April 7, 1936. J. H. MILLER 2,036,347

TUBE CHECKER

Filed July 26, 1935

Fig. 1.

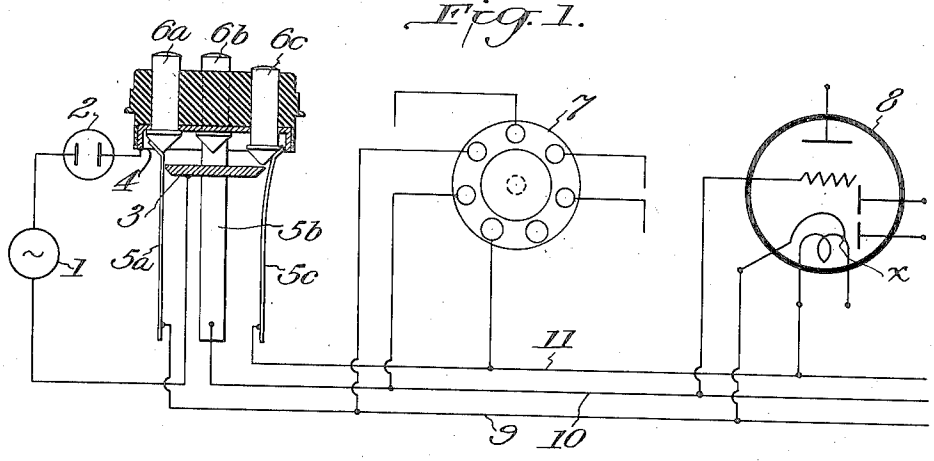


Fig. 2.

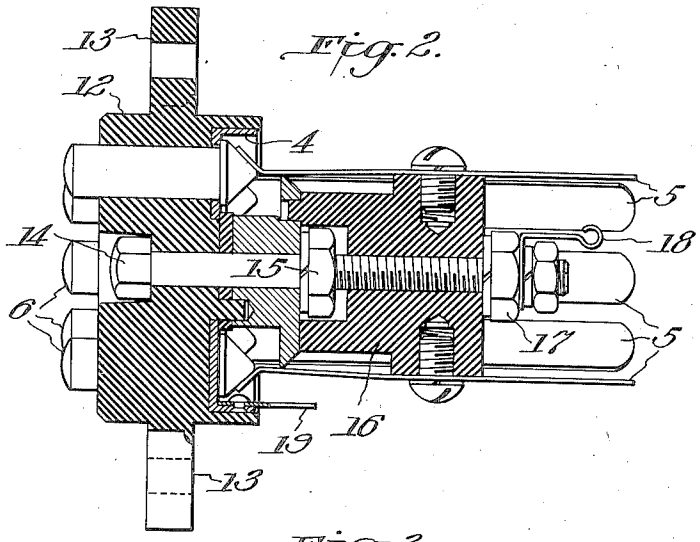
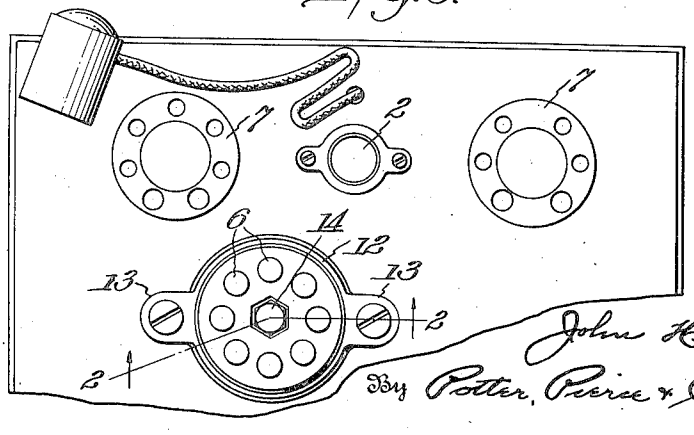


Fig. 3.



Inventor:

John H. Miller,

By Potter, Pierce & Scheffler,

Attorneys.

Patented Apr. 7, 1936 2,036,347

UNITED STATES PATENT OFFICE

2,036,347

TUBE CHECKER

John H. Miller, East Orange, N. J., assignor to Weston Electrical Instrument Corporation, Newark, N. J., a corporation of New Jersey

Application July 26, 1935, Serial No. 33,394

6 Claims. (Cl. 250—27)

This invention relates to apparatus for the checking of vacuum tubes, and more particularly to apparatus for making what is commonly termed a "short test", i. e. a test to determine whether or not a tube is shorted by the contact of two elements within the tube.

An object of the invention is to provide a short test checker of small size which, when incorporated in a tube checker, will not materially increase the size of the panel on which the instruments and switches required for other tests are mounted. An object is to provide a tube checker including a tube socket, a source of current in series with a signal device and a pair of spaced contact plates, a plurality of contact arms connected to the several terminals of the tube socket, the contact arms all normally engaging one contact plate, and buttons individually operable to shift the respective contact arms from normal engagement with one contact plate into engagement with the other contact plate. A further object is to provide a multiple switch assembly for use in a tube checker, the assembly including a pair of spaced contact plates of generally circular shape, a plurality of flexible contact arms normally engaging one contact plate, and buttons individual to the several contact arms for displacing the same from one contact plate to the other.

Therse and other objects and advantages of the invention will be apparent from the following specification when taken with the accompanying drawing, in which:

Fig. 1 is a fragmentary circuit diagram of a tube checker embodying the invention, the switch assembly being shown in somewhat schematic form;

Fig. 2 is a longitudinal section through the switch assembly on line 2—2 of Fig. 3; and

Fig. 3 is a fragmentary plan view of the panel of a tube checker in which the invention is incorporated.

In the circuit diagram, the reference numeral 1 identifies a source of current which may be, and preferably is, the usual 60 cycle, 110 volt lighting circuit customarily employed to energize tube checking apparatus. Only the short test portions of a tube checker are illustrated but it is to be understood that this apparatus will usually be incorporated in a more elaborate system for checking the mutual conductance and/or amplification factor of a tube. The source of current is connected in series with a signal device 2, such as a neon lamp, and a pair of spaced contact plates 3, 4 of a multiple switch assembly. The plates are parallel to each other and of generally circular form, the plate 4 being of somewhat larger diameter than the plate 3 and having an outer flange directed towards the same.

A plurality of flexible contact arms 5*a*, 5*b*, 5*c* are arranged about and normally contact with the plate 3, the outer ends of contact arms being bent towards but normally spaced from the flange of the plate 4. Pusher buttons 6*a*, 6*b*, 6*c* have conical ends resting upon the bent ends of the several contact arms and operate, when depressed, to shift the contact arms from engagement with plate 3 into engagement with the flange of plate 4. Only three contact arms and associated buttons are shown in Fig. 1, but the number of contact arms is equal to the maximum number of electrodes in any tube which is to be tested. Obviously, only one contact arm is provided for the pair of heater terminals, or filamentary cathode terminals. A single switch assembly may be associated with one or a plurality of tube sockets as the successive actuation of the push buttons will not result in false indications when checking a tube having less electrode elements than the number of switch contact arms. One tube socket 7 is shown in the circuit diagram and a second socket is indicated by the tube 8 which may be inserted in the same. As shown, a lead 9 connects contact arm 5*a* to a terminal of socket 7 and to the cathode terminal of tube 8. Contact arms 6*b*, 6*c* are similarly connected by leads 10, 11, respectively, to terminals of socket 7 and to the control grid or cap terminal and to one heater terminal of the socket receiving tube 8. In the complete assembly, there are other contact arms for connection to the other socket terminals and, for the testing of the tubes now in use, eight contact arms will usually be included in the switch assembly.

When a tube is inserted in a socket, the test for short circuits within the tube is made by progressively depressing the series of push buttons 6*a*, 6*b*, etc. The signal lamp 2 should not light during this operation since the contact arms do not simultaneously engage the contact plates 3, 4. A defective tube having, for example, a cathode shorted on the heater element, will be detected by the lighting of the neon tube when either the cathode or the heater contact is switched over to the contact plate 4. This defective condition is illustrated, at point x, in the tube 8. When push button 6*c* is depressed, a circuit is completed across the plates 3, 4 as the cathode lead 9 of that tube is connected to plate 3 through contact arm 5*a*, and the contact arm 5*c* which engages the rim of plate 4 is connected to the heater through the lead 11. Similarly, the depressing of push button 6*b* after releasing button 6*c* will energize the signal lamp.

It is usually sufficient to know that a tube is short circuited without ascertaining the particular electrodes which are in contact. The push buttons can be provided with legends to indicate the corresponding tube electrodes when it is de-

sirable to determine the location of the short circuit.

A practical form of switch assembly that occupies but little space on a tube checker panel is shown in Figs. 2 and 3. A cylindrical body member 12 of insulating material has a small flanged rim and lateral extensions 13 which rest against the outer face of a panel when the switch assembly is inserted in a circular opening in the panel. The inner face of the body member is recessed to receive the contact plate 4 which is held in place by an insulating washer 13 and a cylindrical extension or spool 3' which is integral with the contact plate 3. A bolt 14 extends axially through the body member and contact plates, and the parts are clamped in assembled position by a nut 15. A contact holder 16 of insulating material is fitted upon the inner end of the bolt and held in place by a nut 17. The bolt 14 is in metallic contact with the contact plate and carries a terminal lug 18 to receive the lead from the signal circuit. A short terminal 19 is riveted to the rim of the contact plate 4 to receive the other lead from the signal circuit.

A series of contact arms or flexible strips 5 are secured to the contact holder 16 and normally contact with the contact rim of the plate 3, the outer ends of the strips being bent towards the rim of the contact plate 4. The bent ends of the flexible contact strips bear against the inner conical ends of the push buttons 6 that are slidably mounted in cylindrical bores that extend through the body member 12 and contact plate 4. The push buttons move in lines parallel to the axis of the switch assembly, i. e. approximately longitudinally of the associated contact strips. It will be noted that the line of contact of each push button with its contact strip is so inclined to the longitudinal axis of the strip that the push button is normally held in raised position by the lateral pressure exerted thereon by the spring contact strip.

The several push buttons and their associated contact strips are held in alinement by short lugs 20, 21 of the body member 12 and contact holder 16 which enter openings in the spool 3' and contact plate 3, respectively.

The compact size of the switch assembly will be apparent from Fig. 3 which shows one panel arrangement of the body member 12 of the switch assembly, a pair of sockets 6 and the neon lamp 2.

It will be apparent that any desired number of contact strips may be incorporated in the short test switch and that any number of tube sockets may be associated with a single switch. While I have illustrated a preferred physical construction for a short test switch, it is to be understood that various changes which may be made in the size, shape and location of the several parts fall within the spirit of my invention as set forth in the following claims.

I claim:

1. In a tube checker, a circuit for testing to locate short-circuited tube elements, said circuit including a source of current and a signal device serially connected between spaced contact members, a plurality of contact arms normally engaging one contact member, means for individually separating the several contact arms from normal engagement with one contact member and engaging the same with the other contact member, a tube socket having a plurality of terminals, and connections between the socket terminals and said contact arms.

2. In a tube checker, a short test switch comprising a body member, a pair of contact plates at the inner side of said body member, means for securing one plate against the body member and the second plate parallel to and insulated from the first plate, a contact holder secured to said body member, a plurality of flexible contact strips mounted on said contact holder, each strip having an end portion adjacent the first contact plate and an intermediate portion normally in contact with the second plate, and push buttons slidably mounted on said body member, each push button being operable to flex the associated contact strip to engage the end portion thereof with the first contact plate after breaking the contact between the intermediate portion thereof and the second plate.

3. In a tube checker, a short test switch having a cylindrical body member adapted to be secured to a panel, a contact plate at the inner face of said body member, said plate having a cylindrical contact surface, a second contact plate having a cylindrical contact surface spaced from and coaxial with the contact surface of the first plate, a plurality of flexible contact strips arranged substantially in a cylindrical surface, each strip having an end adjacent the contact surface of the first plate and a second portion normally in engagement with the contact surface of the second plate, and push buttons slidable in said body member for contacting the ends of the several contact strips with the first plate and breaking the contact engagement with the second plate.

4. A tube checker as claimed in claim 3, wherein the ends of said contact strips are bent towards the cylindrical contact surface of said first plate, and said push buttons having conical inner ends for forcing the bent ends of the contact strips against the cylindrical contact surface.

5. In a tube checker, a short test switch comprising a cylindrical body member of insulating material, an annular contact plate at the inner face of said body and having an outer flange directed away from the same, a second contact plate having a circular contact surface of smaller diameter than said flange and spaced axially therefrom, a cylindrical contact holder of insulating material, a bolt passing through said body member and said contact holder to secure the same in axial alinement with said contact plates clamped between the same, a plurality of contact strips mounted on said contact holder and having free ends within and spaced from the flange of the first contact plate, said contact strips being flexible and normally engaging the contact surface of the second plate, and a push button for each contact strip, said buttons being slidably mounted in said body member and having inner ends engaging the free ends of the respective contact strips.

6. The invention as claimed in claim 5, wherein said push buttons are slidable parallel to the axis of the cylindrical body and longitudinally of the contact strips, the cooperating surface of each push button and its contact strip being inclined to the path of movement of the push button, whereby the resiliency of the spring strip restores the push button to normal position.

JOHN H. MILLER.