

WESTINGHOUSE  
ELECTRIC & MANUFACTURING COMPANY  
EAST PITTSBURGH, PA.



FORM 16406 A

RELEASE

NEW MERCURY LAMP  
HAS UNIQUE DESIGN

Tubular Bulb has Innertube of Glass ---  
Produces Bluish-White Light ---  
Lamps Will Light Ford Building  
At A Century of Progress

The principle of producing artificial light by passing an electrical charge through metallic vapors finds further application in the new high pressure mercury lamp. Engineers of the Westinghouse Lamp Company have just perfected this new light source in their laboratories at Bloomfield, New Jersey. Several hundred of these lamps will be used in combination with incandescent lamps to produce an illumination almost the same color as daylight in the main exhibition hall and in other locations of the Ford Building at A Century of Progress this summer.

The public, accustomed to the tungsten filament lamp so widely used today, will be interested in this new lamp because of its unique construction. Inside the lamp bulb is another glass tube. This innertube of glass is the actual light source. It contains a tiny drop of mercury no larger than the head of a match. When an electric arc is passed through the lamp, this mercury is vaporized and fills the innertube with a brilliant bluish-white glow.

Perhaps the outstanding feature of the high pressure mercury lamp is its high operating efficiency. The use of vaporized mercury as a source of light is in itself nothing of revolutionary character. For a number of years, low pressure mercury lamps have been in use, but their efficiency is on the order of 15 to 20 lumens per watt. In the new lamp the mercury in the innertube is vaporized by the electric arc and the pressure kept relatively high through the maintenance of a high operating temperature. In this way, it is possible to obtain efficiencies of 35 to 45 lumens per watt. The resultant light is distinctly bluish-white in color instead of the bluish-green of low pressure design.

For the present, the new lamp is made in the one size only. The Westinghouse design has a tubular bulb about 13 inches long and two inches in diameter, and has a mogul screw base. It has a rating of 15,000 lumens and consumes 400 watts of electricity. As the demand for this type of light source grows, other sizes with different ratings will necessarily become available.

#### INTRICATE CONSTRUCTION

In comparison to the simple construction of a tungsten filament lamp, that of the high pressure mercury the design seems quite intricate. (Fig. 1) The glass innertube which is approximately 7 1/2 inches long and 1 3/8 inches in diameter, contains the mercury which is later vaporized by



the electric arc. There are two electrodes at each end of this innertube. The arc is established between these electrodes. The innertube is supported and held firmly in place by the current carrying lead-in wires as well as by a special arrangement of metal bands which fit tightly against the inside surface of the outer bulb.

Since this lamp must be operated at high temperature in order to keep the mercury vapor at the proper pressure, the glass in the main body of the tube was necessarily constructed to withstand high temperatures. One of the reasons for constructing the lamp with two tubes was to provide a means of conserving heat. The outer tube or the apparent lamp bulb, acts as a jacket. In the space between these two bulbs is nitrogen gas at approximately one half atmosphere pressure. This gas prevents arcing between the metal parts which hold the innertube firmly in the lamp bulb. The ends of the innertube are coated with a gold paint which reflects heat back into the innertube and further contributes to a constant high temperature.

The electrodes in the ends of the innertube are nothing more than coils of tungsten wire. Trapped in each coil, however, is a small slug of a special chemical compound which supplies a copious flow of electrons from the time the lamp first begins to operate. Note that one electrode is mounted vertically and that the other is in a horizontal

position. This arrangement is necessary in order to center the arc stream through the mercury vapor.

#### HOW LAMP OPERATES

Operating characteristics of this new lamp are equally as complex as the construction. In a metallic vapor light source, such as this, the maintenance of a constant temperature is essential to successful operation. But there must also be some provision for easy starting. To facilitate easy arcing, therefore easy starting, of the high pressure mercury lamp, a small quantity of pure Argon gas has also been added to the innertube. As may be seen in the accompanying line drawing of the lamp (Fig. 2) there are several turns of wire wound around the innertube. This wire contributes to quick arcing and therefore must be placed at a critical position along the tube.

The voltage required to start and maintain an arc across the electrodes of the high pressure mercury lamp is supplied by a special transformer or reactance. (Fig. 3) As soon as the arc is established the voltage across the electrodes drops to 20 volts with a current flow of about 5 amperes. At this stage, the entire innertube is filled with greenish-blue glow that produces relatively little visible light.

As the lamp heats up, the mercury vapor pressure increases slowly. During this period the voltage rises and



the current falls. About 12 minutes are required before the lamp reaches normal operating conditions. The operating voltage is then 155 volts and the current flow is 2.8 amperes. The appearance of the lamp has now changed considerably. The discharge, which formerly filled the entire innertube, has now concentrated in a narrow, pencil-like arc stream of light great brilliancy. The increase in lumen output during the heating period is quite rapid after the first two minutes of operation. (Fig. 4) Designed life of the high pressure mercury lamp is 1500 hours and has an average lumen maintenance throughout life equal to 85 percent of the initial lumen output.

#### LIGHTING OF DAYLIGHT COLOR

Another outstanding feature of the new lamp is the color of its light. It is strong in the violet, blue and green rays of the spectrum. (Fig. 5) The tungsten filament lamp which has been in general use for a number of years, is deficient in these colors. Though we are accustomed to the color of tungsten light, it again is considerably different from the color of daylight.

When high pressure mercury lamps are operated in conjunction with tungsten filament lamps, the color deficiency in the light of one is corrected by the presence of certain colors in the light of the other, giving an illumination of a color closely approaching that of daylight.

Special lighting fixtures which are to be used to illuminate the main exhibition hall in the Ford Building at A Century of Progress this summer, are designed to produce a combination of incandescent and high pressure mercury lighting. (Fig. 6) In order for the color of this combined light to approximate that of daylight, an equal number of lumens of incandescent tungsten filament light and of high pressure mercury light is blended. From a series of experiments, it was found that best results could be obtained by using the 500 watt Mazda lamp, as it has a suitable color temperature. In the Ford Building fixtures, two high pressure mercury lamps are to be operated with three of the 500 watt Mazda lamps.

#### POSSIBLE USES

The principal reason for selecting such a lighting unit in the Ford Building was to give the cars on display the same appearance they have on the road in daylight. Where, in clothing stores and in the purchase of other color merchandise, customers frequently take the articles to the window or to a special "daylight" lamp to observe color harmonies as they will appear outdoors, visitors to the Ford Building will see Ford Cars in their true color.

The potentialities of such lighting are farreaching. It is not inconceivable that in five or ten years, further applications of this principle of combining different designs



of lamps may give us a light source that will make all lighting in the world, both artificial and natural, both indoors and outdoors, almost identical in color quality.

But the high pressure mercury lamp is expected to carve its own field of use. The peculiar color of this light is particularly advantageous for observing small and fine objects. Thus it is expected to find increasing use in certain industrial operations where inspection procedure is paramount in the maintenance of quality production.

The principle of passing an electric charge through mercury vapor is used in certain types of ultraviolet lamps, of which the most familiar are the Type G-1 and Type G-5. These produce a soft bluish-green glow and operate on the low pressure principle.

At the present time, the high pressure mercury lamp does not emit any of the biologically active ultraviolet radiations as these rays are completely absorbed by the special glass used in the bulbs. Later on, as development proceeds, it may be possible to provide for a small amount of these ultraviolet radiations, if desired.

High pressure mercury lamps also hold some promise in the field of photography, blueprinting, and photostating. The light of these lamps is strong in actinic quality. Low pressure mercury lamps are now used widely for these purposes, and since the high pressure design produces light stronger in actinic value, it is reasonable to assume that they will eventually find important application in these fields.

CAPTIONS

Fig. 1 - (Photo #WL-906)

Standard 500 watt Mazda lamp and new Westinghouse High Pressure Mercury lamp which will be operated together in special fixtures. -- Their combined light is almost the same color as daylight - in the Ford Building at A Century of Progress this summer.

Fig. 2 (Photostat)

Line drawing of the new Westinghouse High Pressure Mercury lamp shows complex construction.

Fig. 3 (Photo #WL-888)

Reactances on top of the special fixtures for the Ford World's Fair Building, supply the correct voltage for operating the new Westinghouse High Pressure Mercury lamps.

Fig. 4 (Photostat) -- Curve showing rapid increase in lumen output of new Westinghouse High Pressure Mercury lamp during first few minutes of operation.

Fig. 5 (Photostat) -- Chart showing color quality of tungsten lamps alone; High Pressure Mercury lamps alone; these two together, and how they compare with the color quality of daylight (sunlight).

Fig. 6 (Photo #WL-885) -- Special fixture which uses three 500 watt standard Mazda lamps and two of the new High Pressure Mercury lamps and which will supply illumination of daylight color in the Ford Building at the World's Fair.