

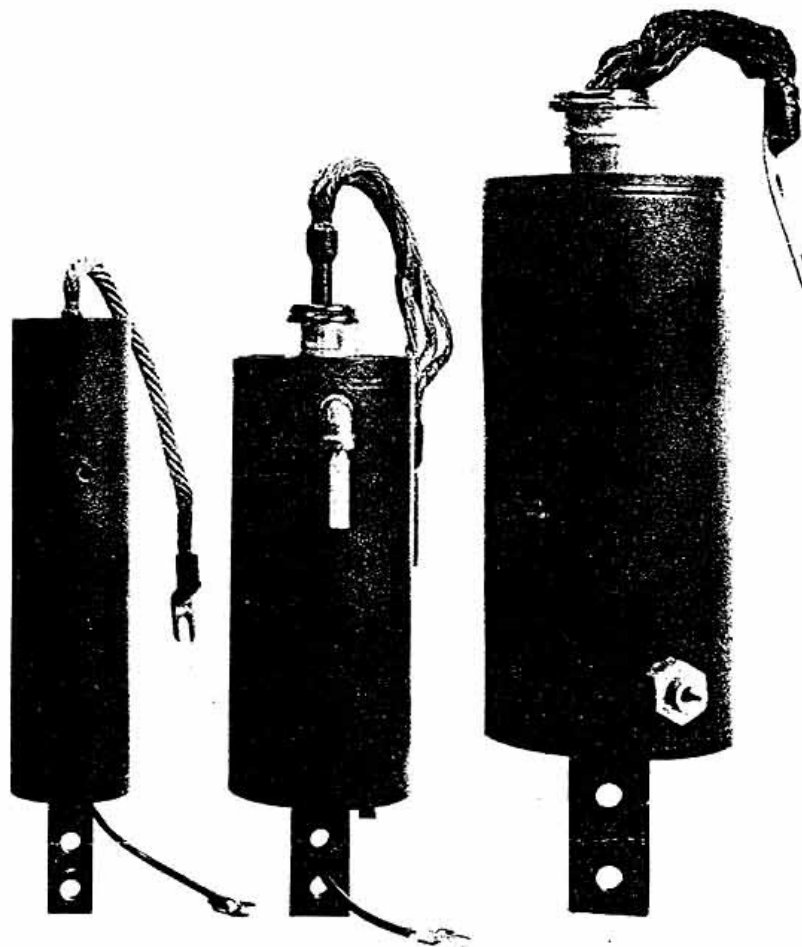


# INFORMATION BULLETIN

NOVEMBER, 1938

NO. 17

## WESTINGHOUSE IGNITRON TUBES



The Ignitron Tube is a Westinghouse contribution to the electronic art and promises to become one of the most useful tubes ever produced for heavy industrial service.

The Ignitron conducts unidirectional current by means of the controlled ionization of mercury vapor. For its control, the Ignitron contains a starting electrode or ignitor which functions in the tube as

a spark plug does in an automobile cylinder. This ignitor energizes the tube at the beginning or any other desired point in each positive half cycle of anode voltage.

The tubes have a permanently evacuated water-cooled, metallic cylinder with the mercury pool cathode in the bottom and a graphite anode supported by an insulating bushing at the top. The auxiliary control electrode, or ignitor, dips into the mer-

cury pool and is supported by an insulating bushing. The principle of operation is quite different from the common gas-filled thyatron. The Ignitron conducts current in the form of an arc discharge in mercury vapor from a graphite anode to mercury pool as does the conventional mercury arc rectifier. However, the usual keep-alive arc, with its associated cathode spot, is absent in the Ignitron tube. Instead, the ignitor causes formation of a cathode spot for each desired half-cycle of current. Once energized by the ignitor, the tube will conduct current to the end of the half-cycle, at which time the current falls to zero. Zero current extinguishes the arc discharge and the cathode spot disappears. The tube must then be again ignited for any further current conduction.

The ignitor operates not from high potential but from a current impulse conducted through it to the mercury pool. When a relatively small current impulse is passed into the ignitor, a spark first forms at the junction of the ignitor and the mercury. This small spark functions as a primary source of electrons. The positive potential of the anode attracts these electrons. In passing at high velocity through mercury vapor, these electrons collide with, and ionize, certain of the mercury vapor atoms which, in turn, furnish additional electrons as well as positive mercury ions. These positive ions are attracted to the cathode where they cause rapid expansion of the cathode spot and ionization of the vapor content takes place. This entire process occurs in a few micro-seconds after the initiating spark appears.

Because of its mercury pool type of cathode, which provides unlimited electron emission; the Ignitron is ideally suited for high surge current applications, such

as the control of spot and seam welders.

The Ignitron circuit most commonly employed, in which the tubes act as a switch as in welding service is shown in Figure (1). This shows two Ignitrons in reverse parallel connection for conducting and interrupting alternating current to a load circuit represented by L and R. The two grid controlled Thyratrons contained in each ignition circuit, conduct ignition current from the power circuit to energize their respective Ignitrons. When either Ignitron tube has been ignited, the low arc drop cuts off further flow of ignition current through the shunt-connected Thyatron and Ignitor. Ignition current, therefore, flows only for a few micro-seconds during each half-cycle of power current. The control of the Thyratrons may be of the conventional magnitude or phase shift type, dependent upon the desired characteristics to be achieved.

The controlled ignition feature permits its use on variable voltage rectifiers in the chemical industry and wherever conversion or inversion is economically justified.

In some instances a firing circuit entirely independent of the load characteristics is advantageous. Such a circuit is illustrated in Figure (2). A capacitor "C" is charged to a potential of approximately 600 volts on each half cycle of Ignitron negative anode voltage. This is several times the required firing voltage of the ignitor. This potential is then applied to the ignitor through the series Thyatron which may be biased to break down at a pre-determined point on the positive half cycle of Ignitron anode voltage. When breakdown occurs, the capacitor discharge is so intense that the Ignitron fires very promptly. With this type of control the ignitor carries no current until the capacitor is allowed to discharge

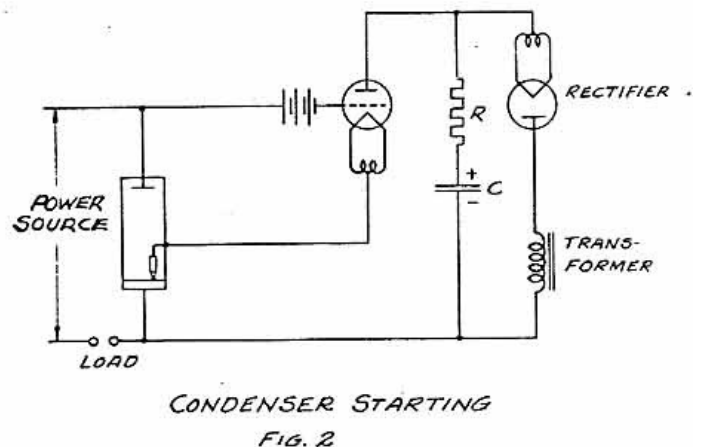
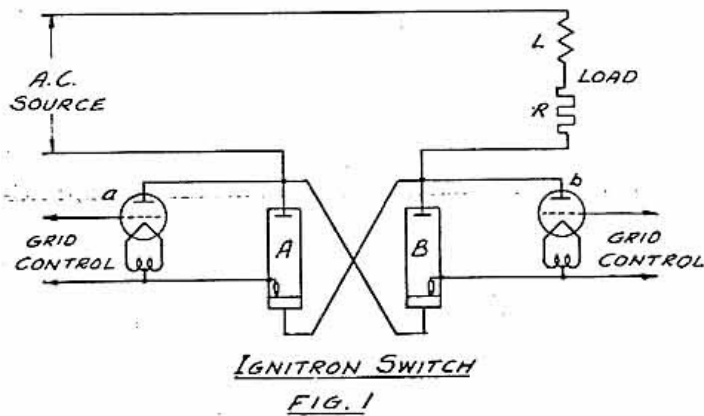
through it. This current lasts only approximately 200 micro-seconds. The duration and wave shape of the firing impulse may be varied by insertion of 1 to 10 ohms in series with the capacitor.

With no hot cathode or filament to burn out, the Ignitron has a very long and useful life. The pool type cathode permits severe overloads for short periods and the ignition type of control makes it a universal tube that may be generally applied to the severe conditions imposed by industry.

For straight rectification such as required in the mining industry, or as a power source for D.C. elevator equipment, it is ideal. For controlled rectification such as used in the Chemical industry, or for field excitation of generators or large

synchronous motors, the Ignitrons can furnish the quick and instantaneous response desired. Motor speed control, high speed relays, welding controls, quick response circuit breakers, all are among the many successful duties performed by Ignitron tubes.

To the complete line of Westinghouse Industrial Tubes is now added a generous group of Ignitron Power Tubes. The accompanying table lists the various Westinghouse Ignitron tubes which are regularly available and carried in stock. Because of space limitations the ratings given are brief, and more complete information should be obtained before designing equipment in which it is planned to use these tubes. Additional technical ratings and circuit information on these tubes will be supplied upon request.



**NOTICE**

THE CIRCUITS HEREIN SHOWN ARE FOR THE PURPOSE OF ILLUSTRATION ONLY AND NO LICENSE IS EXPRESSED OR TO BE IMPLIED TO EMPLOY SUCH CIRCUITS IF COVERED BY PATENTS.

IGNITRONS

| <u>TUBE<br/>TYPE<br/>NUMBER</u> | <u>NOMINAL<br/>R. M. S.<br/>VOLTS</u> | <u>CREST<br/>INVERSE<br/>VOLTS</u> | <u>NOMINAL<br/>AVERAGE<br/>ANODE<br/>AMPERES</u> | <u>PEAK<br/>R. M. S.<br/>AMPERES</u> | <u>IGNITOR<br/>VOLTS<br/>MAXIMUM</u> | <u>IGNITOR<br/>AMPERES<br/>MAXIMUM</u> | <u>MAXIMUM<br/>LENGTH<br/>INCHES</u> | <u>MAXIMUM<br/>DIAMETER<br/>INCHES</u> |
|---------------------------------|---------------------------------------|------------------------------------|--|--------------------------------------|--------------------------------------|--|--------------------------------------|--|
| WL-659                          | 220                                   | 900                                | 12.5   | 1000                                 | 100                                  | 25                                     | 10-1/2                               | * 4                                    |
| WL-654                          | 440                                   | 900                                | 12.5   | 800                                  | 200                                  | 25                                     | 10-1/2                               | * 4                                    |
| WL-657                          | 220                                   | 900                                | 40   | 2000                                 | 100                                  | 25                                     | 14-3/4                               | 2-3/4                                  |
| WL-652                          | 440                                   | 900                                | 40   | 1500                                 | 200                                  | 25                                     | 14-3/4                               | 2-3/4                                  |
| WL-656                          | 220                                   | 900                                | 125  | 4200                                 | 100                                  | 25                                     | 15-3/4                               | 4-1/4                                  |
| WL-651                          | 440                                   | 900                                | 125  | 2800                                 | 200                                  | 25                                     | 15-3/4                               | 4-1/4                                  |
| WL-658                          | 220                                   | 900                                | 400  | 7200                                 | 100                                  | 25                                     | 19-1/4                               | 6                                      |
| WL-655                          | 440                                   | 900                                | 400  | 5300                                 | 200                                  | 25                                     | 19-1/4                               | 6                                      |
| WL-653                          | 600                                   | 2000                               | 150  | 1500                                 | 150                                  | 25                                     | 19-1/4                               | 6                                      |

\* Includes removable water jacket.

Note; Dimensions are approximate and should not be used for design purposes.

For prices and further information write to  
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