fixtures, in so far as no provision has been made for lowering or drawing them to the side of the street. All trimming has therefore to be done from a tower wagon. This decision was come to after carefully considering the extra expense and complication involved in arranging for lowering gear, and also with due regard to the type of lamp selected, the hours of burning, and the local conditions.

The first results obtained were not considered altogether satisfactory; the shadows under the lamps, thrown by the ash-trays, were most pronounced, as was also the series of concentric rings on the surface of the roadway. As fitted with clear inner and opalescent outer globes, the lamps gave a minimum candle-power on the 20-degree ray of 2,250. This was substantially lower than the result anticipated.

Photometric tests showed that the polar curve of the lamps with the particular inner and outer globes used did not meet the necessary requirements, and the resulting distribution of the light was very unequal. The shadows and concentric rings were practically eliminated by the use of slightly opalescent outer globes, but the efficiency of the lamps was impaired to a very appreciable extent, and the distribution of light was rather worse than before, the change from the dark zone midway between lamps to the bright zone adjacent to the lamps being very pronounced.

The paper mentioned that all the testing was done in the streets at night with the lamps burning under normal conditions, and consequently the results obtained are directly applicable to the requirements of practical work.

**General Comparisons.**—The authors proceeded to observe that any comparison of the Portland Street and Princess Street lighting other than on an "equal basis of cost and illumination" required to be very unbiassed, since there was much to be said in favor of both systems.

"The gas lamps give a much steadier light than the arc lamps, although the difference is not very noticeable to a casual observer, or even to a keen observer; but it is very noticeable when making measurements with a flicker photometer. . . Unfortunately, although the gas lamps give a steadier light, their candle-power varies very considerably from day to day. The candle-power of a particular lamp may fall at least 50 per cent. before the mantles are renewed, unless it is arranged to change only one mantle at a time, thus spreading the complete change over a fairly long period.

"The candle-power of the arc lamps may vary quite appreciably within a few minutes; but provided that the same make of carbons is used, the average candle-power at any particular angle will not change to any extent from day to day if the line voltage is reasonably constant.

"A very important feature directly affecting the comfort of the general public is the absence or otherwise of glare. ••• Obviously the larger the surface of the light source in proportion to the total amount of light emitted the lower the intrinsic brilliancy and the less the effect of glare. In this respect the three-burner high-pressure gas lamps have an advantage over the flame arc lamps with clear inner and outer globes. The use of clear outer globes with flame arc lamps is, in fact, hardly advisable from the point of view of scientific lighting, since any form of lighting which is productive of eyestrain is essentially unscientific, and is certainly unsatisfactory.

"Two noticeable features in Princess Street are the combarative softness of the shadows of objects cast on the ground and the absence of a pronounced dark horizontal zone in line with the reflectors. The first result is, undoubtedly, due in a great measure to the fairly large triple light source, which has the effect of shading off the edges of shadows; and the absence of a dark zone in line with the reflectors is, no doubt, due partly to the fact that the source of light is well below the reflector, and partly to the reflection from the inner surface of the large globes. The shadows cast by the flame arc lamps when burning with clear inner and outer globes are very intense, and there is no appreciable shading of the edges; consequently it is possible to confuse shadows with actual objects. The smallness of the light source, or, in other words, the high intrinsic brilliancy, and the fact that the arc is well up under the reflector, is no doubt the cause of the objectionable horizontal dark zone noticeable in cases where reflectors are used."

The Portland Street light is considered by the authors to have a much warmer and more cheerful effect than the comparatively cold light in Princess Street The actual relative values of the two schemes of lighting is clearly shown by various tables and curves in the paper giving the results of photometric tests and the contour curves showing the portions of the street area within which the illumination on a horizontal plane is equal to or greater than 0.5 foot-candle.

"Purely from the point of view of illuminating effect," the paper adds, "there is much to be said in favor of both systems; but the electric lighting system possesses all the practical advantages, a few of the more important of which are: (a) Lower cost; (b) simplicity of switching operations, and possibility of dispensing with lamplighters; (c) flexibility and ease of erection; (d) lamps not affected by vibration when suspended from traction poles; (e) possibility of reliable check on running costs (i.e., current consumption and carbons); (f) negligible leakage; (g) absence of globe breakages due to heating, &c.

"All the above advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use: (a) Extensive and highly dangerous leakage of high-pressure gas; (b) the detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candlepower just at a time when it is most required; (c) partial and occasionally complete failure in frosty weather."

**Conclusions from the Tests.**—Messrs. Pearce and Ratcliff expressed the view that the tests referred to in their paper had at least vindicated the lighting of city streets by means of flame arc lamps, not only on the dual basis of equal cost and illumination, but also on the ground of light distribution.

"Unfortunately," they remarked, "owing to many unavoidable difficulties, the experiments with various forms of frosted globes have not yet been quite completed.

As there was a substantial difference between the cost of the flame arcs and the high-pressure gas lamps for the same minimum illumination, it would be possible to improve the arc lighting, if considered desirable, by reducing the distances between lamps in the case of future extensions. If fixed at the present height, and 100 ft. apart, the minimum illumination would be not less than 0.75 foot-candle. No attempt had been made to obtain perfectly uniform illumination, since it was very doubtful whether such a scheme would be desirable, even if possible. A variation factor of 3.75 was not excessive if the change was fairly gradual; and in this respect partially frosted globes gave results quite as favorable as dioptric ones. A well-known authority on street lighting had expressed the opinion that perfectly uniform lighting was flat and uninteresting. From a purely psychological point of view that was no doubt quite correct; but there was probably a more definite psychological explanation. The visual conception of illumination was largely a matter of contrast, in connection with which fatigue of the eye played a very important part. It was therefore quite probable that the hollows in the illumination provided the rest 'necessary 'to enable the eye to appreciate the peaks, with the result that the average impression produced was superior to the corresponding effect due to a merfectly uniform system of lighting of equal average intensity.