THE INCANDESCENT LAMP OF TO-DAY.

BY JOHN W. HOWELL.

The incandescent lamp is too well known to you all to need an introduction or any description. It has been so often discussed before you that nothing remains to be said about it except as a part of the electric lighting system in the general discussion of the subject under consideration this evening.

The characteristic features of the incandescent lamp are its extreme simplicity, its absolute freedom from mechanism, the ease with which it can be lighted by means of a switch placed where most convenient, and its adaptability to low candle units and decorative effects. These features and the fact that it consumes no oxygen, yields no gases and has no flame, have won for the lamp its great popularity.

The incandescent lamp is adaptable to any system of electrical distribution in use for any purpose. There appears to be no difference in its operation on direct or alternating current, provided the latter has a frequency of 25 cycles or more per second. It is usually operated on constant voltage circuits, but gives even better results when operated at constant current, as the increase in resistance of the filament with use increases the watts consumed, and thus causes the lamp to maintain approximately its initial candle power throughout its life.

For street lighting, incandescent lamps are operated many in series on high voltage circuits of constant current. They are also made for burning directly in series with arc lamps.

The incandescent lamp is adaptable to those voltages which are generally considered safe for interior use. Two kinds of carbon are used in making filaments and the best results require

the proper combination of the two kinds. The specific resistance of these two kinds of carbon limit the voltage of lamps of a given candle power and efficiency in which this proper combination can be made.

Lamps for a higher voltage than will permit the proper combination of the two kinds of carbon may be made with less of the graphitic coating which has a low specific resistance, or entirely of the base carbon, but in either case the lamp should be operated at lower temperature to give equally good life and candle power results.

The best results are obtained with lamps of not higher than 120 volts—250 volts being now regarded as the maximum desirable voltage, and at this point there is an increase of about one-half a watt per candle for equally good results.

The efficiency of an incandescent lamp depends upon the temperature of the filament—the higher the temperature the better the efficiency and the shorter the life. Lamp efficiencies are usually stated in watts consumed per horizontal candle. The commercial limits are between $2\frac{1}{2}$ and 4 watts per English candle, or about 120 per cent. of these figures if spherical candle power is considered, the $2\frac{1}{2}$ -watt lamp being used where electricity is expensive and regulation good, and the less efficient lamps where electricity is less expensive or regulation is not so good, or where other considerations demand a longer useful service from the lamps.

The color of the light from an incandescent lamp depends entirely upon the temperature of the filament, the higher the temperature the more nearly white the light becomes. The color of the light generally is yellow. Weber observed that the first visible radiations from a filament as it was heated came not in the red region of the spectrum, but in the yellow region, where the maximum radiation occurs when the lamp is at high temperature.

Dr. Nichols observed that carbon has a selective radiation in the yellow region of the spectrum, the radiations there increasing faster than radiations in the other parts of the spectrum.

The use of higher efficiency lamps is becoming quite general, very few 4 w. p. c. are now used for multiple lighting, while a few years ago no lamps of less than 4 w. p. c. were sold. This is due to the improvement in quality of the lamps and also to better regulation of current. High efficiency lamps are more satisfactory than low. The filament being smaller, the bulbs

blacken less, and being hotter they break before reaching very old age. Low candle power lamps are also coming into more general use. The demand for these has increased very considerably in the last two or three years. The use of lamps for decorative effects and for special work of various kinds has increased the usefulness of the lamp and added to its popularity.

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