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E. PERDIJON

2,561,752

CONNECTING AND SWITCHING DEVICE

Filed June 29, 1949

2 Sheets-Sheet 1

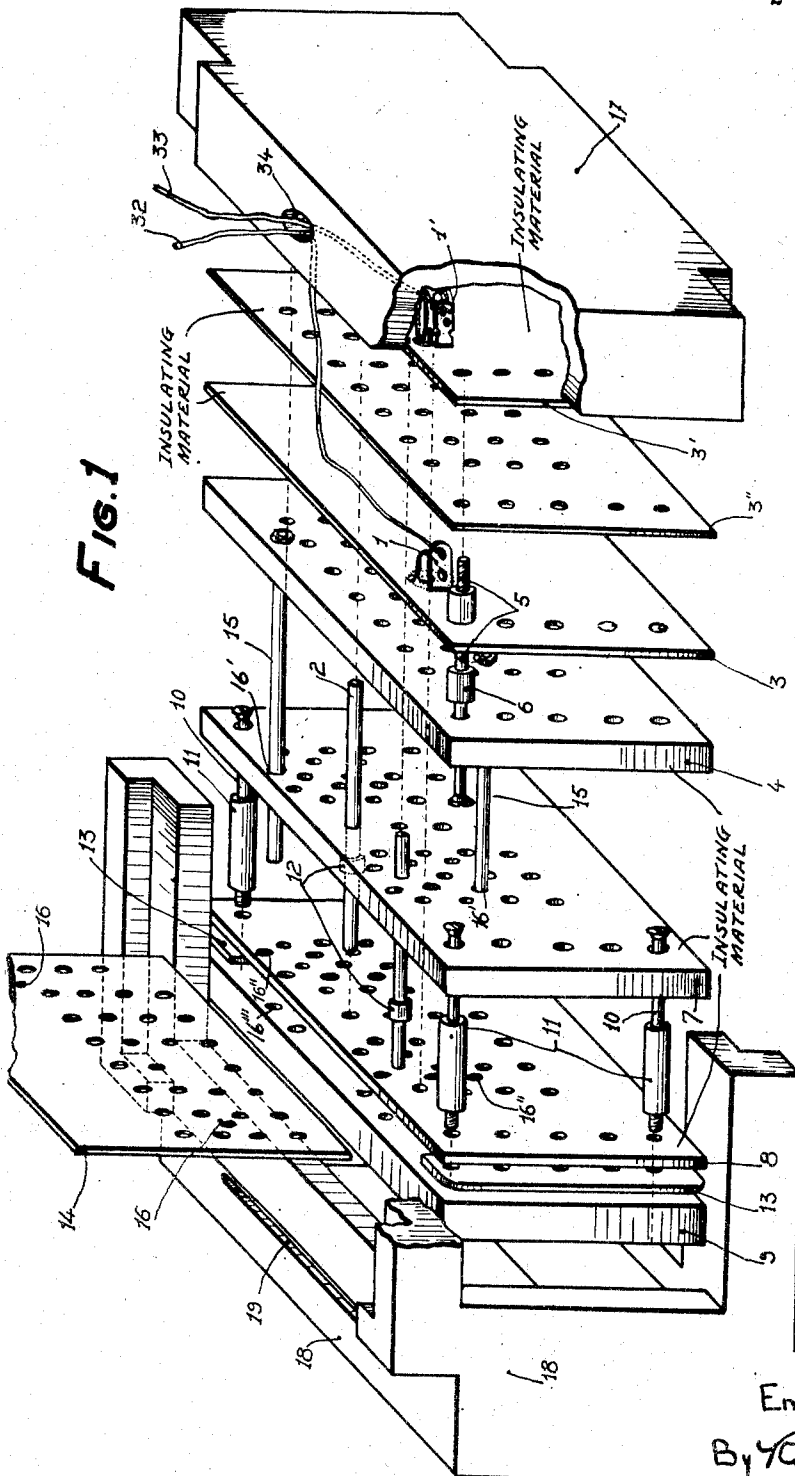


FIG. 1

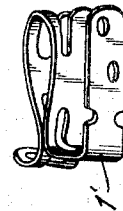


FIG. 6

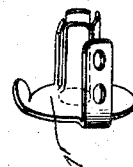


FIG. 5

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FIG. 4

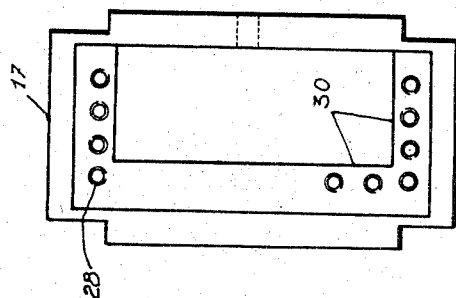


FIG. 3

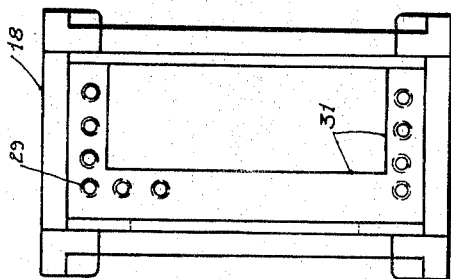
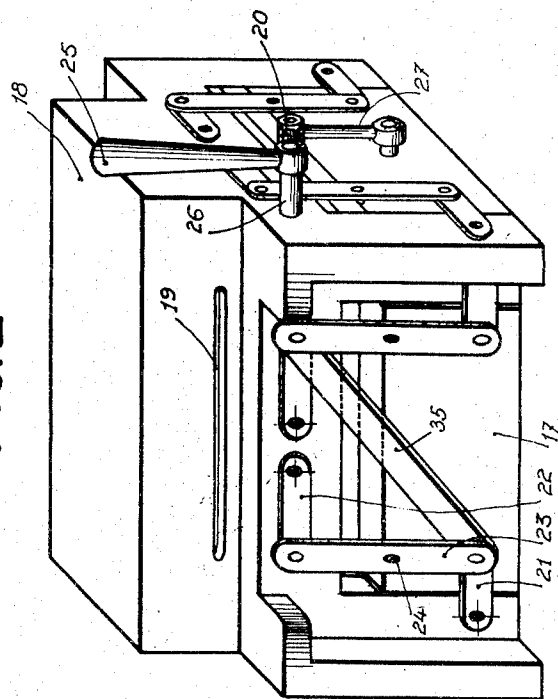


FIG. 2



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2,561,752

CONNECTING AND SWITCHING DEVICE

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6 Claims. (Cl. 200-46)

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This invention relates to connecting and switching devices.

It is an object of this invention to provide a device enabling any desired combination of electrical circuits to be established instantaneously and without any possibility of error.

The need for such a device is being felt increasingly in connection with certain measuring devices, for example such as are used for testing radio tubes.

Considering the great number of valve types and the great variety of operating conditions of such valves it is indispensable, when testing them under normal operating conditions, to apply to various elements of the valve the required voltages. Hitherto such a test was a lengthy and intricate operation requiring highly-skilled workers.

In order to facilitate these measuring operations, multiple-circuit switches have been designed which are provided with as many contacts of each polarity and as many rods as there are circuits to be connected. In these devices the rods corresponding to the circuits to be connected are pushed through perforations provided in a card to establish connection between the contact members of the several circuits.

This old type of device operates with perforated cards in which the arrangement of the perforations varies according to the circuits which are to be established, so that by merely placing suitable reference marks on the cards, the one corresponding to the desired circuit combination can be traced without difficulty. In these devices the rods are usually provided with a return spring which is compressed, when the contacts are closed. It is obvious that the greater the number of rods actuated for each combination, the greater must be the effort to be made to compress the springs.

The present invention has for its object to eliminate this drawback. One characteristic feature of this invention is the fact that the card itself which corresponds to the desired circuit combination, forms the selecting and operating means.

According to another feature of the invention, the new device is a combination of one structure having circuit-closing members mounted thereon, and a second structure in which the contact establishing rods are arranged for free sliding movement in guides having the same geometrical arrangement as the circuit-closing members of the structure first mentioned, the second structure also offering facilities for introducing a perforated card. The two structures are relatively movable in a direction parallel to the rod axes, so

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that during their movement the rods selected by the card are advanced by means of the card to act upon the circuit-closing means registering with these rods.

Other features and advantages of the invention will appear from the specification in connection with the drawings affixed to it, which illustrate a preferred embodiment diagrammatically by way of example.

This specific embodiment is particularly adapted for use in the testing of multi-electrode valves or tubes, but it will be clear that the invention is also applicable to any other case requiring the establishment of a greater variety of circuits, notably when statistic machinery, telephone circuits, etc. are concerned. It is applicable not only to electric, but also to hydraulic circuit combinations.

The principal advantages offered by the device according to the invention are its simple design and the practically unlimited number of combinations which can be made with its aid. In addition, when the invention is applied to the closing of various electric circuits, it offers the further advantage, in comparison with prior art systems, that the contact-closing members employed are highly efficacious and automatically cleaned by frictional engagement with the contact establishing members (rods).

In the drawings:

Fig. 1 is an exploded perspective view of the various component members of the device according to the invention;

Fig. 2 is a perspective view of the casings enclosing the two main parts of this device, while

Figs. 3 and 4 are a plan view and an inside view, respectively, of the casings, and

Figs. 5 and 6 are perspective views of the two types of contact-closing sockets fit to be used in the switching operations according to the invention.

Referring to the drawings and first to Fig. 1, the device illustrated comprises as many contact sockets 1-1' of each polarity and as many rods 2 as there are circuits to be controlled by the device.

The contacts 1-1' are mounted on perforated insulating plates 3-3' formed with the perforations in axial alignment and constituting grids, the sockets 1-1' being mounted in these perforations and the rods 2 being also in axial alignment with the sockets, so that by threading the rods 2 into the sockets 1-1' the latter will be electrically connected and the corresponding circuit closed. While the threaded tips of the rods are called

upon to establish conductive contact between the sockets, the entire lengths of the rods will be made of metal for practical reasons.

The plates 3—3' acting as supporting members for the sockets 1—1' and shown on the right in Fig. 1 are secured to a structure consisting essentially of a plate 4 of insulating material carried at its four corners by screw-threaded braces 5 arranged at right angles to the plate. The plates 4, 3 and 3' are held in parallel spaced relation by means of spacers 6 mounted on the braces 5. A perforated intermediate plate 3'' is inserted between the plates 3 and 3' to prevent any undesired contact between the sockets 1 and 1'. This entire assembly is firmly fitted together to form the first of the two rigid units. The plate 4 is also formed with perforations in axial alignment with the perforations of the plates 3—3', that is to say in alignment with the pair of contact sockets belonging to the same circuit.

The rods 2 are mounted for free sliding movement in a second structure consisting of insulating grids or plates 7 and 8, also formed with perforations in axial alignment with those of the plates 4, 3, 3'' and 3'. This structure is fixed to a base plate 9 and forms the guiding means for the rods 2 which can move axially therein without any appreciable friction.

The plates 7, 8 and 9 are thus connected to form the second rigid structural unit by means of screw-threaded braces 10 on which are also mounted tubular spacers 11 which hold these plates in parallel spaced relation. All the rods 2 are cylindrical and uniformly dimensioned. Each one carries a collar 12. The rods 2 engage, on either side of the collars 12, the perforations of the plates 7 and 8. Marginal plate sections 13 inserted between the plates 8 and 9, are fixed on the braces 10 in such manner that the clearance between the plates 8 and 9 is somewhat greater than the thickness of the perforated card 14 serving for closing the circuit desired. The sections 13 are so shaped that they allow the card to be freely inserted between the plates 8 and 9, the lateral sections serving as guide members, while the bottom section which in the drawing is hidden behind the plate 8, forms an abutment for the bottom edge of the card.

The screw-threaded braces 10 are firmly secured to the plates and the entire assembly forms a rigid structure with all corresponding perforations in axial alignment. Thus, the rods can move freely with the minimum of friction in both directions in the perforations as far as the collars 12 admit such movement.

The length of each rod at one side of its collar is so chosen that the corresponding end is engaged in a predetermined perforation of the plate 8 when the collar 12 abuts against the plate 7, without this rod end protruding from this perforation thereby allowing a card 14 to be inserted in the gap.

The card 14 is formed with less perforations than there are rods or circuits provided. Consequently, while some rods are free to slide axially through the perforations in the card 14, other rods will be stopped by unperforated card sections. These card sections therefore determine the circuits that can be formed with the card. In order to close the circuit represented by the selected card 14, it will be sufficient to start a linear movement of the rod-carrying structure and the contact-carrying structure towards each other in parallel with the rod axes, whereby each rod will engage its corresponding pair of sockets and

establish contact between them. During this movement each rod registering with a perforation in the card 14 is simply stopped by the socket 1 which it meets, while any rod stopped by the card 14 is pushed by it through the socket 1 and through the corresponding socket 1'. The sockets 1 and 1' are thus electrically connected and the corresponding circuits will be closed.

The circuit combinations which can thus be made are of course a function of the number of pairs of sockets 1—1' or rods 2 and correspond to all conceivable combinations of perforations of the cards 14.

The device above described operates with a number of cards 14 which is as great as the number of possible circuits or circuit combinations, each card having a proper reference mark allowing to trace at a glance the combination which can be made therewith, so that no mistake will be possible.

A safety device is also provided for preventing the operator from inserting the selected card 14 in a faulty manner, for instance in an upside-down position or in only partly inserted position. To this end, the righthand unit has a pair of rods 15 mounted thereon in parallel with the axis of the rods 2 and secured to the plate 4, but in sliding engagement with the left hand unit part through perforations 16', 16'' and 16''' which allows these rods to pass through the plates 7, 8 and 9. The card 14 comprises two perforations 16 corresponding to the rods 15 which are allowed to pass therethrough. The perforations 16 are arranged asymmetrically in the card 14 so that if the card is inserted for example upside-down, the rods 15 will engage a non-perforated section, thus preventing the two units from being moved toward each other, and thereby also preventing the closing of a circuit. The positions of the rods 15 and the series of perforations 16', 16'' and 16''' are so arranged that at least one of these series of perforations is positioned forwardly of the first row of normal perforations provided for the passage of rods 2 through the plates 7 and 8, so that the leading edge of the card being inserted between the two units will reach this series of perforations before it reaches the outer row of the normal perforations.

The two units forming the new device are fitted in suitable casings 17, 18 (Figs. 2-4) serving to protect them from dirt and dust. The casing 18 is formed with a slot 19 for the introduction of the card 14. The two movable units are guided by means of three-link hinges of a well known kind which consist of two links 21, 22 of even length, pivotally mounted on the casing 18 and connected by a link 23 of suitable length. Under these conditions the middle point of the connecting link 23 will follow a substantially rectilinear path. A pivot pin 24 secured to the casing 17 enters the middle of the connecting link 23. Preferably each side of the casings is provided with a pair of symmetrically disposed three-link devices connected by an additional link having one end pivotally mounted on the pin which connects the link 21 with the link 23 of one device, while its other end is also pivotally mounted on the pin connecting the link 21 and the link 23 of the other device on one side of the casing, so that the displacements of the middle points 24 of both links 23 will be equal in length.

The casings 17 and 18 are connected by means of a plurality of identical three-link devices with a minimum of two arranged on two orthogonal

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faces of both casings, respectively. However, for the sake of symmetry it is preferable to provide one device of this type on each side of the two casings. With these devices it will be possible to make the two casings perform a relative rectilinear movement without causing any friction between the parts. A handle 25 is fixed to one end of a shaft 26 mounted for rotation in the casing 18, and has fixed to it an arm 20 connected to the other casing 17 by means of a link 27.

The casing 17 is arranged beneath the casing 18 so that the rods 2 can normally meet the sockets 1 by gravity, thus uncovering the gap between the plates 8 and 9 into which the selected card 14 can now be introduced. When this card has been inserted in its operative position, the casing 17 and with it all the rods 2 can be lifted by operating the handle 25. Some of the rods will follow the rectilinear motion without any difficulty and will pass through the perforations in the card 14, while others will abut against unperforated sections of the card and be stopped thereby. They will therefore engage the sockets 1, 1' in succession, thus closing the desired circuit or circuits according to the perforation of the card inserted. By operating the lever 25 in the opposite direction the casing 17 will be moved away from the casing 18 and the sockets 1—1' will be freed from the rods which connected them, by the action of the collar portions 12.

Of course, the device above described, instead of being utilized in the position in which the rods 2 bear freely by gravity upon the sockets 1, may be used in any other position. In this case, catches may be provided for holding the rods applied against the opening ends of the sockets 1.

In Figs. 5 and 6 are shown types of sockets which may be used with advantage in the device above described. These types of sockets may be replaced by any other known type adapted to ensure an efficient contact with the rods 2. As these various types of sockets are well known in the art, it is not deemed necessary to describe them in detail.

The first (contact-closing) unit is secured within the casing 17 for example by means of the end portions of the screw-threaded braces 5 which may be screwed into screw-threaded perforations 28 provided in the casing (Fig. 4). The second (rod-carrying) unit can be fastened, for example by means of the end portions of the screw-threaded braces 10, which are screwed into corresponding perforations 29 in the bottom of the casing 18 (Fig. 3). A shoulder portion 30 is provided in the bottom of the casing 17 (Fig. 4) to form the free space required for the sockets 1', a similar shoulder portion 31 being also provided in the bottom of the casing 18 (Fig. 3) to allow the end portions of the rods 2 to move.

The sockets 1 and 1' are connected with their respective circuits by means of conductors 32 and 33, jointed together to form a wire which passes

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through an orifice 34 provided in the casing 17.

I wish it to be understood that I do not desire to be limited to the details shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In a device of the kind described in combination, a plurality of substantially identical grids of insulating material, a plurality of conductive push rods extending through and freely movable in said grids, current carrying contact sockets provided at two of said grids, and means for moving said two grids toward a third grid to establish bodily contact of said rods with said sockets, a clearance being left between said third grid and a fourth grid for the insertion of a perforated stop card barring the way to an end of at least one of said rods, as they move relative to the grids.

2. The device of claim 1, wherein said grids are formed by plates of insulating material formed with a plurality of identically arranged perforations.

3. The device defined in claim 1, wherein said third and fourth grids are combined in a rigid unit by means of marginal plate sections secured between them, whereby to establish the said clearance between said third and fourth grids to permit the insertion of the perforated stop card.

4. The device of claim 1, in which spacing collars are provided on some rods.

5. The device of claim 1, wherein said grids are assembled in two units, said push rods are adapted to pass through corresponding perforations of the grids of both units, said two grids carrying said sockets are assembled to one of said two units, and said third and fourth grids defining said clearance for the insertion of various perforated stop cards are assembled in the other of said two units, said clearance being provided by means of marginal plate sections between said third and fourth grids.

6. The device of claim 1, wherein said grids are assembled in two units, said push rods are adapted to pass through corresponding perforations of the grids of both units, said two grids carrying said sockets are assembled in one of said units, said third and fourth grids defining said clearance for the insertion of various perforated stop cards are assembled in the other of said units, the said clearance being provided by means of marginal plate sections between said third and fourth grids, each unit comprising a protective casing supporting said grids and said units being arranged for rectilinear translation movement parallel to the direction of said push rods.

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No references cited.