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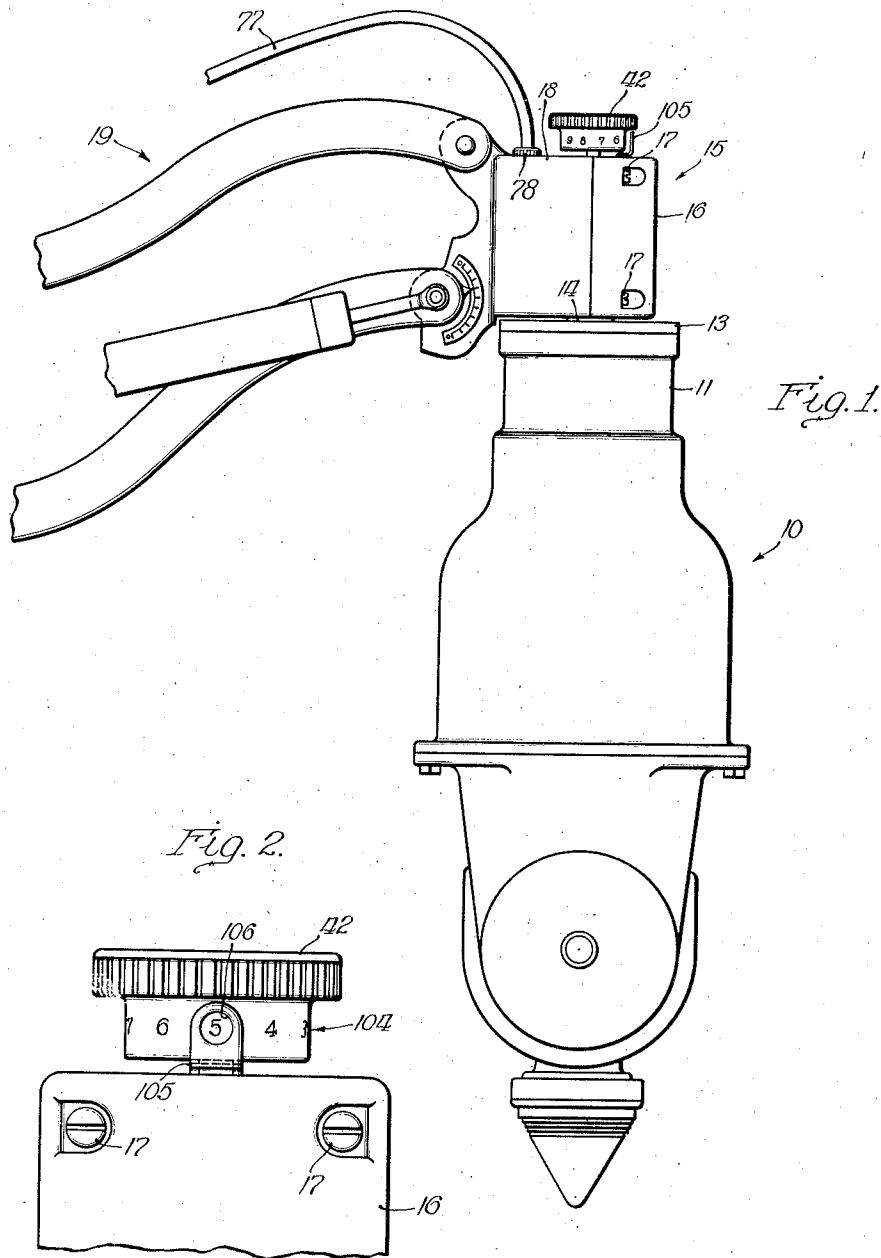
O. H. PIEPER

2,140,299

REGULATOR APPARATUS FOR X-RAY MACHINES

Filed Feb. 8, 1937

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

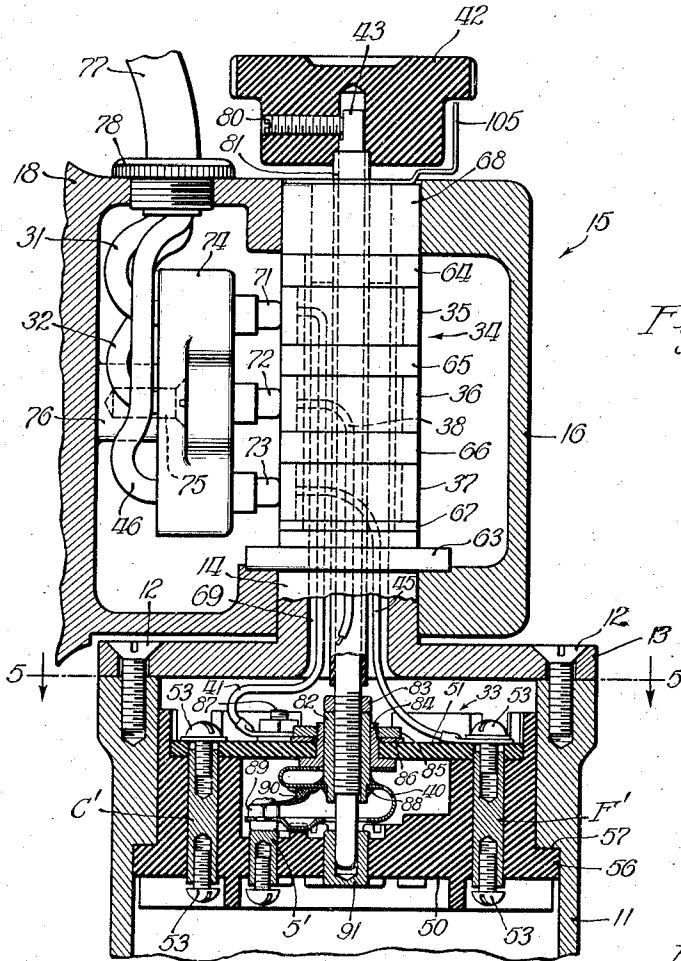
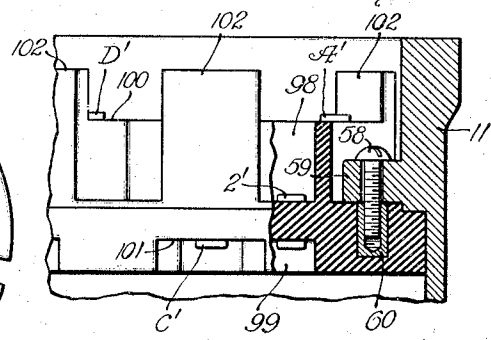
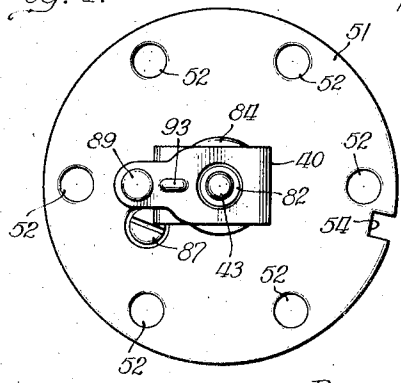


Fig. 3.

Fig. 6.

Fig. 4.



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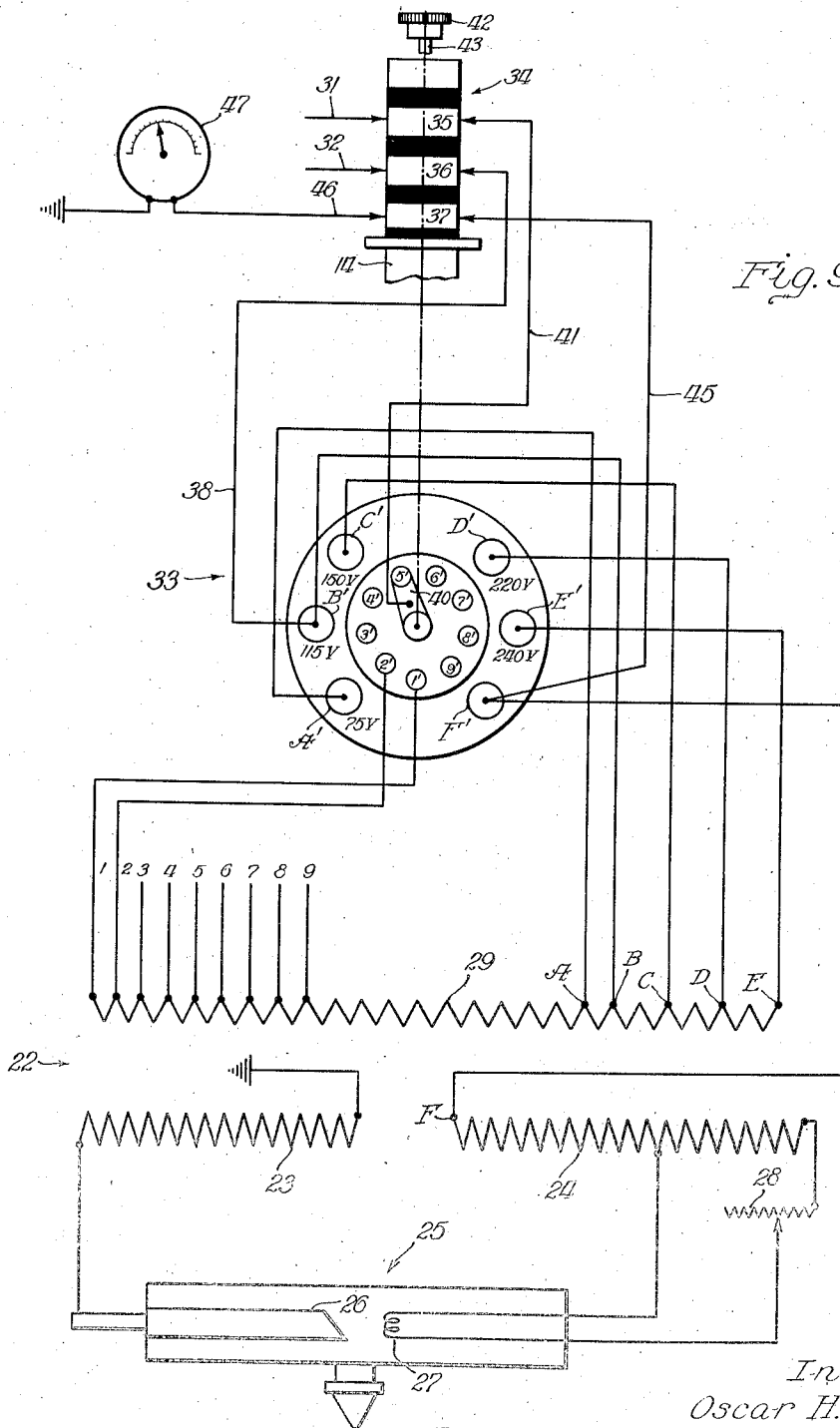


Fig. 9.

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# UNITED STATES PATENT OFFICE

2,140,299

## REGULATOR APPARATUS FOR X-RAY MACHINES

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Application February 8, 1937, Serial No. 124,644

11 Claims. (Cl. 200—11)

My invention relates, generally, to X-ray apparatus and it has particular relation to regulating means for adapting such apparatus to the voltage of the circuit to which it is connected.

5 At the present time X-ray apparatus is widely used, particularly by the medical profession. It is finding widespread use in the dental profession. For such uses it must be so designed that it will be readily adaptable to varying operating conditions.

10 One of the chief difficulties that is encountered in the design of such apparatus, aside from the features of construction of the apparatus itself, lies in the provision of means for readily and simply connecting it to energizing circuits the voltage of which may vary widely from a normal fixed voltage and in which there is a wide variation in the normal voltages. It is desirable, from a manufacturing standpoint, to provide for constructing a single piece of equipment that may be readily adjusted to take care of differences either in normal circuit voltages or slight departures from any normal voltage. It is then unnecessary to carry a stock of apparatus that is especially designed for each normal operating voltage, but rather, only a single line of apparatus need be carried, each unit being adjustable as required. The normal voltage of a circuit that is available for energizing the apparatus is usually one of the following: 75, 115, 150, 220 or 240 volts, depending upon the particular locality and the customary circuit voltages in that locality. These are only normal voltages, however, and the actual voltage that is available may vary from these normal voltages, in some cases by an appreciable percentage. This variation is caused by poor voltage regulation on the circuit, which usually is the result of overloading of the circuit.

35 In order to obtain consistent results in X-ray practice, it is essential that the apparatus operate under substantially identical conditions. That is, the voltage that is applied across the terminals of the X-ray tube should remain substantially constant so that one variable may be eliminated from a consideration of the final results.

40 Ordinarily, the X-ray apparatus for use by a dentist is mounted in a housing that is rotatably mounted on a support bracket that is so constructed that the entire unit may be readily moved toward and away from the dental chair. In order to connect the X-ray apparatus to the energizing circuit a current collector is provided in the form of slip rings that rotate with the X-ray apparatus and its housing. Brushes are mounted on the supporting structure and bear on the slip rings for providing the necessary electrical connections.

45 It has been the practice in the past to connect the circuit to the current collector through a

separate transformer, such as an auto-transformer, the connections to which may be adjusted to take care of variations from the normal circuit voltage. Such a system involves the provision of a separate piece of apparatus, which is undesirable not only from a cost standpoint but also for the reason that additional space must be provided in the dentist's office for it.

Accordingly, the object of my invention, generally stated, is to provide a voltage regulating mechanism for X-ray apparatus and the like that will be simple and efficient in operation, which may be readily and economically manufactured and installed, and which will require a minimum of space.

The principal object of my invention is to provide for manually adjusting the connections to an energizing circuit of X-ray apparatus that is rotatably mounted on a support bracket, the adjusting means being operable through the mounting means.

20 An important object of my invention is to provide for manually adjusting a transformer tap changing device through a current collector and rotatable mounting for a housing containing the transformer.

Another object of my invention is to provide for manually adjusting a transformer tap changing device through a current collector and rotatable mounting for a housing containing the transformer and registering accurately the contact arm of the tap changing device with any of the stationary contact members.

A further object of my invention is to provide for registering accurately the contact arm of a tap changing device that is operable through a rotatable mounting with any of the stationary contact members of the device and, at the same time, indicating externally the particular contact member that is engaged.

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

My invention, accordingly, is disclosed in the embodiment hereof shown in the accompanying drawings, and it comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the appended claims.

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

55 Figure 1 is a view, in side elevation, of an X-ray device in which my invention is embodied and which is particularly adapted for use by a dentist;

60 Figure 2 is a fragmentary view, in front eleva-

tion, of the support bracket and adjusting knob, shown in Figure 1;

Figure 3 is a view, partly in section and partly in side elevation, showing the details of construction of the tap changing device;

Figure 4 is a view, in bottom plan, of the bearing plate and contact arm;

Figure 5 is a sectional view, taken along the line 5—5 of Figure 3;

Figure 6 is a detail sectional view, taken generally along the line 6—6 of Figure 5, certain of the parts being shown in elevation;

Figure 7 is a view, in top plan, of the terminal and contact support member;

Figure 8 is a view, in bottom plan, of the terminal and contact support member shown in Figure 7; and

Figure 9 illustrates diagrammatically the circuit connections that may be employed in practicing my invention.

Referring now particularly to Figures 1 and 3 of the drawings, it will be observed that the reference character 10 designates, generally, a housing for X-ray apparatus that is provided with a neck portion 11 at the upper end thereof. The neck portion 11 may be integrally formed with the housing 10 or it may constitute a separate part and be secured to the housing 10 as may be desired. The neck portion 11 is secured, as by screws 12, to a flange 13 which forms a part of a hub 14 that is arranged to be rotatably mounted in a support member, shown generally at 15. The support member 15 comprises a removable cover 16 that is secured by screws 17 to a support bracket 18. A support structure, shown generally at 19, is provided for carrying the support bracket 18, as illustrated. Only a portion of the support structure 19 is shown in the drawings, since it forms no part of my invention. It will be understood that the combination of the support member 15 rotatably mounting the hub 14 and the housing 10, together with the support structure 19, readily permits the positioning of the X-ray apparatus at the particular point that is desired and also permits the removal thereof, for example, from the vicinity of the dentist's chair, when it is no longer needed.

The apparatus that is mounted within the housing 10 and the support member 15 is illustrated diagrammatically in Figure 9 of the drawings, to which reference will now be had in order to more clearly set forth the novel features of my invention.

Mounted within the housing 10 is a transformer, shown generally at 22, having secondary windings 23 and 24 that are arranged to energize an X-ray tube, shown generally at 25, that is also mounted within the housing 10. The X-ray tube 25 is provided with the customary anode 26 and cathode 27, the anode being connected to one end of the secondary winding 23 and the cathode being connected across a portion of the right-hand end of the secondary winding 24 through a variable resistor 28 for heating it to the required operating temperature.

The transformer 22 is provided with a primary winding 29 that is arranged to be connected for energization across an alternating current circuit represented by the conductors 31 and 32. A terminal and tap changing device, shown generally at 33, and a collector device, shown generally at 34, are interposed between the primary winding 29 and the circuit conductors 31 and 32 for reasons that will presently be set forth.

As indicated hereinbefore, it is desirable to

manufacture apparatus of the type disclosed herein that will be readily adaptable for use in connection with power circuits the normal voltages of which may widely vary and in which there may also be a considerable variation in each of the normal voltages. That is, the apparatus should be so arranged and constructed that only a slight change in connections is required to adapt it for a different normal voltage, and a simple and efficient adjusting means should be provided to take care of any departures of the circuit voltage from its normal value.

In order to accomplish one of these results, the primary winding 29 is provided, at its right-hand end, with a series of taps A, B, C, D and E. These taps are connected to corresponding terminals A', B', C', D' and E' that are mounted on the terminal and tap changing device 33. These terminals correspond to different normal circuit voltages, such as 75, 115, 150, 220 and 240, as illustrated.

The second desired feature of construction is provided by a series of taps 1 through 9, at the left-hand end of the primary winding 29. By selectively connecting these taps to the energizing circuit it is possible to compensate for variations in the voltage above or below the normal circuit voltage. This adjustment is common to each of the taps A, B, C, D or E, as will be readily understood.

For the purpose of effecting this adjustment the terminal and tap changing device 33 is provided with contact members 1' through 9' that may be connected to the taps 1 through 9, respectively.

With a view to readily connecting the terminal and tap changing device 33 to the circuit conductors 31 and 32, the collector device 34 is provided with slip rings 35 and 36. The collector device 34 is also provided with an additional collector ring 37, the purpose of which will be presently set forth.

The circuit conductor 32 may be connected through the slip ring 36 and to any one of the terminals A', B', C', D' or E', by the conductor 38, as may be desired. For example, if the normal voltage of the circuit represented by the conductors 31 and 32 is 115 volts, the conductor 38 may be connected to the terminal B'. If the normal circuit voltage is 220 volts, then the conductor 38 will be connected to the terminal D'.

Connection to any one of the contact members 1' through 9' is provided by a contact arm 40 which is rotatably mounted about the center of the ring of the contact members. The contact arm 40 is connected by conductor 41 to the slip ring 35, which in turn is connected to the circuit conductor 31. An operating knob 42 is mounted on an operating stem 43 which carries the contact arm 40 for adjusting the same. The details of construction of the terminal and tap changing device 33 and the operating means therefor will be set forth hereinafter.

It will be observed that the left-hand terminal F' of the secondary winding 24 is connected to a corresponding terminal F' on the terminal and tap changing device 33. A conductor 45 is provided for connecting the terminal F' to the slip ring 37 which is connected by a conductor 46 to a milliammeter 47 that is connected, as illustrated, to ground. Since the right-hand terminal of the secondary winding 23 is also connected to ground, it will be observed that the secondary windings 23 and 24 are connected electrically in series circuit relation. The milliammeter 47 provides an

indication of the current flow through the X-ray tube 25 and gives an indication of whether or not the proper operating voltage is applied thereto. For any particular normal circuit voltage, variations therefrom, as noted by the reading of the milliammeter 47, may be compensated for by moving the operating knob 42.

Referring again to Figure 3 of the drawings, it will be observed that the terminal and tap changing device 33 comprises a terminal and contact support member 50 that is formed preferably of moulded insulating material, such as a phenolic condensation product. Mounted on top of the support member 50 is a disc-like bearing plate 51 that is also preferably formed of insulating material. The bearing plate 51 is provided with clearance holes 52 that fit over the upper ends of the terminals A', B', C', D', E' and F'. These terminals, and the contact members 1' through 9', are preferably moulded integrally with the terminal and contact support member 50. In this manner they are securely held in insulated spaced relation. It will be observed that both ends of the terminals A' through F' are threaded, while only the lower ends of the contact members 1' through 9' are threaded. Screws 53 are positioned in these threaded ends to permit connection of conductors thereto, as illustrated. The bearing plate 51 is provided with a notch 54 that interfits with a lug 55, (Figure 5), for centering it in position in the terminal and contact support member 50. The support member 50 is provided adjacent its lower end with an integrally formed radially extending flange 56 that interfits with a corresponding shoulder 57 on the neck portion 11. The flange 56 and shoulder 57 serve to position the support member 50 within the neck portion 11, and it is secured therein by screws 58 that extend through inwardly extending apertured lugs 59, formed integrally with the neck portion 11, that are threaded into inserts 60 which are moulded integrally with the support member 50. This construction is more clearly shown in Figures 5 and 6 of the drawings.

Referring particularly to Figure 3 of the drawings, it will be observed that the hub 14 is journaled in semi-circular openings at the lower ends of the cover 16 and support bracket 18. A flange 63, integrally formed with the hub 14, provides a bearing surface for resisting downward thrust. A sleeve of insulation surrounds the intermediate portion of the hub 14 and portions 64, 65, 66 and 67 are positioned above and below the slip rings 35, 36 and 37 for holding them in insulated spaced relation. The upper end 68 of the hub 14 is journaled in suitable semi-circular openings in the upper ends of the cover 16 and the support bracket 18.

With a view to providing a passageway for the conductors 38, 41 and 45, the hub 14 is provided with an internal opening at 69. These conductors are connected internally to the slip rings 35, 36 and 37. Brushes 71, 72 and 73, slidably mounted in a brush holder 74, are provided for engaging the slip rings 35, 36 and 37, respectively. The brush holder 74 may be secured by screws 75 to bosses 76 that are formed integrally with the support bracket 18. The conductors 31, 32 and 46 may be formed into a single cable, as indicated by the reference character 77, and an insulating bushing 78 may be threaded into a suitable opening on the upper side of the support bracket 18 for bringing them into the interior thereof. When the X-ray apparatus is mounted and con-

nected in this manner it is freely rotatable to any position and the necessary circuit connections are maintained.

As illustrated, the knob 42 is formed of insulating material and it is secured against rotation, to the operating stem 43, by a set screw 80. One side of the upper end of the operating stem or rod 43 is slabbled off to provide a seat for the inner end of the set screw 80. The operating rod or stem 43 is rotatably mounted in a sleeve of insulation that fits tightly inside of the upper end 68 of the hub 14. The sleeve 81 of insulation extends throughout the length of the operating rod or stem 43 inside of the hub 14 and up into the operating knob 42 for the purpose of providing adequate insulation. A bearing sleeve 82 is threaded on the lower end of the operating stem or rod 43 and is secured in position by a lock nut 83. The bearing sleeve 82 is journaled in a bearing 84 which extends through a centrally located aperture in the bearing plate 51. The upper end of the bearing 84 is threaded for receiving a nut 85 that not only serves to hold the bearing 84 in position but also serves to clamp a pear-shaped terminal 86 thereto in contact therewith. A screw 87, extending through the bearing plate 51 and the terminal 86, is provided for connecting the conductor 41 thereto.

The contact arm 40 is formed preferably of flexible copper strap or like material into a substantially S-shape, the intermediate portion of which is apertured for fitting over the lower end of the bearing sleeve 82 and which is soldered thereto as indicated at 88. The lower end of the contact arm 40 is provided with a contact screw the lower surface of which is arranged to engage the contact members 1' through 9'. A flexible conductor 90 is soldered to the contact screw and to the intermediate portion of the contact arm 40 in order to insure a good electrical connection therebetween. The upper end of the contact arm 40 bears against the under flat surface of the bearing 84 for completing a circuit to the conductor 41.

A guide member 91, in the form of a metal sleeve that is closed at its lower end, is integrally formed with the terminal and contact support member 50 at the center thereof for guiding the lower end of the operating stem or rod 43.

It is desirable that some means be provided for accurately registering the contact screw 89 with the contact members 1' through 9'. For this purpose the under side of the lower portion of the contact arm 40 is provided with an index member 93 that is formed by upsetting a portion of the contact arm 40. This arrangement is best shown in Figure 4 of the drawings. The index member 93 is arranged to interfit with the several serrations 94 of an index ring 95 that is integrally formed with the terminal and contact support member 50 and is disposed within the ring of contact members 1' through 9', as illustrated in Figure 7 of the drawings. Each of the serrations 94 is individual to one of the contact members, so that when the index member 93 is inter-fitted therewith the contact screw 89 accurately registers with the contact member corresponding thereto. A stop member 96, formed integrally with the terminal and contact support member 50, is positioned in the path of movement of the lower end of the contact arm 40 to prevent movement thereof beyond predetermined points in either direction when either the contact 1' or the contact member 9' is engaged.

As illustrated more clearly in Figures 7 and 8

of the drawings, the contact members 1' through 9' are positioned in a ring in trough-like recesses 98 and 99 on the upper and under sides of the terminal and contact support member 50. The terminals A' through F' extend through raised portions 100 on the upper side of the terminal and contact support member 50 and terminate in recesses 101 on the under side. It will be noted that the inserts 60 are positioned between the raised portions 100 and that they do not extend entirely through the terminal and contact support member 50. Curved lips extend upwardly adjacent each of the terminals A' through F'. All of these features of construction go to improve the insulation of the terminals and contact members from each other and from the housing 10 and the neck portion 11.

It is desirable to provide an indication to the operator of the particular contact member that is engaged by the contact arm 40. For this purpose a scale 103 is provided by engraving or otherwise indicating numerals 1 through 9 around the lower periphery of the operating knob 42 to correspond to the contact members 1' through 9'. An index member 105, in the form of an L-shaped metal strip is secured, as by screws or otherwise, to the upper end 68 of the hub 14 and is provided with a circular opening 106 with which the various numerals of the 104 register, as shown in Figure 2 of the drawings. The particular numeral appearing in the opening 106 indicates the contact member that is engaged by the contact arm 40 at that time. The tap changing device is so adjusted that when the numeral of the scale 103 is centered in the opening 106 of the index member 105, the index member 93 carried by the contact arm 40 interfits with one of the serrations 94 in the index ring 95 and the contact screw 89 is in accurate registration with the corresponding contact member.

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

I claim as my invention:

1. In combination, a support member, a housing, a hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, insulating means mounted in said housing, a plurality of terminals carried by said insulating means, a plurality of conductors for interconnecting said slip rings and said terminals, a plurality of contact members carried by said insulating means for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, and a manually adjustable operating rod extending through said hub and said slip rings and operatively connected to said contact arm for moving the same.

2. In combination, a support member, a housing, a hollow metal hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, insulating means mounted in said housing, a plurality of terminals carried by said insulating means, a plurality of conductors in said hollow hub for interconnecting said slip rings and said terminals, a plurality of contact

members carried by said insulating means for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a manually adjustable metal operating rod extending through said hub and operatively connected to said contact arm for moving the same, and a sleeve of insulation surrounding said operating rod and insulating it from said hub.

3. In combination, a support member, a housing, a hollow metal hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, a terminal and contact support member formed of insulating material and mounted in said housing, a plurality of terminals carried by said terminal and contact support member, a plurality of conductors in said hollow hub for interconnecting said slip rings and said terminals, a plurality of contact members carried by said terminal and contact support member for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a bearing plate formed of insulating material and secured to said terminal and contact support member, and a manually adjustable operating rod extending through said hub, journaled in said bearing plate and carrying said contact arm for moving the same.

4. In combination, a support member, a housing, a hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, insulating means mounted in said housing, a plurality of terminals carried by said insulating means, a plurality of conductors for interconnecting said slip rings and said terminals, a plurality of contact members carried by said insulating means and arranged in a circle for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a manually adjustable rotatably mounted operating rod extending through said hub and said slip rings and carrying said contact arm for moving it, the axis of rotation of said rod passing through the center of said circle, and indexing means cooperating with said rod for registering said contact arm with said contact members.

5. In combination, a support member, a housing, a hollow metal hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, a terminal and contact support member formed of insulating material and mounted in said housing, a plurality of terminals carried by said terminal and contact support member, a plurality of conductors in said hollow hub for interconnecting said slip rings and said terminals, a plurality of contact members carried by said terminal and contact support member and arranged in a circle for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a bearing plate formed of insulating material and secured to said terminal and contact support member; a manually adjustable operating rod extending through said hub and housing, journaled in said bearing plate and carrying said contact arm for moving it, the axis of rotation of said rod passing through the center of said circle; and indexing means cooperating with said rod for registering said contact arm with said contact members.

6. In combination, a support member, a

housing, a hollow metal hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, a terminal and contact support member formed of insulating material and mounted in said housing, a plurality of terminals carried by said terminal and contact support member, a plurality of conductors in said hollow hub for interconnecting said ring and said terminals, a plurality of contact members carried by said terminal and contact support member and arranged in a circle for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a bearing plate formed of insulating material and secured to said terminal and contact support member; a manually adjustable operating rod extending through said hub and housing, journaled in said bearing plate and carrying said contact arm for moving it, the axis of rotation of said rod passing through the center of said circle; means carried by said terminal and contact support member for guiding the inner end of said rod, and indexing means cooperating with said terminal and contact support member and said rod for registering said contact arm with said contact members.

7. In combination, a support member, a housing, a hollow metal hub carrying said housing and journaled in said support member, a plurality of slip rings carried by said hub in insulated spaced relation, a terminal and contact support member formed of insulating material and mounted in said housing, a plurality of terminals carried by said terminal and contact support member, a plurality of conductors in said hollow hub for interconnecting said slip rings and said terminals, a plurality of contact members carried by said terminal and contact support member and arranged in a circle for connection to electrical apparatus carried by said housing, a contact arm for selectively engaging said contact members, a bearing plate formed of insulating material and secured to said terminal and contact support member; a manually adjustable operating rod extending through said hub and housing, journaled in said bearing plate and carrying said contact arm for moving it, the axis of rotation of said rod passing through the center of said circle; indexing means cooperating with said terminal and contact support member and said rod for registering said contact arm with said contact members, a knob non-rotatably mounted on the end of said rod outside said housing, and an indicator stationarily mounted on said hub adjacent said knob, said knob having markings registering with said indicator for indicating the contact member engaged by said contact arm.

8. In combination with a housing, a terminal and contact support member formed of insulating material and carried by said housing, a plurality of terminals extending through said support member, said terminals being threaded at each end for connection of conductors thereto, a ring of contact members extending through said support member, said contact members being threaded at one end for receiving conductors connected to electrical apparatus carried by said housing, a bearing plate carried by said support member, and a contact arm rotatably mounted on said bearing plate for selectively engaging the unthreaded ends of said contact members.

9. In combination with a housing, a terminal and contact support member formed of insulating material and carried by said housing, a plurality of terminals extending through said support member, said terminals being threaded at each end for connection of conductors thereto, a ring of contact members extending through said support member, said contact members being threaded at one end for receiving conductors connected to electrical apparatus carried by said housing, a bearing plate carried by said support member, a contact arm rotatably mounted on said bearing plate for selectively engaging the unthreaded ends of said contact members, a circular ridge formed integrally with said support member inside said rings of contact members having a plurality of notches therein each individual to one of said contact members, and index means cooperating with said contact arm and interfitting with said notches for registering said contact arm with said contact members.

10. In combination with a housing, a terminal and contact support member formed of molded insulating material and carried by said housing, a plurality of rod-like terminals having internally threaded ends extending through and integrally formed with said support member, a ring of contact members internally threaded at one end extending through and integrally formed with said support member, screws in the threaded ends of said terminals and said contact members for receiving conductors connected to electrical apparatus carried by said housing, a bearing plate formed of insulating material and interfitting with said support member, and a remotely operable contact arm rotatably mounted on said bearing plate for selectively engaging the unthreaded ends of said contact members, the axis of rotation of said contact arm passing through the center of said ring of contact members.

11. In combination with a housing, a terminal and contact support member formed of molded insulating material and carried by said housing, a plurality of rod-like terminals having internally threaded ends extending through and integrally formed with said support member, a ring of contact members internally threaded at one end extending through and integrally formed with said support member, screws in the threaded end of said terminals and said contact members for receiving conductors connected to electrical apparatus carried by said housing, a bearing plate formed of insulating material and interfitting with said support member, a remotely operable contact arm rotatably mounted on said bearing plate for selectively engaging the unthreaded ends of said contact members, the axis of rotation of said contact arm passing through the center of said ring of contact members, a circular ridge forming an integral part of said support member inside said ring of contact members having a plurality of notches therein, each individual to one of said contact members, and a raised portion forming a part of said contact arm and disposed to interfit with said notches for registering said contact arm with said contact members.

CERTIFICATE OF CORRECTION.

Patent No. 2,140,299.

December 13, 1938.

OSCAR H. PIEPER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 9, claim 6, for "said ring" read said slip rings; line 42, claim 7, for "sad" read said; same page, second column, line 16, claim 9, for "rings" read ring; line 50, claim 11, for "end" read ends; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of January, A. D. 1939.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.

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Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.