the light output may fall to an uneconomic figure due either to migration of the sodium to one end of the lamp or to blackening of the inner discharge tube caused by sodium vapour attack. Very substantial improvements have been made in recent years, however, in the resistance of glasses to sodium vapour and the reduction in efficiency due to this cause is now relatively small. A third possible cause of failure, viz. glass-cracks, is one which seldom occurs.

Part IV.—OSIRA COLOUR FLOODLIGHTING LAMPS.

General Description.

Colour floodlighting using tungsten filament lamps in conjunction with suitable coloured filters has been in use for many years. The low efficiency of this method of producing coloured light, however, considerably restricted its use.

It will be clear from what has been said in the preceding pages, that discharges in suitable gases present great possibilities of producing coloured light of exceptional vividness at relatively high efficiencies.

The pale blue colour of the mercury vapour discharge, for example, may be obtained at efficiencies of from 12–45 lumens per watt according to the type of lamp employed. This colour is made up of a few lines in the blue and green regions of the spectrum as shown in figure 9(b). By the use of blue or green filters or coloured tubing the pale blue colour of the light may be made a deeper blue or a green and in the latter case, by using fluorescent uranium glass, the green colour is obtained with little or no reduction in efficiency. Even when a blue filter is used to obtain a darker blue light the efficiency is still from 4 to 10 times that of a tungsten lamp and blue filter giving approximately the same colour.

At the other end of the visible spectrum red and yellow light may be obtained from neon and sodium vapour discharges respectively at efficiencies about 2 to 5 times that possible from a tungsten lamp and filter combination giving similar colours.

A system of colour floodlighting utilising hot cathode discharge lamps was placed on the market by the G.E.C. in 1932. In the original system the lamps employed were low pressure discharge lamps filled with neon and mercury, the former giving a characteristic orange-red light and the latter a pale blue or green light according to the type of glass tubing employed. More recently both sodium vapour lamps and high pressure mercury vapour lamps of the types already described have been successfully used for colour floodlighting and have been added to the standard range of Osira colour floodlighting lamps.

Range of Colours Available.

Osira floodlighting lamps are available in the following colours :— red, light blue, light green, dark blue, dark green and yellow. The red or neon-filled floodlighting lamps are rated at 150 and 400 watts. The blue and green lamps are either 100w. and 250w. low pressure

TABLE 14.

Technical Data for Osira Colour Floodlighting Lamps.*

Colour	Red		Light Blue		Light Green		Dark Blue		Dark Green	
Lamp watts	150	400	100	250	100	250	100	250	100	250
Supply voltage	200–250 A.C.		200–250 A.C.		200–250 A.C.		200–250 A.C.		200–250 A.C.	
Lamp current, amps.	2.5	6.0	2.5	6.0	2.5	6.0	2.5	6.0	2.5	6.0
Efficiency L/W. Initial	10.0	11.0	12.5	15.0	12.5	15.0	5.5	6.5	9.5	11.5
Max. brightness of arc candles/cm.^{2}	2.0	3.7	1.8	3.0	1.8	3.0	0.8	1.3	1.4	2.3
Overall length mm.	690±10	1180±19	690±10	1180±19	690±10	1180±19	690±10	1180±19	690±10	1180±19
Arc length mm.	480	920	480	920	480	920	480	920	480	920
Diameter of tubular part mm.	37±1.5	37±1.5	26±1.5	26±1.5	26±1.5	26±1.5	26±1.5	26±1.5	26±1.5	26±1.5
Diameter of bulbous part mm.	55±5	65±4	55±5	65±4	55±5	65±4	55±5	65±4	55±5	65±4
Cap	3-Prong	2-Prong	3-Prong	2-Prong	3-Prong	2-Prong	3-Prong	2-Prong	3-Prong	2-Prong
Bulb	Clear	Clear	Clear	Clear	Light Green	Light Green	Blue	Blue	Green	Green

*Technical Data for 250w. and 400w. H.P.M.V. and 85w. Sodium Vapour Floodlighting Lamps are given in Table 1, page 20, and Table 12, page 40 respectively.

mercury vapour lamps or 250w. and 400w. horizontal burning high pressure mercury vapour lamps. In the former lamps the dark blue, light green, dark green and dark blue colours are obtained from lamps with appropriately coloured bulbs. The corresponding colours using h.p.m.v. lamps are obtained at relatively high efficiencies by means of coloured glass screens mounted in the floodlight. The h.p.m.v. lamps employed are identical with those already described (see page 19). The yellow floodlighting lamp is identical with the 85w. sodium vapour lamp already described (see page 40).

Constructional Details and Method of Operation.

The 400w. neon filled and the 100w. mercury filled floodlighting lamps are shown in figure 31. The 150w. neon lamp is the same length as the 100w. mercury filled lamp but of larger diameter, while the

Fig. 31.—Osira Colour Floodlighting Lamps. (a) 400w. Neon-filled Lamp. (b) 100w. Mercury-filled Lamp.

250w. mercury lamp is the same length as the 400w. neon lamp but of smaller diameter. The relevant technical data are given in table 14.

Each Osira low pressure colour floodlighting lamp requires a filament heating transformer and the usual choke to operate the tube at the correct wattage. The 400w. and 250w. lamps have in addition a small Tesla or high frequency coil operated from the filament heating transformer the purpose of which is to start the discharge. The filament heating transformer and Tesla coil are mounted in the floodlight housing, while the choke can be placed in any convenient position between the floodlight and the control board. The chokes are supplied with tappings to operate from 50 cycle a.c. supplies between 200 and 250 volts, but can be adapted if required for supplies of certain non-standard frequencies. Table 15 gives the choke tapping schedule for neon and low pressure mercury vapour floodlighting lamps. The corresponding data for h.p.m.v. and sodium vapour floodlighting lamps will be found in tables 11 and 13 respectively.

TABLE 15.

Choke Tapping Schedule for Osira Low Pressure Floodlighting Lamps.

Supply voltage	Tappings for Red Tubes		Tappings for Blue and Green Tubes	
	150w.	400w.	100w.	250w.
190	215 and 0	2 and 3	215 and 5	1 and 3
200	215 and 0	2 and 3	225 and 0	2 and 4
210	215 and 5	1 and 3	235 and 0	1 and 4
220	225 and 0	2 and 4	235 and 5	2 and 5
230	235 and 0	1 and 4	245 and 0	1 and 5
240	235 and 0	2 and 5	245 and 0	2 and 6
250	245 and 5	1 and 5	255 and 15	1 and 6

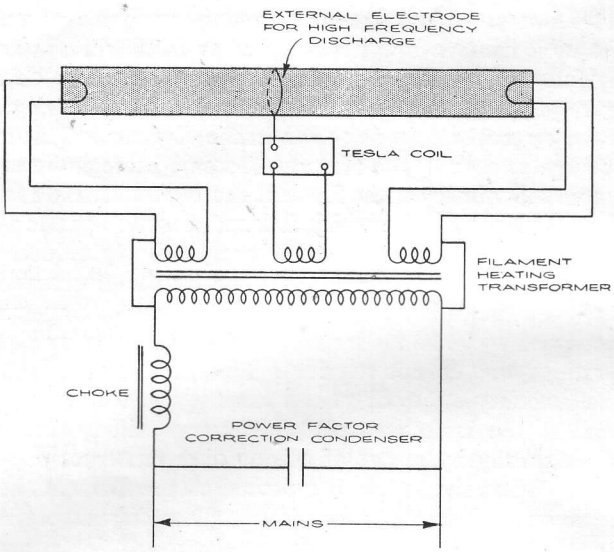

Fig. 32 (a).—Circuit Diagram for 250w. and 400w. Low Pressure Colour Floodlighting Lamps.

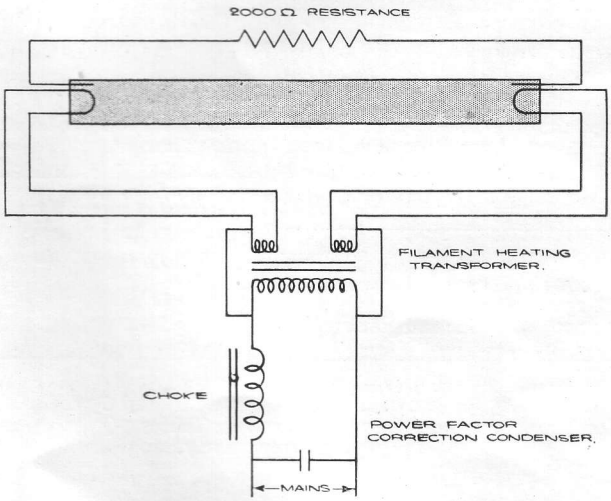

Fig. 32 (b).—Circuit Diagram for 100w. and 150w. Low Pressure Colour Floodlighting Lamps.

Figure 32(a) shows the circuit diagram for the 250w. and 400w. lamps while figure 32(b) is the circuit diagram for the 100w. and 150w. low pressure lamps. Apart from the starting arrangements the circuits are identical. When the supply is switched on the filaments heat up and practically full mains voltage is applied across the lamp. The Tesla coil in figure 32(a) operates and produces a high frequency discharge by means of the external electrode shown in the diagram. This starts the main discharge as soon as the filaments become heated whereupon the voltage across the primary of the filament heating transformer falls to the operating voltage of the tube which is insufficient to operate the Tesla coil. The filament heating voltage is correspondingly reduced but the residual heating together with that supplied by the discharge itself, is sufficient to keep the cathodes at the correct operating temperature.

The 100w. and 150w. lamps are shorter than the 250w. and 400w. low pressure ratings and do not require a Tesla discharge to start them. Instead, an auxiliary electrode placed close to the filamentary cathode at each end of the lamp is used. The two auxiliary electrodes are connected externally by means of a 2000 ohm resistance as shown in figure 32(b). When the supply is switched on the filaments heat up as described above and at the same time a glow discharge takes place between each filament and its auxiliary electrode. This enables the main discharge to pass whereupon the auxiliary discharges extinguish since the lamp voltage is insufficient to maintain them.

The uncorrected power factor of Osira colour floodlighting lamps is approximately 0.3, but this can be improved to approximately 0.8 by the use of suitable condensers, as shown in table 16. As with other discharge lamps a single larger condenser to correct a group of lamps may be used.

TABLE 16.

Capacity of Condenser for Power Factor Correction of Osira Low Pressure Floodlighting Lamps.

Lamp Wattage	Capacity to give power factor of approx. 0.8
400 watts red	80 mfd.
250 ,, blue and green	80 ,,
150 ,, red	30 ,,
100 ,, blue and green	30 ,,

The capacity for 250w. and 400w. H.P.M.V. and 85w. Sodium Vapour Floodlighting Lamps are given in Tables 9 (page 37) and 13 (page 42) respectively.