NEWS
DEP'T

WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.

FORM 16406 A

RELEASE

OVERCOME MANY OBSTACLES IN DEVELOPING NEW HIGH PRESSURE MERCURY LAMP

Has No Filament -- Innertube of Hardest Glass Is Source of Light -- Drop of Mercury Is Vaporized to Produce Light -- Gold Paint Used to Conserve Heat.

---ooOoo---

The job of developing a new source of articicial light today offers as many obstacles as it did forty years ago when our present mechanical and electrical age was just gaining a foothold. At least, so say the engineers of the Westinghouse Lamp Company who have spent the past six months wrestling with countless design and manufacturing problems in connection with the development of the new high pressure mercury lamp. To them, history appears to be repeating itself, for it was a little more than forty years ago that George Westinghouse was involved in the gigantic task of lighting the Columbian Exposition in Chicago with electricity. He too, was gravely concerned with design and manufacturing problems for his now famous "Stopper Lamp". With him also, it was a matter of creating a radically new design in light sources under the pressure of a time limit and the lack of equipment facilities.

At the Century of Progress this year, Mr. Henry Ford was in quest of a light source that would make his exhibition distinctive. The high pressure mercury lamp, which produces a bluish-white light, offered possibilities as the answer to

his problem because, when combined with the light of tungsten filament lamps, it produces an illumination of a color almost identical to that of daylight. Under lighting of this character, Mr. Ford felt that visitors to his exhibit would view his cars in their true color harmonies, exactly as they appear along the road in daylight illumination.

However, high pressure mercury lamps were scarcely more than a laboratory plaything when Mr. Ford was laying plans for his World's Fair building. Usually, artificial light sources must go through months of experimenting in which test after test offers the surest way of ironing out all the wrinkles of a new lamp. Though preliminary research and engineering work on the high pressure lamp had been in progress for several months, less time than customary was available to manufacture some six hundred of these new lamps and have them ready for use by the opening of the Chicago Exposition, May 26, particularly since the order for these lamps was received in the middle of April.

START FROM SCRATCH

The demand came as a challenge. Westinghouse placed its best engineers behind the project, and now the lamps are in Chicago ready for installation to illuminate the main exhibition hall and other nearby areas of the Ford Building with light of approximately daylight color.

These engineers, however, had little to work from. They started from scratch, practically, and found it necessary to develop their own manufacturing methods and technique. Despite all the modern lamp making machinery available, none could be used; for the new lamp required such a radical design that all operations had to be made by hand. Westinghouse engineers are of the opinion that perhaps the founder of their organization had no tougher time of it with his Stopper Lamp, so many were the obstacles encountered in perfecting the high pressure mercury lamp.

The new lamp has no filament. It was this feature which accounted for most of the obstacles in the design and manufacturing work.

The light is produced by passing an electric arc through a tube of glass which contains mercury vapor. Inside an ordinary lamp bulb, almost 13 inches long and about 2 inches in diameter, is an innertube of glass. This innertube contains a drop of mercury no larger than the head of a match. When the lamp is operated an electric discharge is sent through this innertube until an arc is established between electrodes in either end. Extreme heat is generated by this arc, and that is what vaporizes the mercury. After the mercury is fully vaporized, this arc assumes a pencil shape along the length of the innertube, setting up an electronic discharge in the mercury vapor that results in a brilliant glow of bluish-white light.

HARDEST GLASS KNOWN

At the outset of the development work it was found that the hardest glass used in lamp bulbs today proved too soft for the innertube of the high pressure mercury lamp. When subjected to the high temperature of the mercury arc, the glass would soften and destroy the lamp. (Hardness of glass under these conditions is gaged by the heat it will withstand without softening).

The only other hard glass known was the kind used for combustion tubing in which carbon compounds are analyzed under temperatures of some 1000°F. This glass was tried out and proved successful. But its use introduced more obstacles, some old, others never before encountered in lamp making. It was found that the lead-in wires which bring electric current into the lamp from the base could not be sealed absolutely air tight with the hard glass.

With years of experience in metal-to-glass seals gained in the manufacture of incandescent lamps, Westinghouse engineers adopted a process of elimination and soon had this problem solved. Uranium glass was used for the ends of the innertube. They knew that metal will seal tightly with uranium glass and also that uranium glass can be sealed to other glass. But this step again introduced further difficulties.

In welding these uranium cups to the ends of the hard glass cylinder to form a tube, the glass at the weld would crystalize, resulting in a pithy construction which lent itself

to leaks or cracks. Only after days of "cut and try" was the glass worker able to develop a technique of welding the two kinds of glass together at precisely the right temperature to prevent crystalization.

USE DROP OF MERCURY

Perhaps one of the most delicate of all steps in the development of the high pressure mercury lamp was that which determined the weight of a drop of mercury which was inserted in the innertube. When this drop of mercury is vaporized by the extreme heat generated by the electric arc the resultant pressure must be just so in order for the lamp to operate at a specific voltage. In that way only could the high pressure mercury lamp be designed to operate at a certain voltage.

In order to facilitate quick arcing and therefore easy starting of the lamp a small quantity of rare gas was first inserted into the innertube. When the lamp is turned on the arc takes hold immediately and begins to increase in temperature which of course starts vaporization of the mercury. The weight of this mercury globule is such that when fully vaporized by the arc it fills the innertube to a pressure of one atmosphere. At this pressure it was found that the lamp would operate at a constant voltage of approximately 155 v.

ELECTRODES ARE SPECIAL

The filament wire is known as the heart of a tungsten incandescent lamp. In the high pressure mercury lamp, the

electrodes deserve the same distinction, for they produce the arc which generates the heat that vaporizes the mercury and then continues to maintain the discharge which results in the light.

The electrode consists of a coil of tungsten wire in which is imbedded a pellet of special chemical compound. This compound has a characteristic of producing a slight electron emission when cold, and then when heated by the tungsten coil, gives the best emission of any substance known.

The final operation in the construction of this inner-tube is the exhausting or cleansing process. Where a glass tumbler in the home may be cleaned with water, special rare gases are used to clean the innertube of high pressure mercury lamps. Impurities are lurking in the microscopic surface depressions on the inside of the glass tube, in the electrode pellets, in the electrode coils, and in the lead-in wires which pass through either end of the tube. Several times, rare gases are inserted into the tube and the electrodes heated to produce a high temperature. This drives out the impurities, vaporizes them, and then when the gas is exhausted, draws them from the tube. Were any impurity to remain in the tube, later to combine with the mercury vapor, it might be enough to discolor the characteristic bluish-white light. Or, the presence of an impurity, even of infinitesimal quantity, might jeopardize the voltage normally required to operate the lamp. In either case, the lamp would be sent to the scrap heap.

Immediately following the several flushing operations, the globule of mercury is placed within the innertube which is then sealed. The innertube is then placed within the lamp bulb and a base attached. To hold the innertube rigid in the lamp bulb a special arrangement of circular clamps fit around each end and press tightly against the inside of the outer bulb.

With this the lamps are ready to begin their journey to Chicago, there to fulfill an assignment which may perhaps be regarded as a precedent that portends important changes in artificial lighting of the future.

# # # # #

CAPTIONS FOR ILLUSTRATIONS

Photo #WL-906 -- Standard 500 watt Mazda lamp and new Westinghouse High Pressure Mercury lamp which will be used together to provide special illumination in the Ford Building at the World's Fair this summer.

Photo #WL-903 -- To clean impurities out of the innertubes of the new Westinghouse High Pressure Mercury lamps, rare gases are injected into them and high temperature produced by heating the electrodes.

Photo #WL-886 -- Making voltage readings on the special lighting fixture which will be used to provide "daylight" illumination in the Ford Building at the World's Fair this summer. Each fixture has three 500 watt standard Mazda lamps and two of the new Westinghouse High Pressure Mercury lamps.