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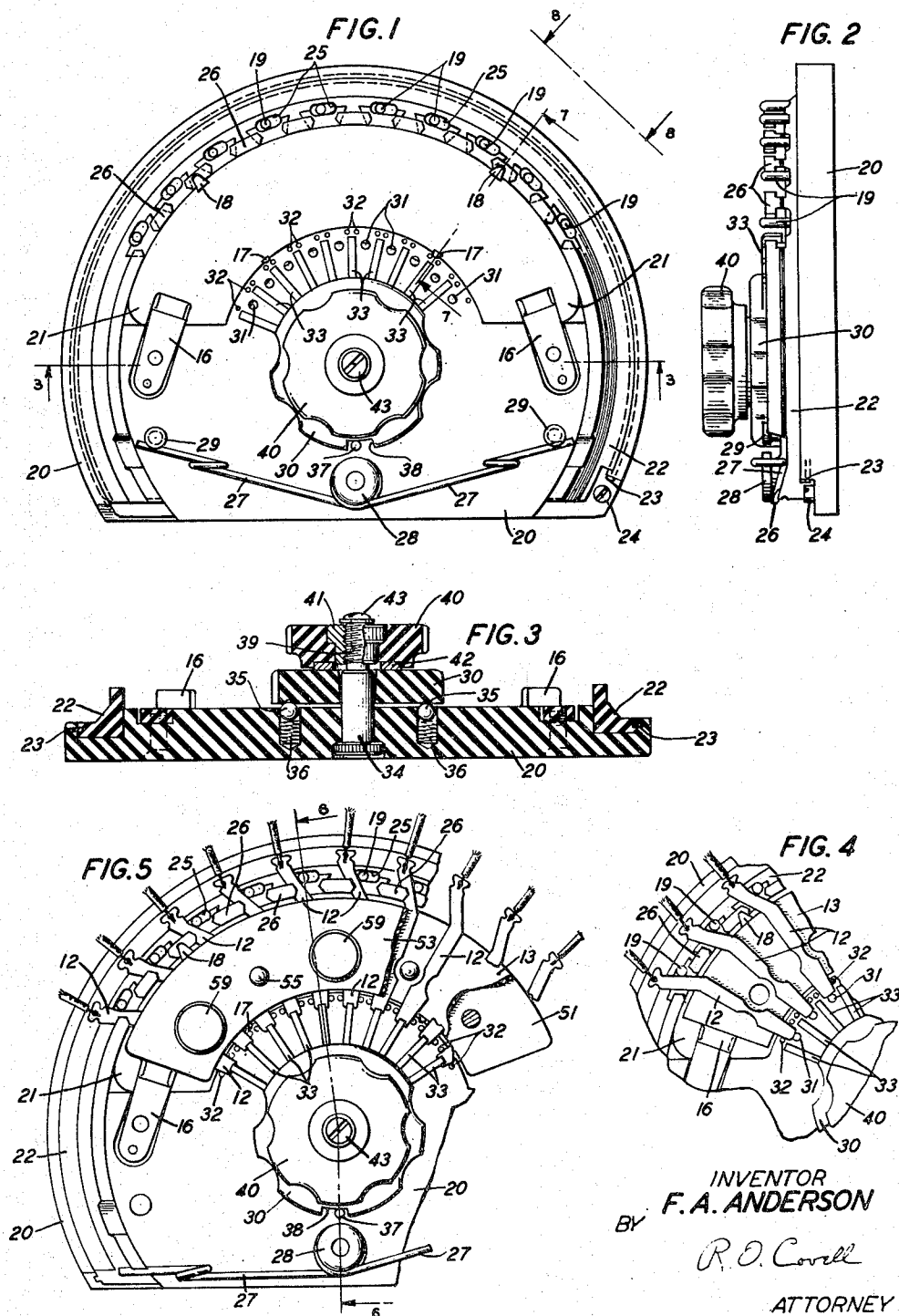
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TOOL FOR USE IN REPLACING INSULATORS IN SWITCH BANKS

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2 Sheets-Sheet 1



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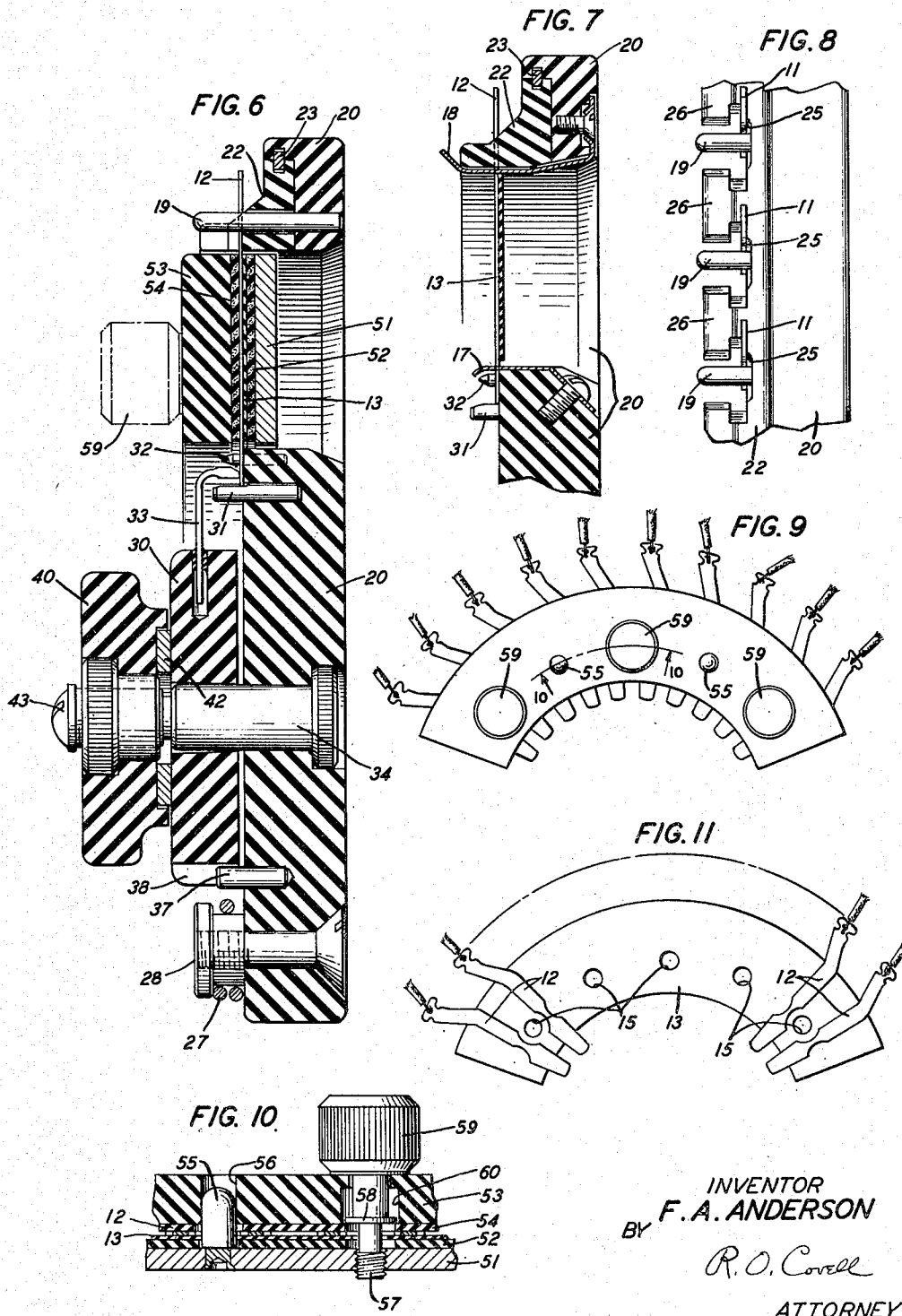
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UNITED STATES PATENT OFFICE

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TOOL FOR USE IN REPLACING INSULATORS
IN SWITCH BANKS

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This invention relates to the terminal banks of selective rotary switches used in telephone or other electrical switching systems and particularly to a tool for use in replacing defective insulators without unsoldering and disconnecting any of the bank wires from the bank terminals.

Objects of the invention are the provision of more conveniently usable means for enabling and facilitating the replacement of defective insulators in multilevel or multirow switch banks without unsoldering and disconnecting any of the bank wires from the bank terminals and without interfering, while an insulator is being replaced, with telephone connections established through the banks of other switches to which the terminals of the switch in question are multiplied.

According to this invention a tool is provided for use in replacing defective insulators in multirow switch banks with new insulators, without disconnecting the bank wires from the terminals, one part of the tool being arranged to locate and clamp the terminals of a row and hold these terminals in normally spaced relationship while the defective insulator to which the terminals are adhesively attached is being loosened from the terminals and while the terminals are being coated with liquid adhesive and the new insulator is being placed in proper position with respect to the clamped terminals, and another part being arranged to clamp the new insulator and terminals until the adhesive has dried and the terminals are thus fixed in proper position on the insulator.

A feature of the invention is a terminal-locating and clamping fixture for locating and clamping the terminals of one level of a multirow rotary switch bank, the fixture comprising a base and a terminal lock ring each made of hard rubber or other similar insulating material steel pins, one for each of a row of terminals to be clamped, are set vertically in the circular rim of the base and spaced corresponding to the normal spacing of terminals in the bank, the lock ring having corresponding vertical slots through which the pins project and having notches in the upper edge corresponding to and opposite the slots so as to form T-shaped posts between which the soldering ends of a row of terminals may be located, one terminal in each notch, the ring being movable to lock the outer wiring ends of the terminals between the posts and the pins in normally spaced relationship.

Another feature of the invention is a fixture according to the preceding paragraph in which

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the base has a hub section with locating pins set therein for individually locating the inner, contact ends of the terminals and with individual metal terminal holding arms set therein, the arms being insulated from each other and rotatable together into engagement with the terminals so as to hold and lock the inner ends of the terminals in normally spaced relationship.

A further feature is a tool according to the preceding paragraph, the locating and clamping fixture being so arranged that the terminals of a row can be positioned in the notches on the one or the other side of the metal pins fixed in the base depending upon whether the soldering ends curve to the right or to the left, the lock ring being movable in one direction in a circular retaining channel in the rim of the base to lock the terminals if positioned on one side of the pins and movable in the other direction to lock the terminals if positioned on the other side of the pins.

An understanding of the invention will be facilitated by description of a tool embodying the invention and its features, one such tool being shown in the drawing which consists of eleven figures.

Figs. 1 to 8 are various views of the terminal-locating and holding fixtures; Figs. 9 and 10 show the terminal clamping device for holding the terminals to a new insulator; and Fig. 11 shows an insulator and terminals with which the tool is adapted for use, the intermediate terminals of the row being omitted.

Fig. 1 is a plan view and Fig. 2 is a side view of the terminal-locating and holding fixture;

Fig. 3 is a front section taken on line 3-3 of Fig. 1;

Fig. 4 is a partial top view of the terminal-locating and holding fixture, showing one end of an insulator with affixed terminals in position before the terminals are locked therein.

Fig. 5 is a partial top view of the terminal locating and holding fixture with terminals locked therein. Fig. 5 further shows the terminal clamping device with the terminals and insulator clamped therein before the terminals are released from the terminal-locating and holding fixture.

Fig. 6 is an enlarged section taken on line 6-6 of Fig. 5.

Fig. 7 is an enlarged partial section taken on line 7-7 of Fig. 1 to show insulator positioning springs 17 and 18, and terminal 12 and an insulator 13 positioned by these springs.

Fig. 8 is an enlarged partial view of the ter-

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minal positioning and locking device taken on line 2—2 of Fig. 1 to show the pin and slot structure for holding the outer ends of terminals.

Fig. 9 is a top view of the clamping fixture with an insulator and row of terminals clamped therein.

Fig. 10 is a partial section taken on line 10—10 of Fig. 9.

Reference may be had to "Automatic Telephony" by Smith and Campbell, 2nd edition, Figs. 55, 56 and 57 for illustration of a switch bank of the type with which the tool herein described is particularly designed to be used.

The tools shown in the drawings comprise a terminal-locating and clamping fixture and a terminal and insulator clamping device. The locating and clamping fixture comprises a base 20 which is a segment of a disc of hard rubber or similar electrically non-conductive material, having a cut-out space 21 of substantially the same shape and size as the insulator shown in Fig. 11. The top surface of the base is channeled adjacent its circular periphery to receive a hard rubber terminal lock ring 22, having an L-shaped cross section, the base of the L being on the outside. The outer edge of the ring and the outside wall of the channel are slotted to receive a metal retaining ring 23; and a stop screw 24 holds the retaining ring in place. The base 20 has metal locating pins 19 projecting upwardly through individual arcuate slots 25 in the horizontal rim of the lock ring 22, one pin for each terminal of a row attached to an insulator of the bank in which defective insulators are to be replaced. The lock ring may be moved in its circular channel with respect to the base, the movement being limited by the length of the vertical slots 25 through which the pins 19 project. There are notches in the inner rim of the lock ring opposite the vertical slots for receiving and clamping the soldering ends of the terminals of a row attached to an insulator. The space between the notches takes on the appearance of teeth or posts 26 of T shape, the heads of the posts serving to lock the terminals against the pins by moving the lock ring in one direction or the other depending upon whether the terminals lie in the notches on the one side or the other of the pins 19. Since the soldering ends of the terminals of adjacent levels of a switch bank are curved laterally in opposite directions to provide a greater separation between like positioned terminals, the movement of the lock ring allows the soldering ends of a row of terminals to be placed in these notches of the ring on one side or the other of the pins 19 depending upon whether these ends of the row of terminals in question curve to the right or the left. In Figs. 4 and 5 the soldering ends of the terminals are shown curved to the left and are placed in the notches to the left of the pins 19. A lock spring 27, fixed at its mid-point by a screw and nut 28 to the base 20, is adapted to engage either end of the lock ring as desired and to apply pressure to move the lock ring into one or the other of its extreme positions in which positions the terminals placed in the notches are locked against the pins 19 by the posts 26. The ends of the lock spring 27 normally rest against stops 29, the one end of the spring or the other being moved into engagement with the corresponding end of ring 22 when desired, as illustrated in Fig. 5.

The middle or hub-like portion of the base 20 has sets of locating pins 31, 32 set therein in position to locate the inner ends of the terminals

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of a row in normally spaced relation and further has a set of steel spring locking arms 33 set in a knob 30 of hard insulating material, the knob being rotatable through a small angle on a pivot pin or stud 34 set in the base 20, whereby all of the arms 33 may be moved into or out of engagement with the inner ends of terminals having their outer or soldering ends positioned in the notches of lock ring 22. The movement of the knob 30 is limited by pin 37 set into the base 20 so as to engage the ends of a slot 38 cut vertically in outer edge of knob 30, as shown particularly in Figs. 1 and 6. An extension 39 of the stud 34 is threaded above the knob 30 and a lock knob 40 with a threaded metal insert therein screws on to this extension. By turning the lock knob 40, a lock washer 42 is forced against the knob 30 and the knob 30 may thus be locked with its arms 33 in engagement with the inner ends of the terminals. A screw 43 prevents the lock knob 40 from being turned off from the threaded portion of stud 34. Two balls 35 are held in engagement with the lower surface of knob 30 by springs 36 positioned in recesses in the upper surface of base 20. There is a slight recess in the under-surface of knob 30 to seat one ball when arms 33 are in position to engage the inner ends of terminals; and there is a like recess in required position to seat the other ball when arms 33 are out of engagement with the terminals. Insulator positioning lugs 16 are secured to the base 20 in position to engage the ends of an insulator as shown in Figs. 4 and 5. These lugs extend above the top surface of base 20 as shown in Fig. 3 so as to be able to engage the ends of an insulator which is attached to the upper surfaces of a row of terminals or to engage the ends of an insulator which is attached to the lower surfaces of terminals clamped in the tool. In Figs. 4 and 5 the insulator is shown under the terminals but in other cases the insulator may be on top. The ends of the lugs are rounded to facilitate the placing of the insulator against the terminals. In order to insure accurate positioning of the insulators radially two sets of positioning springs 17 and 18 are provided, springs 17 being fastened to the hub portion of base 20 and springs 18 to the inner edge of the circular rim portion of the base as shown particularly in Fig. 7.

It frequently happens that some or all of the terminals of a row become detached from the insulator which is to be replaced during removal of the insulator from the switch bank; and each of these loose terminals must be separately inserted in the locating and clamping fixture but with knob 40 not tightened down to cause springs 33 to exert maximum pressure on terminals that are properly located in the fixture. The insertion of loose terminals is facilitated in the device described by beveling the clamping portion of the springs 33 as shown in Fig. 6. A further feature in this respect is the use of two springs and followers not shown but similar to items 35 and 36 shown in Fig. 3, and like these items located in base 20 but in such position that they, together with items 35 and 36 and with the action of springs 33 against any properly located terminals, tend to have a leveling effect so that a loose terminal can be more readily inserted under a spring 33 than would otherwise be the case. This leveling action is of considerable importance in that it permits the springs 33 to be made stiff enough to adequately hold terminals when properly clamped.

The terminal and insulator clamp or clamping

device comprise a lower clamping plate 51, an upper clamping plate 53 and three screws 57. (See Figs. 5, 6, 9 and 10.) The plate 51 has a layer of soft rubber 52 or other suitable insulating material attached to its upper surface and the plate 53 has a like insulating layer 54 attached to its lower surface. The plate 51 has two positioning pins 55 set in its upper surface in required position to engage two of the holes of an insulator. The upper clamp plate has holes 56 in corresponding position into which the pins 55 project when an insulator and row of terminals are clamped together by the two plates 51 and 53. Each screw 57 is loosely but permanently held in attachment with plate 53 by the collar 58 in recess 60, the knob 59 being forced onto the shank end of the screws extending upward through the plate 53. The plate 51 has threaded holes positioned to receive the screws 57, whereby the plates 51 and 53 can be screwed together to hold a new insulator in close engagement with the terminals while liquid adhesive between the insulator and terminals is drying, as hereinafter described.

While the base 20 of the locating and clamping fixture is shown in the drawings as being one piece, it may be desirable to make the clamp assembly for the inner ends of the terminals separately and attach it to the remainder of the base 20. Various other mechanical expedients may be substituted for those shown. For instance, the inner ends of the terminals may be positioned by like shaped depressions in the edge of the hub section of base 20 in place of the pins 31 and 32.

When a defective insulator is to be replaced in one bank of a group of switches in which the terminals are multiplied, the screws which hold the terminals and insulators of the bank as a unit are removed, the bank is broken open and the defective insulator with terminals attached is loosened from the bank pile up. The terminals, with the defective insulator attached, are placed in the base 20 with the soldering ends of the terminals in the notches of lock ring 22 and the inner ends of the terminals positioned by the pins 31 and 32 as previously described and as illustrated in Fig. 4. One end of lock spring 27 is thereupon positioned to engage one end of the lock ring 22 and thereby shift the ring to lock the outer ends of the terminals under the head of posts 26 and against the pins 19 as shown in Fig. 5. The knob 30 is then turned so that the ends of arms 33 engage the inner ends of the terminals; and lock knob 40 is turned to lock the arms 33 in engagement with the terminals. The defective insulator is then loosened and removed from the terminals; and the terminals are scraped, if necessary, to remove the dried adhesive therefrom. Liquid adhesive is then applied to the terminals and a new insulator placed in position against the terminals, the new insulator being accurately positioned by lugs 16 and the two sets of positioning springs 17, 18. The lower clamping plate 51 of the terminal and insulator clamping device is then placed below the terminals and insulator with pins 55 extending through two of the holes in the insulator. The upper clamping plate 53 is then placed over the terminals and insulator with pins 55 extending into holes 56. After the knobs 59 are turned to screw the two clamping plates together, the lock knob 40 of the locating and clamping fixture is loosened and knob 30 turned to disengage arms 33 and the inner ends of the terminals; and the spring 27 is disengaged from the end of lock ring 22 and the

ring is moved to unlock the outer ends of the terminals. The terminal and clamping fixture with the terminals and insulator clamped therein is now removed from the terminal-locating and clamping fixture which may now be used with another insulator and row of terminals. When the adhesive between the insulator and terminals has dried, the plate 53 is unscrewed from plate 51 and the insulator with attached terminals removed and placed in proper position in the bank.

What is claimed is:

1. A tool for use in replacing insulators in switch banks without disconnecting the bank wiring from the terminals attached to an insulator which is to be replaced, consisting of a terminal locating and clamping fixture and an insulator clamping fixture; said terminal locating fixture comprising a base of hard rubber or similar insulating material, the shape of said base being a major segment of a circle having a cut-out space of the same shape as said insulators and only slightly larger in size, a terminal lock ring slidably channeled in the outer rim of said base having inverted T-shaped notches in its upper edge, one notch for each terminal to be clamped in said fixture, metal pins extending upwardly through vertical slots in said ring opposite and just outside of said notches so that the wiring ends of a row of terminals may be individually placed on one side or the other of the notches depending upon whether the terminals curve outwardly to the right or to the left, spring means adapted to engage either end of the lock ring as desired to move the ring to lock the terminals placed in said fixture between said pins and the one or the other side of the notches, metal pins set in the outer edge of the hub section of said base to position the inner ends of a row of terminals, retaining springs set in a knob of insulating material, one spring for each terminal, said knob having a limited rotary movement to move the springs into and out of engagement with the upper surface of the inner ends of terminals placed in said notches and between said pins, and a locking knob and washer mounted on a screw set in the pivot pin of said first-mentioned knob adapted when turned to press against and thereby lock the first-mentioned knob and springs in terminal retaining position, lugs on said base in position to accurately confine the ends of an insulator placed over terminals locked in said fixture, and flat springs fastened to said base and extending vertically adjacent the opposing edges of said cut-out section to further accurately confine an insulator with respect to a clamped row of terminals; said insulator clamping device comprising a top plate and a bottom plate which may be placed on opposite sides of a row of terminals held in said terminal clamping fixture with an insulator in position between the top plate and the terminals, the adjacent surfaces of said plates being covered with a layer of insulating material, said lower plate having pins corresponding to holes in the insulator extending upward through the insulator into corresponding holes in the upper plate so as to properly align the two plates with respect to each other and with respect to the insulator, and thumb screws loosely fixed in said upper plate positioned corresponding to the other holes through the insulator and to threaded holes in the lower plate for clamping the insulator and terminals between the plates; said insulator clamping fixture and clamped insulator and terminals being

removable from the base upon release of the said lock knob and lock spring of said base.

2. A stool for use in replacing insulators in switch banks without disconnecting the bank wiring from the terminals attached to an insulator which is to be replaced, consisting of a terminal locating and clamping fixture and an insulator clamping fixture; said terminal locating fixture comprising a base of hard rubber or similar insulating material, the shape of said base being a major segment of a circle having a cut-out space of the same shape as said insulators and only slightly larger in size, a terminal lock ring slidably channeled in the outer rim of said base having inverted T-shaped notches in its upper edge, one notch for each terminal to be clamped in said fixture, metal pins extending upwardly through vertical slots in said ring opposite and just outside of said notches so that the wiring ends of a row of terminals may be individually placed on one side or the other of the notches depending upon whether the terminals curve to the right or to the left, spring means adapted to engage either end of the lock ring as desired to move the ring to lock the terminals placed in said fixture between said pins and the one or the other side of the notches, metal pins set in the outer edge of the hub section of said base to localize the inner ends of a row of terminals, retaining springs set in a knob of insulating material, one spring for each terminal, said knob having a limited rotary movement to move the springs into and out of engagement with the upper surface of the inner ends of terminals placed in said notches and between said pins, and a locking knob and washer mounted on a screw set in the pivot pin of said first-mentioned knob adapted when turned to press against and thereby lock the first-mentioned knob and springs in terminal retaining position, lugs fastened to the base in position to accurately confine the ends of an insulator placed over terminals locked in said fixture, and flat springs

fastened to said base and extending vertically adjacent the opposing edges of said cut-out section to further accurately confine an insulator with respect to a clamped row of terminals.

3. A tool for use in replacing insulators in switch banks without disconnecting the bank wiring from the terminals attached to the insulator to be replaced, comprising a unitary terminal locating and clamping fixture for clamping the terminals of a row in proper relative positions, said fixture including insulating material for maintaining electrical separation between terminals while clamped therein and means for confining an insulator in proper position with respect to the clamped terminals, and a separate clamping fixture comprising two plates adapted to be positioned on opposite sides of said clamped terminals and insulator for clamping said terminals and insulator while adhesive therebetween is drying, said separate clamping fixture including insulating material for maintaining electrical separation between terminals clamped therein, the terminal locating and clamping fixture being arranged to release the terminals to permit the insulator clamping fixture and clamped insulator and terminals to be withdrawn.

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