there is also a considerable loss of silver in the fine particles of rich ore which are carried away as dust and and irrevocably lost. prevent this loss the writer proposed whilst at Huanchaca that a chamber should be constructed, into which all the fine dust might be exhausted or blown by a powerful fan or ventilator.