Jan. 13, 1931. H. L. STEINFELD 1,788,963

ORGAN

Filed Jan. 18, 1929 3 Sheets-Sheet 1

Fig. 1.

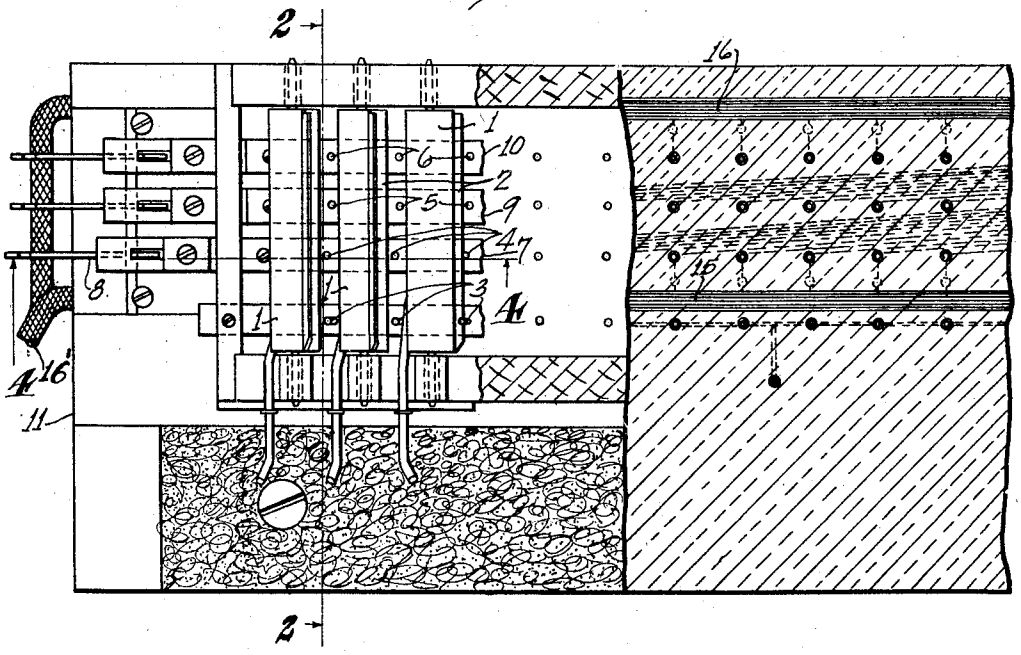
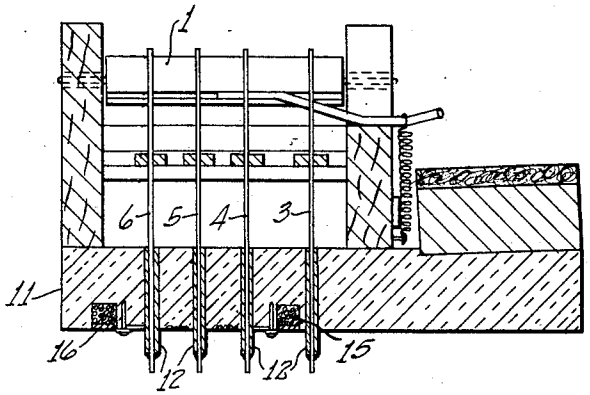


Fig. 2.



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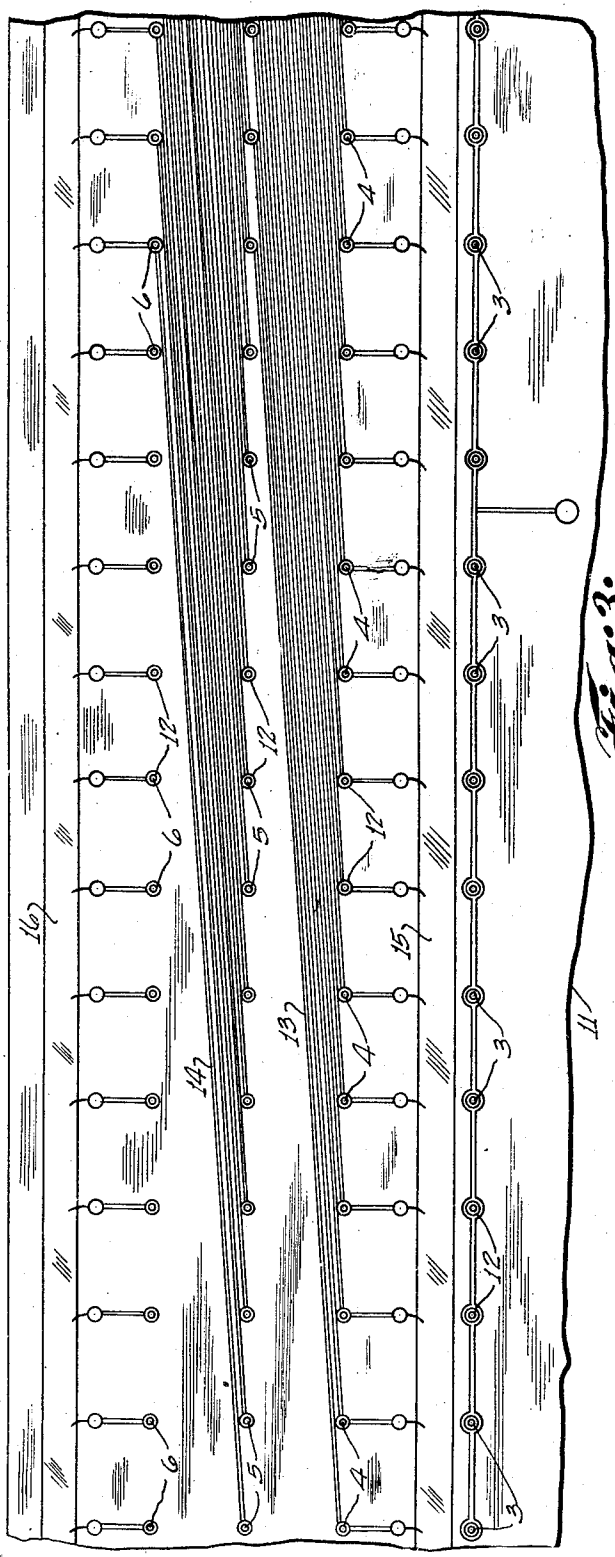


Fig. 3.

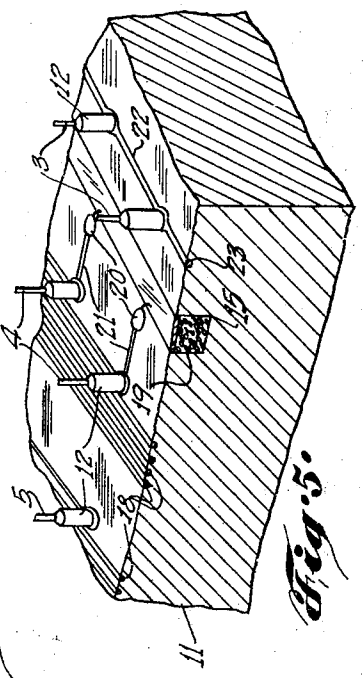


Fig. 5.

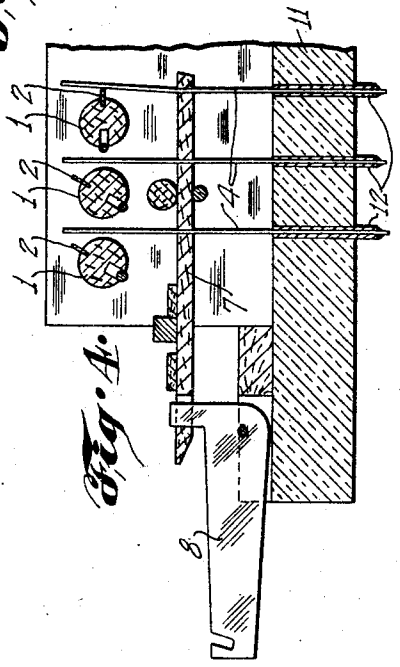


Fig. 4.

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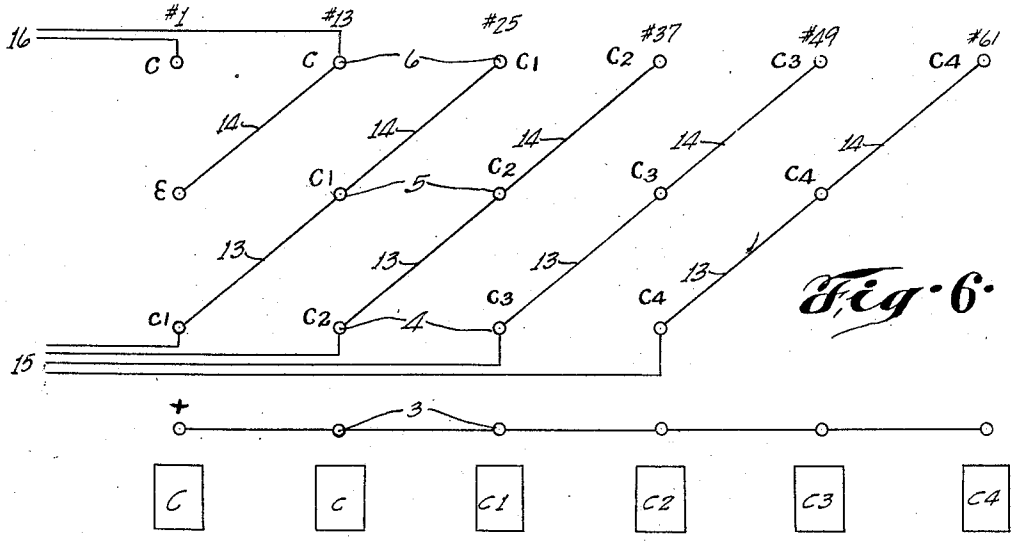


Fig. 6.

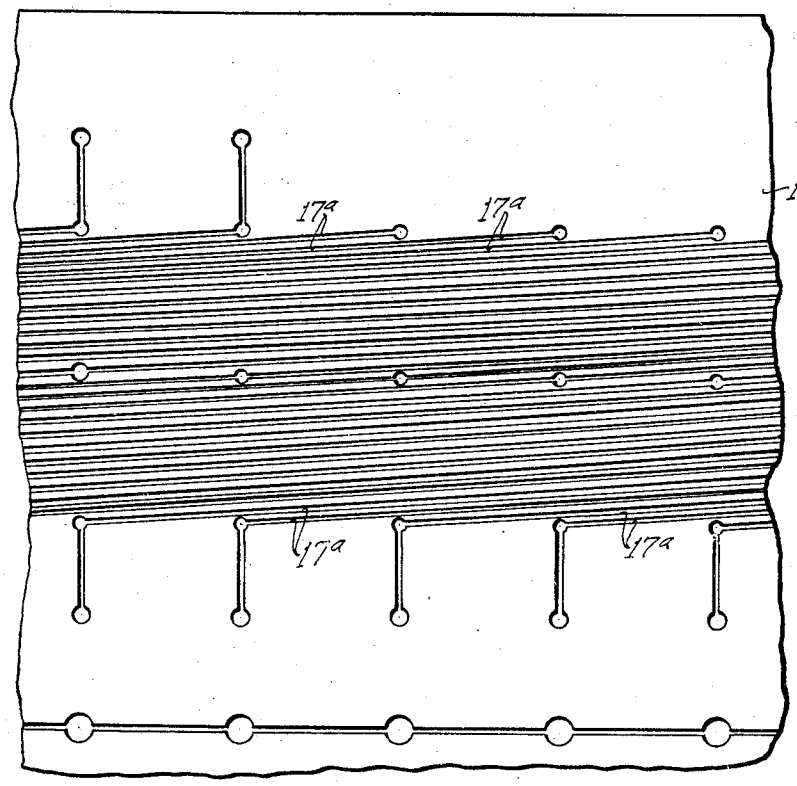


Fig. 7.

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Patented Jan. 13, 1931 1,788,963

UNITED STATES PATENT OFFICE

HAROLD L. STEINFELD, OF ST. LOUIS, MISSOURI

ORGAN

Application filed January 18, 1929. Serial No. 333,350.

This invention relates generally to electric organs and, more particularly, to a certain new and useful improvement in the arrangement and construction of the electrical conductors associated with the action of the organ.

The modern organ is generally a very complex mechanism, its complexity being increased since the application of electricity to the action. For purposes of the present specification, it may be said that the instrument consists of three principal parts, the wind-supply, the pipe-work, and the action. My invention is directed to the action, which is the mechanism that controls the actual playing of the instrument. Under or within the term, are included the keys, stop-knobs, the combination pistons, the couplers, by means of which it is possible to couple one manual to one or more others or to the pedal or itself, and relays by means of which it is possible to make one set of pipes simulate several by unifying it and playing it at different pitch and on different manuals independently of other stops. If an 8-foot or unison coupler is drawn, the notes played on one manual sound at the exact pitch on the manual that is coupled. A 4-foot or octave coupler causes the coupled notes to sound an octave higher; a 16-foot or sub-octave coupler, an octave lower. Formerly these combination pistons were mechanical levers serving many purposes, but with the introduction of the electric action, the mechanical levers were replaced with a system of contacts, electromagnets, and pneumatics, which performed the same function with less effort on the part of the organist.

Since the couplers may operate to cause a pipe to speak that it is not only an octave higher or lower than the key played at the console of the organ, but may also be in a stop not drawn on the manual played, the cross wiring becomes exceedingly complicated. Aside from the exacting workmanship required to correctly wire up such an arrangement, the interlaced wires are subject to short circuits and like derangements, frequently resulting in ciphers and other faulty intonation of the pipes. And unifying additionally complicates matters.

The prime object of my present invention is to provide an improved method of construction of the electrical conductors in the electrical action of an organ, and the arrangement thereof, for the purpose of facilitating the connections of the coacting parts of the action and coincidently of lessening the cost of construction of the action.

Another object of my invention is to provide an improved construction of a coupler or relay switch-board, or like device in the action, whereby the dangers of short-circuits and other faults common to electric organ actions are avoided.

Still another object of my invention is to provide an improved conductor associated with a coupler switch-board or the like, characterized by employing a fluid, preferably plastic conductor, preferably having siccative or hardening properties, which is applied on, or, preferably, inlaid in, an insulating material forming the switch-board base.

A further object of my invention is to provide a method of applying said plastic conductor, characterized by employing a stencil, pattern, or like formative means, which is placed on or over the insulating base, and the plastic conducting material painted, sprayed, or otherwise spread over the stencil or pattern, upon the removal of which the desired conformation of conducting material remains on the base-board for utilization as electrical connections between the coacting parts of the action.

A still further object of my invention is to provide an insulating base forming preferably part of a switchboard, and having grooves in the desired conformation suitably to the parts of the action to be electrically connected, the grooves being filled, by painting or spraying the baseboard with a plastic conducting material, preferably having siccative properties, this construction providing the said electrical conductors in a fully protected and highly efficient manner, substantially free from the dangers of short circuits or damage from handling or the like.

And with the above and other objects in

view, my invention resides in the novel features of form, construction, arrangement, and combination of parts hereinafter described and pointed out in the claims.

In the accompanying drawings:

Figure 1 is a fragmentary top plan view, partly broken away and in action, of an electric organ switch-board embodying my invention;

Figure 2 is a sectional view thereof taken approximately along the line 2—2, Figure 1;

Figure 3 is a fragmentary bottom or inverted plan view of the switch-board of Figure 1;

Figure 4 is a sectional view taken approximately along the line 4—4, Figure 1;

Figure 5 is a fragmentary inverted perspective view of the switch-board;

Figure 6 is a diagram of the switch-board connections showing, for simplicity, the octaves only; and

Figure 7 is a fragmentary plan view of a stencil, capable of employment in the construction of the switch-board.

Briefly described, an organ action of the character illustrated may comprise a plurality of rotatable contact drums 1, 1, each provided longitudinally with a contact-strip 2 adapted, on rotation of the respective drums 1, 1, by a suitable actuating mechanism (not shown), to establish electrically conducting contact between the adjacent one of a row of upstanding flexible contact-pins 3, 3, and such adjacent ones of a plurality of rows of upstanding flexible contact-pins 4, 5, and 6, as may have previously been swung, as presently appearing, into the path of the contact-strip 2.

The pins 3, 3, are preferably permanently disposed to be slidingly contacted by the contact-strip 2 of the respectively adjacent drum 1, and in the action there are as many of said pins 3 as there are drums 1, usually in number equal to sixty-one, which commonly comprises the gamut of the manual on the console. The pins 4, 5, and 6 are each approximately aligned with one of the pins 3, but are disposed so as to normally be out of the rotative path of the contact strip 2, and it may here be stated that there may be more or less than sixty-one of the pins 3, 4, 5, or 6, in each of the respective rows thereof, as the device is particularly useful for extending the range of the manual so that the lowest digital, for example, may be coupled to a sub-octave, and the highest digital coupled to an octave or double-octave, so that the stop or register may thus have at times a total number of as many as ninety-seven speaking pipes.

The several pins 4, so arranged and disposed in a row extending for the greater part of the length of the switch-board, are all operatively engaged by a shiftable coupler or relay bar 7, which, in the present instance, is operable by a bell-crank 8 actuated by a suitable device (not shown) usually associated with the stop knobs or tablets on the console, the particular coupler or relay bar 7 acting to simultaneously flex all of the several pins 4 into a position in the paths of the respective contact-strips 2 of the several drums 1, as shown in Figures 1 and 4.

In a like manner, and by a similar mechanism, the row of pins 5 may be swung by a coupler or relay bar 9 into the paths of the respective contact-strips 2; and a coupler or relay bar 10 performs a like function for the row of pins 6.

There may, of course, be more than three rows of shiftable or swingable contact-pins on the switch-board, depending upon the degree of coupling or unifying effected by the action, as, for example, when it is desired to couple to a stop not on the manual being played. In the present instance, the switch-board, as shown, couples in only one stop and provides octave and double-octave coupling only; the principle of my invention remains the same, however, in any of the actions of the organ.

The action is such that, in the present instance, if the coupler bar 10 is shifted, the notes played on the manual sound at the pitch played; if the bar 9 is shifted, the notes sound an octave higher; and if the bar 7 is shifted, the notes sound a double octave higher. It follows, therefore, that the respective pins 4, 5, and 6, must be inter-connected electrically with the action of the pipes in such a way as to cause the pipes to speak in the desired manner.

The wiring heretofore associated with such a switchboard is of an exceedingly complex nature, but in my invention the electrical connections at the switch or other board are simplified so as to eliminate the cross wiring heretofore required to properly connect the different contact pins, as will now appear.

Commonly, the supporting parts of the action are constructed of wood, and the flexible pins, 3, 4, 5, and 6, are mounted in and through insulating ferrules passed through the wood-base of the switch-board, while to the projecting lower ends of the said pins are soldered or otherwise connected the necessary wires to establish the desired electrical connections.

In my invention, the base-board 11 is constructed of a suitable dielectric or insulating body, and the ferrules 12 are formed of conducting material, the respective pins 3, 4, 5, and 6 each tightly fitting into their respective ferrules 12 for establishing electrical contact therewith. The several pins may at their respective lower ends project through the ferrules, as shown in the drawings, but I prefer to connect the different pins with each other and with the cables leading to other parts of

the organ through the conducting ferrules 12 in a manner and for a purpose now appearing.

Referring now to Figures 3 and 5, which particularly illustrate my improved form of electrical connectors, attention is directed to the arrangement of the conductors, the construction of which will presently appear, wherein it will be seen that each of the pins 4, for example, is electrically connected to a pin 5 an octave higher by a conductor 13, so that all the conductors, taken together, are arranged, at its were, in echelon, each being in spaced parallelism with its neighbors. In a like manner, each of the pins 5 is electrically connected to a pin 6 an octave higher on the switchboard by a conductor 14, these latter being thus also arranged in echelon, and some of them forming continuations of the conductors 13.

Assuming that the range of the manual associated with the present switch-board is from C to *c*4, as shown in the diagrammatic view Figure 6, wherein the connections for the octaves beginning with C and ending with *c*4 are shown, the other notes being omitted, for simplicity. Here the digital C is shown opposite the pin No. 1, with which it is associated; the digital *c* is shown opposite the pin No. 13; and so on for the length of the manual. Thus, the first one of the contact drums 1 is operatively associated with the digital playing the note C, the thirteenth one of said drums will cause the pipe *c* to speak; the twenty-fifth drum will cause pipe *c*1 to speak; the thirty-seventh drum, pipe *c*2; the forty-ninth drum, pipe *c*3; and the sixty-first drum, pipe *c*4.

Hence, if the coupler 10 is drawn, the digitals play their corresponding pipes; if the coupler 9 is drawn, the digital C, for example, will play pipe *c*, while the digital *c*, in turn, will play pipe *c*1, and so on; if the coupler 7 is drawn, the digital C will play pipe *c*1, and the digital *c* will play pipe *c*2. What has been said about the digitals also applies to the pedals, if the switch-board is associated with the pedal manual, or if a mutation stop is used. Of course, more than one coupler may be drawn, in which case each digital will play its proper pipe and the pipe an octave or double-octave higher, or all of them, as the case may be.

It will now be seen that the pin 6 on one side of the switch board corresponding to a note, for example, *c*1, is connected electrically by the conductors 13 and 14 to the pin 4 on the other side of the switch-board corresponding to the note C, since they are connected, as described, in echelon across the switch board. Hence, instead of connecting the said pin 6 for the note *c*1 directly to a cable leading to other parts of the organ, the pin 4 corresponding to the note C may be connected to an adjacent cable 15 for actuating the pipe *c*1.

On the other hand, the first twenty-four of the pins 6 do not have electrical connection with any pins 4, that is to say, there are no pins 4 corresponding to the double-sub-octave of the notes in the gamut from C to *b*. Hence, to connect these pins 6 for this double octave to the cable 15 would require that cross wires be run over the switch-board and the conductors 13, 14, with consequent possibility of short circuits and the like, and complication of the wiring. To avoid this latter effect, the pins 6 from note C to *b*, that is to say, the first twenty-four of said pins, are connected each to a proper lead in a cable 16 on the adjacent side of the switch-board, thus located oppositely to the cable 15, the cables 15 and 16 being brought together around the end of the switch-board, to form a common cable 16′ leading to the desired parts of the organ, as illustrated in Figure 1.

Thus the conductors on the switch-board are arranged in an orderly manner, such that no conductor crosses any other. By this means I am able to employ a method of constructing these conductors, as will now be described, which is characterized by a simplicity and accuracy highly desirable and useful in the organ art, so that not only are dangers from derangements of the wiring eliminated, but the cost of the wiring is materially cheapened and reduced over the method and materials heretofore, so far as I am aware, employed.

To form the conductors, as 13 and 14, I preferably employ a conducting material in a fluid, preferably plastic state or condition, which material has hardening or siccative properties, and which is laid down upon the baseboard 11 in strips or bands to form the means for electrically connecting the several pins 4, 5, and 6, arranged as hereinbefore described, the metallic ferrules 12 being preferably employed or made use of to establish the electrical connection between the ends of the conductors and the pins. It will be readily seen that the spaced arrangement of the conductors, and the absence of any cross wiring, permits the convenient employment of a stencil 17 or the like (Figure 7) having cut-outs 17*a* corresponding to the desired location of the conductors, which stencil 17 is laid down on the base board 11, and the hardening material sprayed, painted, or otherwise applied thereto, with the result that, upon the removal of the stencil after such application, the desired conformation of the conductors is left upon the baseboard 11, the hardening or siccative properties of the plastic material thereafter acting to harden the same and establish the permanence of the conductors.

While the foregoing described method of construction of the conductors has general applicability to any part of the organ, I

prefer to form, in the base board 11, or other part of the action where my invention is employed, grooves or ducts 18 (Figure 5) corresponding to the desired conformation of the conductors, into which grooves or ducts 18 the hardening material may be inserted by use of the stencil 17, if desired, or by simply spraying or painting the base-board with such material, or pressing the latter into the grooves, or dipping the base board in a vat of said material, the excess thereof being wiped off or otherwise removed, leaving the desired amount of conducting material in the grooves, fully protected from damage or derangement, and likewise fully insulated from each other by the insulating baseboard 11. If said material in the grooves is struck off just below the surface of the base board, the possibility of short circuits due to lodgement of foreign matter across the base board is substantially eliminated.

For convenience, the cables 15 and 16 may be inserted in suitable grooves 19 extending along each side of the base-board 11. The respective leads in these cables are brought out at appropriate points to soldering lugs 20 disposed at the terminus of suitable grooves 21 extending from adjacent ferrules 12, said grooves 21 being filled with the hardening conducting material in a manner similar to the conductors 15 and 16. As best seen in Figure 5, I prefer to form the grooves 18 with an enlargement at each end, through which the ferrules 12 extend, so that the conducting material will thus completely surround said ferrules to insure a satisfactory electrical contact therebetween.

The pins 3 are connected to each other by a common conductor 22 disposed in a groove 23, and constructed in every respect like the conductors hereinbefore described for connecting the pins 4, 5, and 6. This common conductor 22 forms, in the present instance, the means for supplying the motivating energy to the action and may be connected with the positive or the negative pole of the usual source of energy, as an electric battery, in a manner depending upon the construction of the action, as well known to those skilled in the art.

Thus it will be seen that I provide an improved method of construction of the conductors in the electrical action of an electric organ and, concomitantly, provide a construction substantially eliminating the danger of short circuits or derangement of the conductors, which tend to impair the functions of the action, and I accomplish the foregoing by a means characterized by simplicity and ease of application, whereby the cost of construction of some of the most complicated parts of the wiring of the action is materially cheapened over the methods and materials heretofore, so far as I am aware, employed in the art.

Obviously, my invention is not limited in its application to coupler switch-boards, but may be usefully employed in switch-boards of any type that may be incorporated in the organ, as, for example, the switch-boards controlling the stops or registers, which are, in turn, controlled by the stop-knobs or tablets on the console of the organ. My invention also is of great value in connecting the keyboard, that is to say, the switches operated by the digitals or pedals, with other parts of the organ; and, further, at appropriate localities, a board having a plurality of conductors as described may be usefully employed to replace the ordinary cables.

It will thus be readily understood that my invention has many diversified uses in the construction of an organ, and that, while one embodiment of such use has been illustrated and several pertinent employments thereof suggested, other changes and modifications in the form, construction, arrangement, and combination of the several parts thereof may be made and substituted for those herein shown and described without departing from the nature and principle of the invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an electric organ, a board comprising an insulation base-plate, and an electrical conductor associated with the base-plate, said conductor being formed of a hardening conducting material adhering to the board.

2. In an electric organ, a board comprising an insulation base-plate, and a plurality of electrical conductors associated with the base-plate, said conductors being formed of a hardening conducting material adhering to the surface of the plate.

3. In an electric organ, a board comprising an insulation base-plate provided with a plurality of surface grooves, each of the grooves conforming to the location of an electrical connection in the board, and electrical conductors disposed in each of said grooves, said conductors being formed of a fluid conducting material adapted to harden in said grooves.

4. In an electric organ, the combination with a plurality of electrically contacting members, of means for connecting said members to other parts of the organ, said means including a base plate associated with said contacting members, and a hardening conducting material adhering to the base plate to form, on hardening, electrical conducting members.

5. A switch-board for an electric organ comprising, in combination, a base plate of insulating material, a plurality of ferrules of conducting material mounted through said base plate, contact-pins upstandingly fixed in each of said ferrules, an electrically con-

tacting action associated with said contact-pins, and electrical conductors connecting some of said ferrules at one point of the base plate with others of said ferrules at another point of the base plate, said conductors being formed of strips of a hardening conducting material applied adheringly to said base plate to form, on hardening, conducting members having electrical contact with the ferrules to be connected.

6. A switch-board for an electric organ comprising, in combination, a base plate of insulating material, a plurality of ferrules of conducting material mounted through said base plate, contact-pins upstandingly fixed in each of said ferrules, an electrically contacting action associated with said contact-pins, said base-plate having a plurality of grooves formed on its surface extending from some of the ferrules at one point of the base plate to others of said ferrules at another point of the base plate, each groove terminating at its opposite ends in an enlargement surrounding one of said ferrules, and a hardening conducting material deposited in each of said grooves, adapted to form, on hardening, electrical conductors connecting the respective ferrules at the opposite ends of the respective grooves.

7. A switch-board for an electric organ comprising, in combination, a base plate of insulating material, a plurality of ferrules of conducting material mounted through the base plate in longitudinal and transverse rows, each transverse row thereof corresponding to one of the keys of the manual associated with the switch-board, contact pins upstandingly fixed in each of said ferrules, each longitudinal row of said contact-pins being associated with a coupled or unified stop of the organ, a plurality of electrically contacting actions associated with said contact-pins each operable by one of said keys, and a hardening conducting material adhering to said base plate to form a plurality of spaced parallel conducting strips each electrically connecting one ferrule in a longitudinal row with another ferrule in the adjacent longitudinal row, said strips of material forming, on hardening, electrical conductors arranged in echelon across the base plate such that no conductor crosses any other and contacting at their opposite ends the respective ferrules in adjacent longitudinal rows thereof corresponding to the octaves in the gamut of the organ.

8. A switch board for an electric organ including a base, and a plurality of contact members opposite each key action of the organ arranged in longitudinal rows on said base, the contact-members opposite each key action being connected to the contact-members of their respective octaves in the successive longitudinal rows, one contact-member opposite each key action being connected to the action of the organ.

9. A switch board for an electric organ including a base, a plurality of contact-members opposite each key action of the organ arranged in longitudinal rows on said base, and means including electrical conductors for connecting the contact-members opposite each key to the contact-members of their respective octaves in the successive longitudinal rows, said conductors being arranged in echelon such that no conductor crosses any other.

10. A switch board for an electric organ comprising, in combination, a base plate of insulating material, contact-members arranged on said base plate in longitudinal rows each corresponding to a stop of the organ, said contact-members being also arranged in transverse rows each corresponding to a digital of the organ, and means including electrical conductors arranged in echelon for connecting said contact-members in octaves between adjacent longitudinal rows such that no conductor crosses any other.

In testimony whereof, I have signed my name to this specification.

HAROLD L. STEINFELD.