wafted across the water of the discovery of a new light, although details of the discovery were entirely lacking until Mr. Swinburne delivered his now famous lecture before the Society of Arts in London, February 8th. I will quote from this lecture a few descriptive remarks and then give some criticisms of the lamp from other sources. Mr. Swinburne in speaking of Nernst's discovery says: "Nernst's, like most great inventions, is exceedingly simple as soon as it is understood. The efficiency of an incandescent body, as far as radiation goes, depends simply on temperature of the filament only, providing there is no loss by convection. The carbon will not stand a sufficiently high temperature. Nernst therefore chose a material that would stand higher temperature than carbon, and his material has the incidental advantage, that its specific resistance is so high, that strong rods can be used for high pressure instead of thin filaments. Nernst takes highly refractory oxides as his material. It does not seem promising, because such oxides are notoriously good insulators. But such insulators are electrolytes when hot; Nernst therefore, heats the rod to make them conduct, and then heats them electrically, preserving a temperature which is within the limits that the material can bear without softening. * * * The material is worked up into little white rods. Each rod is mounted on two platinum wires, a little paste made of refractory oxides being applied to the joints. The little rod with its two wires, is then mounted in holder which fits ordinary electric light fittings. As the rods fall in resistance as the temperature increases, after the manner of electrolytes, an increase of current produces a decrease of resistance. This tends to give some instability in running in parallel on supply circuits. This instability is corrected, as in an arc lamp which has analogous properties due to a different cause by a series resistance. The Nernst rod has therefore a resistance in series. This is made up of exceedingly fine wire, and for ordinary circuits amounts to 10 or 12 per cent. of the whole resistance of the lamp. The consumption, including the resistance is 1.5 watts per candle for large lamps, and 1.6 for small lights of low pressures. In small or low pressure lamps the loss of heat at the ends is larger in proportion. Such a lamp as I have described will not light up of itself, for the rod is an insulator when cold. The simplest way to start it is to warm it with a match, or better with a small spirit lamp. Such a lamp as this is not only very cheap as regards first cost, but economical in running. The life of rods, running at an efficiency of two-thirds of a candle per watt, including the resistance, is already more than 500 hours in good specimens. If the Nernst lamp advances as much in the first years of its existence as the carbon lamp did between 1880 and 1882, it will soon be made so well that the rods will last a lifetime. When the rod is worn out, a new rod with its little mounts is all that is replaced. The whole lamp is not thrown away at all. The small lamps and the lamps of medium size are in practice started by a heating resistance. This is arranged close to the rod, and in shunt to it. As soon as the rod is hot enough to conduct, its current works a tiny cut-out in the resistance circuit. In large lamps the heating system is a little more elaborate, as the resistance arrangement is arranged as a sort of hood which covers the rod. As soon as the rod conducts, not only is the resistance circuit broken, but the electro-magnet lifts the little hood clear off the rod. In all these forms, the rod and its mounting are replaceable without interfering with the rest of the lamp."

The above extracts give a very clear idea of the Nernst lamp, as first described to the public by those interested in promoting a large company for its exploitation. There are however serious practical difficulties involved in the practical operation of these lamps at the present time. Assuming however for the sake of argument that the Nernst lamps can be operated successfully in practice, the relative cost of this operation compared to arc and incandescent lamps is what chiefly interests the central station manager. The English Electrical Review recently published an article by John I. Hall upon "The Nernst Lamp vs. The Arc and Incandescence Lamps." I quote for your information a part of this article, giving comparisons in cost between the Nernst and arc lamps. These are the only figures that have been recently published. After speaking of various methods of lighting, Mr. Hall writes: "But at present the position of the various illuminants may be summed up as follows. 1. The Welsbach system is an advance over the ordinary method of lighting by gas. 2. The enclosed arc lamp is an advance over the open arc. 3. The Nernst system is an advance in incandescent lighting. The electric lamps are placed in the order they will occupy in regard to cost of maintenance, for as the Nernst lamp supersedes the enclosed carbon lamp, so does the arc lamp supersede the Nernst lamp." J. Swinburne, in the prospectus of the Nernst Electric Light, Limited, states that: "It will, I believe, oust the arc lamp in nearly all cases." On examination it will be found that it will not oust one arc lamp at present in use, as the following particulars will show:

The Nernst lamp is said to give 1 c.p. for an expenditure of 1.5 watts. The arc lamp (2,000 n.c.p.) absorbs 500 watts and actually gives 1,200 c.p. The Nernst lamp to give 1,200 c.p., will require an expenditure of 1,800 watts, or 3.6 times more energy than the arc lamp; 1,800 watts = 1.8 kilowatts per hour, which will cost to the consumer 3.6d. per k.w. per hour. The arc lamp absorbs 0.5 k.w. per hour, and this at 3d. per unit equals 1.5d. These figures are for public lighting; for private consumers the cost is, of course, increased. Allow a liberal amount for carbons, trimming and cleaning, etc., say, 0.5d. per hour, then there is $1.5 + 0.5 = 2$d. per hour as the cost of the arc lamp against 3.6d. as the cost of the Nernst lamp. The figures given above are for the open arc lamp, but for the enclosed arc lamp the cost would be about 1.6d. against 3.6d. for the Nernst lamp. In other words, instead of our corporations running their street arc lamps for, say £18 per annum per lamp, they will, by adopting the Nernst lamp, run them at £64, or spend £46 more per lamp.

It will therefore be considerable time before the municipal electrical engineer is found who will be ready and willing to come forward and suggest the ousting of the arc by the Nernst lamp. The Nernst Electric Light, Limited, prospectus further states that "there is no difficulty in running in parallel on 1,000-volt circuits without transformers." It will be of some interest to the electric light engineers to find the 1,000-volt circuits without transformers amongst the electric lighting stations. However, the merits of the 1,000-volt lamps can be considered as against the arc lamps. Suppose the advantages of the Nernst lamps are considered running in parallel on 1,000-volt mains. Is there any economy in conductors to be secured under these circumstances? Take a section of, say, 20 arc lamps, with transformers, running in parallel and controlled from a sub-station. The current required will be

$$\frac{20 \times 500 \text{ watts}}{2{,}000 \text{ volts}} = 5 \text{ amperes primary current.}$$

For 20 Nernst lamps the current will be

$$\frac{20 \times 1{,}800}{1{,}000} = 36 \text{ amperes primary current.}$$

Thus it will be seen that, taking the most favorable conditions set down by the prospectus of the company for the Nernst lamp to compete with the arc lamp, a cable of seven (7) times the sectional area will be required, in addition to the transformer, for them to run on existing installations where the E.M.F. is 2,000 volts. The cost of the lamp cases and posts now remains to be considered. It may be taken that the lamp-posts will cost about the same in both cases. The arc lamp complete, with hood and globe, costs, say, £6, and the Nernst lamp £1. This appears to be a fair price, allowing for promotion anticipations without actual figures as to cost. The first cost, and maintenance for 12 months, may now be considered, voltage 2,000 lamps in parallel:

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|---|---|
| Arc lamp and transformer, say..... ..... | £12 |
| Say cost of cables ..... | 3 |
| Maintenance for twelve months ..... | 18 |
| Total cost ..... | £33 |
| Nernst lamp and part cost of transformer situate in sub-chamber (voltage 2,000 to 1,000)..... | £ 3 |
| Cost of cables ..... | 21 |
| Maintenance for twelve months ..... | 64 |
| Total cost ..... ..... | £88 |

There are other considerations of cost, such as conduits, depreciation and interest on capital outlay, which the electrical engineer will observe are not in favor of the Nernst lamp, and so they are, in kindness, omitted. To summarize the foregoing