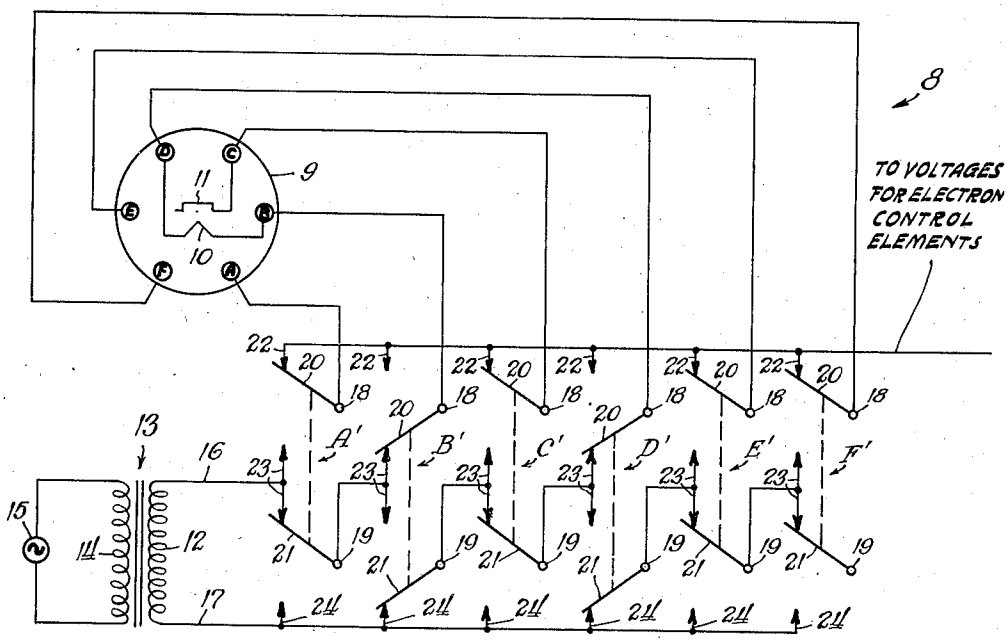
June 3, 1941. H. P. MANLY 2,244,495

TUBE TESTING SYSTEM

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Fig. 1.



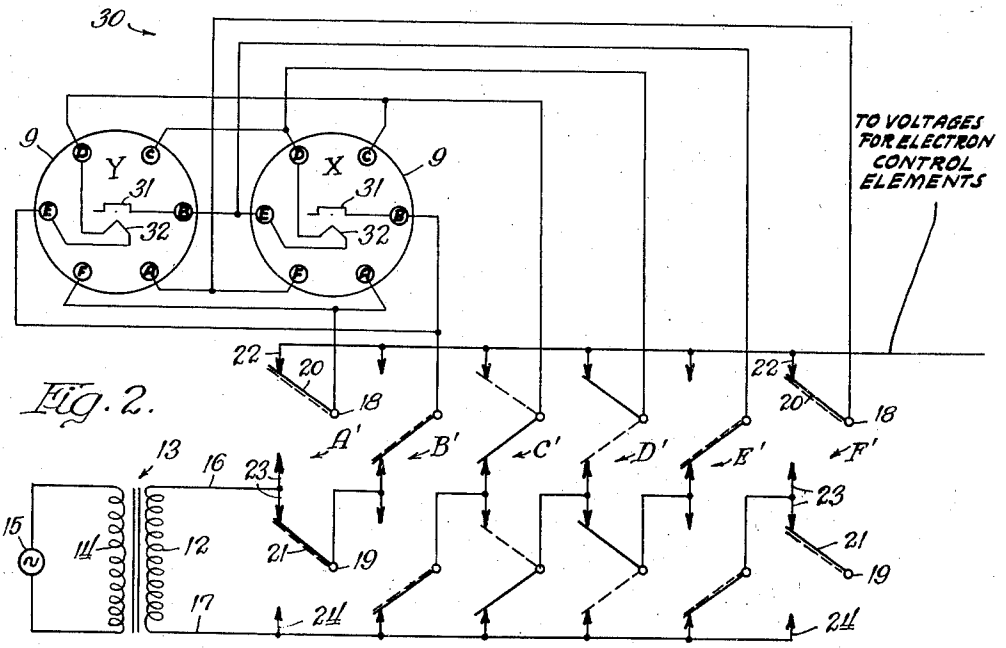


Fig. 2.

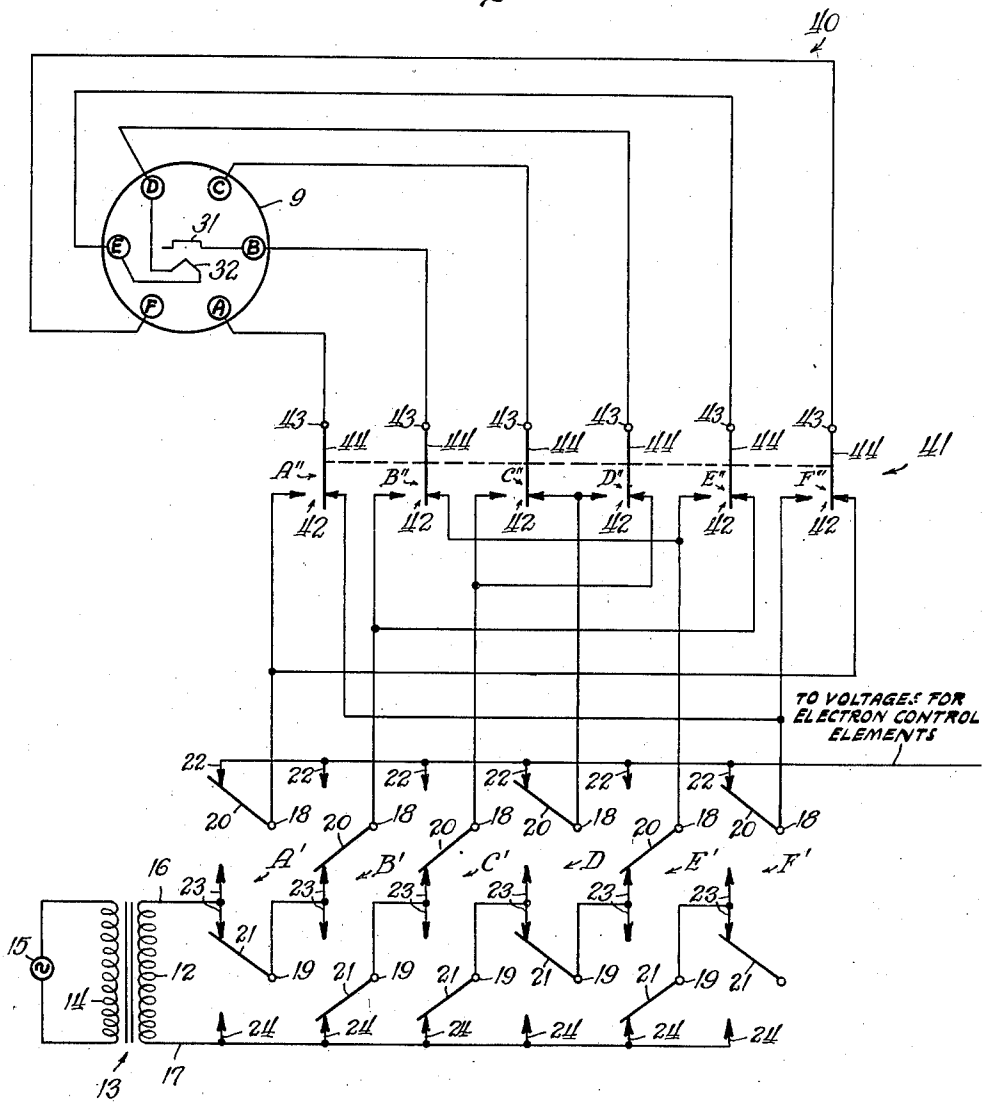
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Fig. 3.



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TUBE TESTING SYSTEM

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Application March 22, 1940, Serial No. 325,325

9 Claims. (Cl. 250—27)

My invention relates, generally, to testing means for electric valves and the like, and it has particular relation to testing means wherein the various terminals of thermionic tubes may be selectively connected to a current source.

Thermionic tubes, classed under the broad term of electric valves, are of many different types. Each comprises a hermetically sealed bulb mounted on a base through which terminals for the internal elements project in the form of prongs or pins. These prong terminals may be in different arrangements, and it is usually impossible to determine by visual inspection to which elements of the tube the terminals belong. Thus, thermionic tubes of the filament type in which the heated element acts as the cathode, commonly have two filament terminals arranged for connection to the two sides of a filament current source. In such tubes the filament element may terminate at any two of the pins or prongs on the base. With a base having eight pins, there are twenty-eight possible different filament terminal arrangements.

In tube testing equipment, it is desirable to select the proper base pins or terminals using a minimum number of sockets for the various types of tubes. It is also desirable to select and connect the proper base terminals to the opposite sides of a current source using a minimum number of switching means. Such testing equipment should be simple in operation and construction, and arranged so as to make it impossible to short circuit the current source regardless of the combination of switch means that may be used.

The object of my invention, generally stated, is to selectively connect the terminals of electric valves and the like having a plurality of terminals in different arrangements and unidentifiable by visual inspection to a current source.

An important object of my invention is to test thermionic tubes using a minimum number of sockets of one type and a minimum number of switch units, so that any two terminals may be selected and connected to the leads of a current source without the possibility of operating a combination of the switch units that would short circuit the current source.

Another important object of my invention is to selectively connect the terminals of a current source to the heater filament terminals of thermionic tubes of the heater type having a separate cathode and a plurality of differently arranged terminals while the cathode terminal is connected to one of the current source terminals using a minimum number of sockets and switching units.

Other objects of my invention will, in part, be obvious, and in part appear hereinafter.

Accordingly, my invention is disclosed in the embodiments thereof shown in the accompanying drawings, and it comprises the features of construction, combination of parts, and arrangement of elements which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of my invention, reference may now be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 illustrates diagrammatically one embodiment of my invention for testing thermionic tubes;

Figure 2 illustrates diagrammatically another embodiment of my invention for testing thermionic tubes having a pair of heater filament terminals and a separate cathode terminal; and

Figure 3 illustrates diagrammatically still another embodiment of my invention for also testing thermionic tubes having a pair of heater filament terminals and a separate cathode terminal.

Referring now to Figure 1 of the drawings, a thermionic tube testing system is indicated generally at 8, including a 6-pin socket 9. The socket 9 is provided with pin receptacles or terminals A, B, C, D, E, and F, as shown. A heater element or filament 10 is shown connected across socket terminals B and D for heating a separate cathode 11 which is connected to socket terminal C. The secondary winding 12 of a transformer, shown generally at 13, has a primary winding 14 connected to a suitable alternating current source 15 and provides a filament current source for testing purposes. The terminals or leads of the secondary winding 12 are indicated at 16 and 17.

In order to selectively connect the socket terminals B and D to the terminals 16 and 17, double-pole double-throw switch units A', B', C', D', E', and F' are provided, as shown. Each of the switch units A', B', C', D', E', and F' comprises upper and lower poles 18 and 19 respectively, including upper and lower movable contact members 20 and 21. The contact members 20 and 21 may be mechanically interconnected for double-throw movement as indicated by the broken lines therebetween. When the upper

movable contact members 20 are in their upper operative positions they engage stationary contact members 22, which are connected in parallel circuit relationship to a circuit to which voltages for the electron control elements, such as the grid and plate, may be applied. When the lower movable contact members 21 are in their upper operative positions they engage the intermediate stationary contact members 23. The contact members 20 engage the intermediate contact members 23 when in their lower operative positions. When the lower movable contact members 21 are in their lower operative positions, they engage a set of stationary contact members 24 which are connected in parallel circuit relationship with the current source terminal 17. The intermediate contact members 23 of switch unit A' are connected to the current source terminal 16. The intermediate contact members 23 of switch B' are connected to the lower pole 19 of switch A', the intermediate contact members 23 of switch C' are connected to the lower pole 19 of switch B', etc. The upper poles 18 of the switch units are connected to corresponding socket terminals A, B, C, D, E or F, as shown.

With the switch unit A' in its upper operative position, moving switch unit B' to its lower operative position connects the socket terminal B to the terminal 16 through switch unit A' as shown. It will also be seen that with the switch unit B' in its lower operative position, all of the switch units to the right thereof are disconnected from the terminal 16. That is, when any one of the switch units is in its lower operative position, all of the switch units to its right will be disconnected from the terminal 16. Now when the switch unit D' is moved to its lower operative position, with switch C' remaining in its upper operative position, the socket terminal D is connected to the terminal 17 through switch units D', C' and B', as shown. Thus, the socket terminals B and D will be connected across the current source.

Regardless of what different combinations of operative positions the switches may occupy, it is impossible to short circuit the secondary winding 12. The tube base pin or the socket terminal connected to the switch unit furthest to the left and occupying its lower operative position is always connected to the terminal 16, while all base pins or socket terminals connected to switches to the right of this left switch can only be connected to the terminal 17 of the current source.

It will be noted that when a filament terminal is in the socket terminal B connected to the switch unit B', which is on the left of the switch unit C' to which the cathode terminal C is connected, it is possible to connect the filament terminals across the terminals 16 and 17 while the cathode terminal may be connected to terminal 17 by moving the switch C' to its lower operative position. However, if both of the terminals of filament 10 were connected to any two of the socket terminals D, E, and F, it would be impossible to connect the filament terminals to the opposite current source terminals 16 and 17 when the switch C' is in its lower operative position connecting the socket terminal C to the current source terminal 16. Instead, both of the filament terminals would be connected to the terminal 17 and the heater filament 10 could not be energized.

In order to insure that the filament terminals may always be connected to the opposite terminals of the current source no matter what base pin arrangement is involved, I have provided a tube testing system indicated generally at 30 in Figure 2 of the drawings. Two complementary sockets 9—X and 9—Y are provided with socket terminals A, B, C, D, E, and F. The socket terminals of sockets 9—X and 9—Y are interconnected in reverse order. That is, A to F, F to A; B to E, E to B; and, C to D, D to C. Now assuming a tube to be tested is inserted in socket 9—X having a separate cathode 31 connected to socket terminal B and a heater filament 32 connected to socket terminals at D and E. The socket terminals of socket 9—X are connected to the upper poles 18 of switch units A', B', C', D', E', and F', as in the tube test system 8 of Figure 1 of the drawings. With a view of testing the tube in socket 9—X the switch units A', B', C', D', E', and F' are operated as shown by the broken lines. That is, switches B', D', and E' are in their lower operative positions, while switches A', C', and F' remain in their upper operative positions. It will be seen that the socket terminal B to which the separate cathode 31 is connected will be connected to the current source terminal 16 through switches B' and A', while the filament socket terminals D and E will be connected to the current source terminal 17 through switches D', C', and B', and switches E' and D', respectively. Since the filament terminals in socket terminals D and E are both connected to current source terminal 17, the heater filament 32 cannot be energized. If the tube being tested is now removed from the socket 9—X and inserted into the socket 9—Y, and the switches A', B', C', D', E', and F' are operated to the positions shown in full lines, the cathode socket terminal B of socket 9—Y will now be connected to the current source terminal 17 through switches E', D' and C'. The filament socket terminal D of socket 9—Y will now be connected to the current source terminal 17 through switches C' and B', and the filament socket terminal E of socket 9—Y will now be connected to the current source terminal 16 through switches B' and A', as shown. It will thus be seen that any possible arrangement of the two heater terminals and separate cathode terminal of a tube to be tested can be handled in either socket 9—X or socket 9—Y of my tube test system 30.

With a view of testing in one socket a tube having filament terminals and a separate cathode terminal in the arrangement shown in Figure 2 of the drawings, I have provided a test system indicated generally at 40 in Figure 3 of the drawings. Only one socket 9 is used. Assume that the tube to be tested is of the same type as that discussed above in connection with system 30 of Figure 2 of the drawings. That is, a tube having a separate cathode 31 connected to socket terminal B, while the terminals of a heater filament 32 are connected to socket terminals D and E. Double-pole double-throw switches A', B', C', D', E' and F' are interconnected between themselves and are connected to the current source terminals 16, and 17, and to the current source for control of the tube elements, as shown in Figures 1 and 2 of the drawings. However, the upper switch poles 18 are connected to corresponding socket terminals A, B, C, D, E, and F through a six-pole double-throw switch indicated generally at 41, instead of being connected directly thereto, as in Figures 1 and 2. The switch 41 comprises

six sets of contacts 42 with a pole 43 for each set, as shown. Movable contact members 44 are provided which are mechanically interconnected for double-throw action as indicated by the broken line running therethrough. The different sections of the switch 41 may be designated as A'', B'', C'', D'', E'', and F''. The switch poles 43 are connected to corresponding socket terminals, as shown. The left hand contact member of each set of contacts 42 is connected to its corresponding pole 18 of the switches A', B', C', D', E', and F'. The right hand contact member of switch section A'' is connected to the switch pole 18 of switch F'. The right hand contact member of switch section B'' is connected to the pole 18 of switch E'. The right hand contact member of switch section C'' is connected to the pole 18 of switch D', etc. To test the tube in socket 9 the movable contact members 44 of switch 41 may be moved to their right hand position, as shown, and switches B' C', and E' may be thrown to their lower operative position, as shown. It will now be seen that socket terminal B, to which the separated cathode 31 is connected, is connected to the current source terminal 17 through switch section B'' and switches E', D', and C'. Socket terminal D will be connected to the current source terminal 17 through switch section D'' and switches C' and B'. And, socket terminal E will be connected to the current source terminal 16 through switch section E'' and switches B' and A'.

If when the movable contact members 44 of switch 41 are in the right hand position, the filament terminals of a tube being tested are both connected to the current source terminal 17, the movable contact members 44 may be then thrown to their left hand position allowing the filament terminals to be connected to the opposite terminals 16 and 17. This is equivalent to changing from one socket to another in test system 30 of Figure 2. A tube having any arrangement of filament terminals and a cathode terminal may thus be tested in the test system 40 by having the reversing switch 41 in either its left hand or right hand position, as the case may be.

In test systems 8, 30 and 40 of Figures 1, 2 and 3 of the drawings respectively, sockets have been shown having six socket terminals. It will be understood that tubes may be tested having any number of base pins in sockets with a corresponding number of socket terminals. For each socket terminal a corresponding double-throw switch unit is provided. The electrical connections of each test system will be according to the principles of my invention as set forth above in connection with Figures 1, 2 and 3 of the drawings.

Since certain further changes may be made in the foregoing constructions, and different embodiments of my invention may be made without departing from the scope thereof, it is intended that all matter described hereinbefore or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. Testing means for electric valves and the like having a plurality of terminals in different arrangements comprising, in combination, means providing a plurality of terminals adapted to be engaged by the terminals of said valves and the like, switch means individual to each of said terminals of said terminal providing means for selectively connecting the same to the terminals of a current source, and circuit means interconnecting said switch means in such manner that no combination of positions thereof will cause short circuiting of said current source.

2. Testing means for electric valves and the like having a plurality of terminals in different arrangements comprising, in combination, means providing a plurality of terminals adapted to be engaged by the terminals of said valves and the like, a double-pole double-throw switch unit individual to each of said terminals of said terminal providing means for selectively connecting the same to the terminals of a current source, and circuit means interconnecting said switch units in such manner that no combination of positions thereof will cause short circuiting of said current source.

3. Testing means for selectively connecting the filament terminals of thermionic tubes having a plurality of terminals in different arrangements to the terminals of a filament current source comprising, in combination, a socket providing terminals for receiving the terminals of said thermionic tubes, a double-pole double-throw switch unit individual to each of said socket terminals for selectively connecting the same to the terminals of said filament current source, and circuit connections between said switch units so arranged that no combination of positions thereof will cause short circuiting of said filament current source.

4. Testing means for thermionic tubes of the heater type having a separate cathode and having a plurality of terminals in different arrangements by which the heater filaments may be selectively connected to the terminals of a filament current source comprising, in combination, a socket providing terminals for receiving the terminals of said thermionic tubes, a double-pole double-throw switch unit individual to each of said socket terminals for selectively connecting the same to the terminals of said filament current source, and circuit connections between the switch units so arranged that no combination of positions thereof will cause short circuiting of said filament current source.

5. Testing means for thermionic tubes of the heater type having a separate cathode and having a plurality of terminals in different arrangements by which the heater filament terminals may be selectively connected to the terminals of a filament current source while the cathode terminal is connected to one of said filament current source terminals comprising, in combination, a first socket providing terminals for receiving the terminals of said thermionic tubes, a second socket providing terminals for receiving the terminals of said thermionic tubes, circuit connections interconnecting the terminals of said first and second sockets in reverse relationship, double-pole double-throw switch units individual to the socket terminals of one of said sockets, and circuit connections between said switch units so arranged that no combination of positions thereof will cause short circuiting of said filament current source.

6. Testing means for thermionic tubes of the heater type having a separate cathode and having a plurality of terminals in different arrangements by which the heater filament terminals may be connected to the terminals of a filament current source while the cathode terminal is connected to one of said filament current source terminals comprising, in combination, a socket providing terminals for receiving the terminals of said thermionic tubes, double-pole double-throw switch

units individual to each of said socket terminals, reversing switch means connected in circuit relationship between said switch units and said socket terminals whereby the connections therebetween may be reversed, and circuit connections between said switch units so arranged that no combination of positions thereof will cause short circuiting of said filament current source.

7. Testing means for electric valves and the like having terminals including filament terminals in different arrangements comprising, in combination, means providing a plurality of terminals adapted to be engaged by the terminals of an electric valve, a series of double-pole double-throw switches each individual to a terminal of said terminal means, circuit means interconnecting a first pole of each switch to the terminal individual thereto, a pair of spaced apart contact members for each switch pole adapted to be individually engaged thereby, circuit means commonly connecting corresponding contact members associated with said first switch poles to one terminal of a control voltage source, circuit means commonly connecting corresponding contact members associated with the second switch poles to one terminal of a current source, circuit means interconnecting the remaining two contact members of the first switch of said series to the opposite terminal of said current source, and circuit means interconnecting the second pole of each switch and the remaining two contact members of the next switch of said series.

8. Testing means for selectively connecting the filament terminals of thermionic tubes having a plurality of terminals in different arrangements to the opposite terminals of a test current source comprising, in combination, a socket providing terminals for receiving the terminals of said thermionic tubes, a series of double-pole double-throw switches each individual to a socket terminal, circuit means interconnecting a first pole of each switch to the socket terminal individual thereto, a pair of spaced apart contact members for each switch pole adapted to be individually engaged thereby, circuit means commonly connecting corresponding contact members associated with said first switch pole to one terminal of a control voltage source, circuit means commonly connecting corresponding contact members associated with the second switch poles to one terminal of said test current source, circuit means interconnecting the remaining two contact members of the first switch of said series to the opposite terminal of said test current source, and circuit means interconnecting the second pole of each switch and the remaining two contact members of the next switch of said series.

9. Testing means for thermionic tubes of the heater type having a separate cathode and having a plurality of terminals in different arrangements by which the heater filament terminals may be selectively connected to the terminals of a filament current source while the cathode terminal is connected to one of said filament current source terminals comprising, in combination, a first socket providing terminals for receiving the terminals of said thermionic tubes, a second socket providing terminals for receiving the terminals of said thermionic tubes, circuit connections interconnecting the terminals of said first and second sockets in reverse relationship, a series of double-pole double-throw switches each individual to a socket terminal of one of said sockets, circuit means interconnecting a first pole of each switch to the socket terminal individual thereto, a pair of spaced apart contact members for each switch pole adapted to be individually engaged thereby, circuit means commonly connecting corresponding contact members associated with said first switch poles to one terminal of a control voltage source, circuit means commonly connecting corresponding contact member associated with the second switch poles to one terminal of said filament current source, circuit means interconnecting the remaining two contact members of the first switch of said series to the opposite terminal of said filament current source, and circuit means interconnecting the second pole of each switch and the remaining two contact members of the next switch of said series.

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