(No Model.)

T. N. VAIL.

ELECTRICAL SWITCH BOARD.

No. 260,067. Patented June 27, 1882.

Fig. 1.

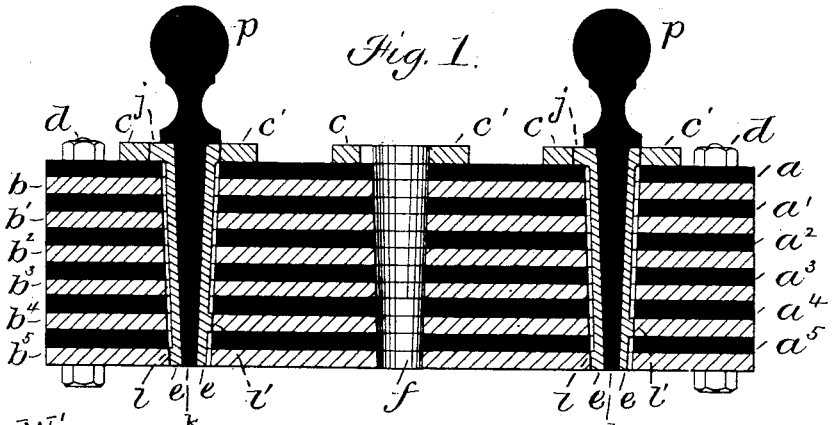


Fig. 2.

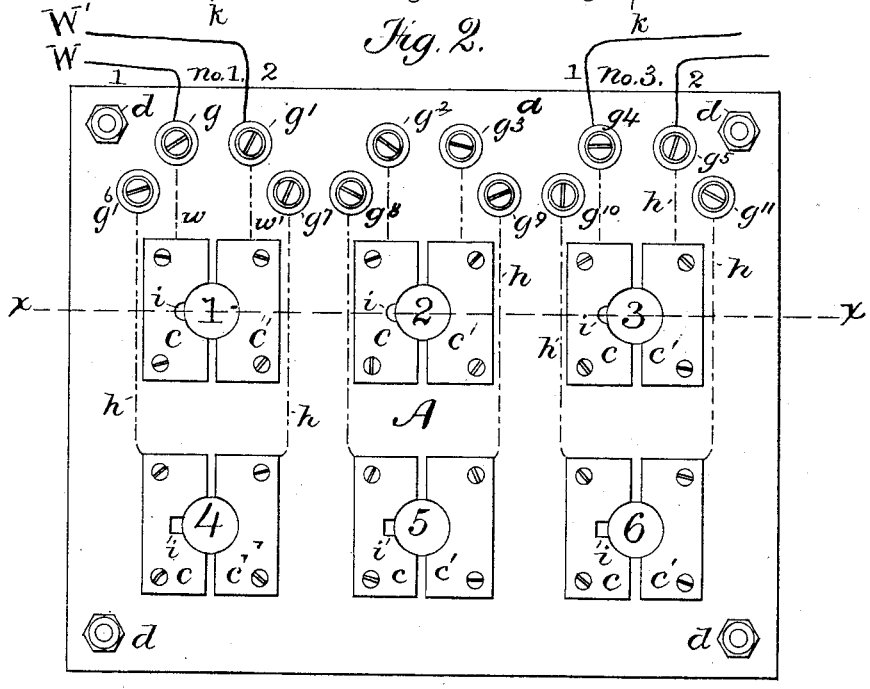
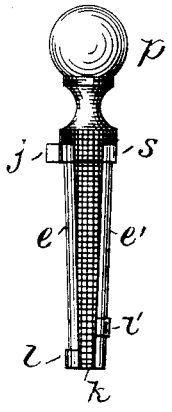


Fig. 3.



Attest.
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UNITED STATES PATENT OFFICE.

THEODORE N. VAIL, OF BOSTON, MASSACHUSETTS.

ELECTRICAL SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 260,067, dated June 27, 1882.

Application filed April 28, 1882. (No model.)

To all whom it may concern:

Be it known that I, THEO. N. VAIL, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electrical Switch-Boards, of which the following is a specification.

The object of this invention is to provide an electrical switch-board which by its use shall render the interconnection of metallic circuits or loops a rapid and easy operation, and which shall also be of simple character and economical construction.

The invention (which is a modification of the switch-board for which Letters Patent were issued to Francis Blake, November 15, 1881, No. 249,574) consists in the following particulars: the adaptation of each line-plate for the reception of both terminals of a metallic line-circuit, which, leaving the central station, traverses the geographical district of which the exchange is the center, returning by a second wire to the central station, and also in the combination of the line-plates so adapted with a double-contact plug-connector and a series of conducting-plates alternating in a pile with a series of non-conducting plates, and provided with plug-holes extending through both series of alternating plates and through the line-plate, whereby when the said plug is placed in the said hole electrical contact is made by such contact-plate of the plug with a separate conducting-plate of the series.

It further consists in a peg or plug with two conducting or contact surfaces longitudinally attached thereto, each conductor being furnished with two flanges, whereby when the said peg is inserted in its place contact is simultaneously made between two line-plates and two connecting-plates.

It is a fact well known to those skilled in applied telephonic science that when ordinary telephonic circuits are extended in parallelism one with another, or parallel with other electricity-conveying wires, the variations in strength or direction of the current upon one wire affects the working of the others in such a manner as to reproduce in the receiving-instruments of one line the signals which are passing upon another. It has been also ascertained that by providing for each circuit a return-wire parallel to and in close proximity to the out-wire, these disturbing effects are in a great measure neutralized; and my switch-board is designed for the convenient manipulation and interchanging of circuits so arranged.

The switch-board to which in this specification I apply my invention is of that class wherein the connection-strips whereby any two circuits are united are represented by sheets or plates of metal insulated one from another by alternate sheets of vulcanite or other suitable non-conducting material, while the several line-circuits are attached to and represented by smaller plates, these latter being secured to the surface of the uppermost or front non-conducting plate. The connections in such switch-boards are made by the insertion of plugs made in pairs of different lengths, and ordinarily each separate pair of plugs is of the precise length requisite to make contact with one of the connection-plates, and with no other, while, irrespective of length, all the pairs are adapted to make contact with the line-plates. I have, however, found it very advantageous to so construct the plugs that they shall make contact with two connection-plates, to the end that both terminals of a metallic circuit shall, by the insertion of the plug, simultaneously be connected with a separate connection-plate. For convenience I shall hereinafter term the large metal plates which are interleaved between the non-conducting plates "connection-plates" and the small plates which surmount the pile "line-plates." By reason of its compactness, solidity, and general simplicity of construction, a switch-board of this class may frequently be used to great advantage, particularly where the superficial space at the disposal of the central-station operators is limited; and the modified method of construction set forth in this specification of my invention becomes essential to its successful adaptation to a central-station system wherein the several lines are constructed on what is generally known as the "metallic-circuit" plan, as hereinbefore indicated.

In the drawings which illustrate my invention, Figure 1 is a sectional elevation taken on the line *x x* of Fig. 2, showing a pair of plugs inserted. Fig. 2 is a plan of the switch-board constructed according to my improvement,

and Fig. 3 is a side view of the plug-connector employed by me in the manipulation of the said switch-board.

In Fig. 2 the letter A represents the uppermost non-conducting plate of a series of conducting and non-conducting-plates interleaved with and piled one upon another, as clearly shown in Fig. 1, in which the dark plates *a* represent the non-conductors and the light plates *b* the conductors. These plates are firmly bolted together at as many points as may be found necessary by the screw-bolts *d*, which I have shown as passed through the pile, one at each corner.

Surmounting the pile of interleaved plates *a b*, I place a series of line-plates, *c c'*. Each line-plate consists of two metal plates completely insulated one from the other, and each one connected by wire with a separate binding-screw, *g*, while the two binding-screws of each line-plate are, when in use, attached to the two terminals of a metallic circuit. Taking, for example, line-plate No. 1, it will be observed that the rectangular half-plate *c* is connected by an insulated wire (represented by dotted line *w*) with the binding-screw *g*, and the complementary half-plate, *c'*, is similarly connected by the wire *w'* with the binding-screw *g'*. One terminal of the line-circuit is then attached to the screw *g* and the other to the screw *g'*, the said line-circuit itself (which I have not considered it necessary to show in full) leading out from *g* by the wire W to the substation, and returning by wire W' to the binding-screw *g'*. The half-plates *c c'* thus form the absolute terminals of the metallic or loop circuit. They are affixed by means of small screws to the uppermost non-conducting plate, *a*, and taper holes are bored through each line-plate and extend through all the conducting and non-conducting plates, for the reception of the plug-connectors, as shown in Fig. 1.

In the patent of Blake which I have hereinbefore cited, as also in an improvement thereon for which I obtained Letters Patent No. 255,056, bearing date March 14, 1882, the interconnection of looped circuits is not contemplated, and no devices operating to that end are therein shown; and as in the employment of those devices but one terminal of each circuit is attached to the line-plate, the other being connected with the earth at the distant substation, the interconnection of two circuits simply requires the insertion of a pair of solid plug-connectors, which each make contact at their upper end with their respective line-plates and at their lower or inner extremity with one and the same connection-plate.

My present invention, having both ends of the line-circuit connected to the line-plate, which, as hereinbefore indicated, is made in two metal pieces insulated from one another, requires the insertion in each of the line-plates belonging to the circuits to be interconnected of plugs provided with two conductors, each of which is adjusted to make contact with a separate line-plate, so that when two metallic circuits are to be connected together in accordance with the terms of my invention the connection-plates *a* are employed in pairs, one of the pair being connected by means of the double conductor-plugs with the half-plate *c* of each line-plate, and the other one of the pair similarly attached by means of the second conductor in the plug to the other half-plate, *c'*, of each line-plate. I accomplish this by a plug-connector composed of two plates or strips of metal, *e e'*, let in on either side of the main stem or nucleus of hard rubber or other non-conducting material, *k*, which is extended to form a handle, *p*.

Each plug is provided with two segmental flanges, one upon each of the metal plates *e e'*. As shown in Fig. 3, one of these flanges, *l*, is placed at the extremity of the plug, so as to make contact with the last or innermost connection-plate to which the said plug extends, and the other flange, *l'*, forming a part of the metal plate *e'*, is placed higher up on the opposite side of the plug for the purpose of making contact with a second connecting-plate higher up in the series, as shown in Fig. 1, in which the inserted plugs contact upon the adjacent connecting-plates d^4 and d^5, which are thus used in pairs to form a connection between any two line-plates.

Although I have, for convenience of illustration, shown the different connecting-plates of a pair to be immediately adjacent to one another, as b^4 and b^5, and separated only by the non-conducting plate a^5, I may, if I so select, use connecting-plates at any distance from one another as the component elements of a pair. Thus plate *b* may be paired with d^3, *d'* with d^4, and b^2 with b^5, in which case, of course, the opposing flanges of the plugs used in connection with each pair of connecting-plates will likewise be necessarily placed at the required distance from one another. This modification will be preferably employed when the connecting-plates are made of very thin metal plates, as shown and described in my former patent of March 14, 1882, hereinbefore cited, to prevent any interference between the respective connecting-plates of a pair.

A separate pair of plugs, *p*, is requisite for each pair of connecting-plates; but, except in the matter of length, it will be seen that all the plugs are constructed alike, and that both plugs of each pair must be long enough to reach to and make contact with the conducting-surface of the lowest connection-plate of the pair to which they belong.

To insure the proper insertion of the plugs, a notch, *z*, is cut in the internal surface of one of the half-plates of each line-plate, and is fitted for the reception of a pin, *j*, abutting from the upper portion of the conducting-surface of the plug *p*, which at this portion of its length, *s*, is amplified somewhat in size in order that it may tightly fit between the two half-plates *c c'* and make a good contact with both.

The shank or main stem of each plug be-

tween the amplication or collar *s* and the flanges *l l'* is made considerably smaller than the hole to prevent accidental contacts with any other connection-plates than the pair intended.

I do not confine myself to the notch *i* and the pin *j* as a means of guiding the adjustment of the plug, as any other special conformation of the line-plate hole which will render compulsory the insertion of the plug always in a particular manner may obviously be substituted therefor.

In the practical utilization of my invention signaling appliances and other apparatus are of course necessary; but they form no part of my invention, and consequently are not herein shown. Let it be supposed that two circuits—No. 1 and No. 3—both of which are metallic, running from the switch-board by wire 1 and returning by wire 2 to the respective half-plates *c* and *c'*, are to be connected one with the other for through communication between substations located thereon. It is also desired that some special pair of connection-plates should be employed in such through connection—for example, b^4 and b^5. The plugs corresponding to those plates are simply inserted in the holes designated by the figures or numbers of the respective lines and the connection is complete. The course of the compound circuit is now from the wire 1 of No. 1 line-circuit to binding-post *g*, half-plate *c*, plug-conducting plate *e*, flange *l*, connection-plate b^5, flange *l* of the second plug, conducting-plate *e*, half-plate *c* of circuit No. 3, binding-screw g^4, wire 1 of No. 3 line, to substations, returning *via* wire 2 of No. 3 line to binding-screw g^5, half-plate *c'*, plug-plate *e'*, flange *l'*, connection-plate b^4, flange *l'* of No. 1 plug, plug-plate *e'*, half-plate *c'*, binding-screw *g'*, and out, *via* wire 2 of line No. 1, to the substations, thence returning *via* wire 1 to the central station.

Having now described my invention, I claim—

1. A switch-board consisting, substantially as hereinbefore described, of a number of conducting connection-plates interleaved in a pile with non-conducting plates a number of line-plates, each split in half, for the reception of both terminals of a metallic circuit or loop line, and provided with plug-holes in and through each line-plate, and extending also through all the connection and insulating plates, and a plug-connector having two conducting-plates attached thereon, for connecting simultaneously each half of the line-plates to a separate connection-plate, for the purpose specified.

2. In an electrical switch-board of the class indicated, the combination of the line plates or commutators, each divided into two contact-plates, to which the terminals of a metallic circuit are permanently attached, with the connection-plates, arranged in pairs and interleaved with non-conducting plates, and means, as indicated, whereby each division of the line-plate may be connected with one of a pair of connection-plates, for the purpose specified.

3. In a switch-board for metallic circuits, a double-contact plug-connector consisting of two strips extending on the sides of the plug and insulated from one another by a base or shank of non-conducting material, both of the said strips being provided at or near each end with a metal projection or flange, the flange at the upper or outer end being in both strips coincident in distance from the end of the plug, and the flanges or projections at the lower or inner end being unequal in distance from the end of the plug, whereby the plug is adapted to make contact at its outer end with the two line contact-plates which are on the same plane and at its inner extremity with any predetermined two connection-plates on different planes, as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 25th day of April, 1882.

THEO. N. VAIL.

Witnesses:

FRED. BARTLEET,

GEO. WILLIS PIERCE.