

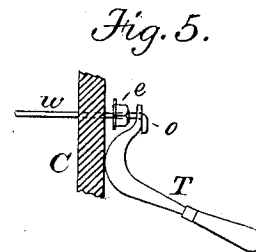
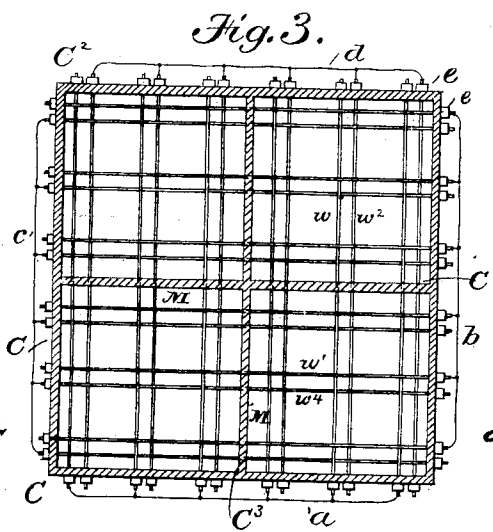
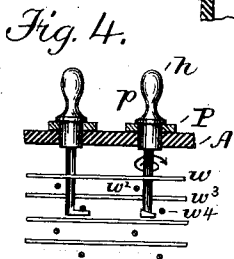
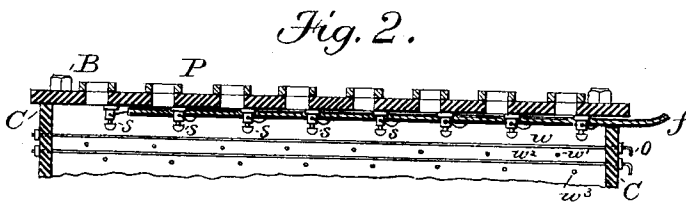
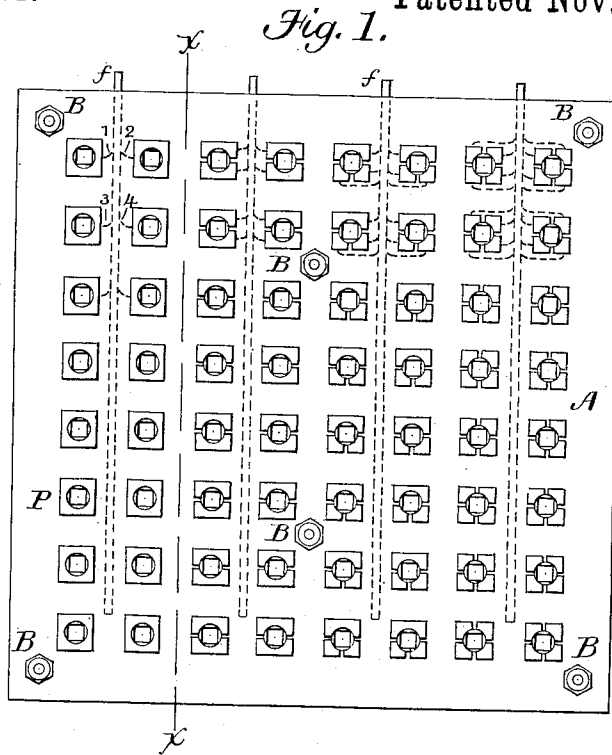
(No Model.)

T. N. VAIL.

ELECTRIC SWITCH BOARD.

No. 330,644.

Patented Nov. 17, 1885.



Witnesses.
Geo. Willis Pierce,
Thos. Lockwood

Inventor,
Thos. Vail

UNITED STATES PATENT OFFICE.

THEODORE N. VAIL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE
AMERICAN BELL TELEPHONE COMPANY, OF SAME PLACE.

ELECTRIC SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 330,644, dated November 17, 1885.

Application filed July 7, 1885. Serial No. 170,849. (No model.)

To all whom it may concern:

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

My invention relates to electrical switch-boards of that class wherein the connection-strips whereby any two circuits are or may be united are represented by sheets or plates of metal insulated one from another, while the several line-circuits are attached to and represented by smaller plates, one for each circuit, these latter being secured to the surface of a plate of non-conducting material, which surmounts the whole. The connections in such switch-boards are made by the insertion of plugs made in pairs of different lengths, each separate pair of plugs being of the precise length requisite to make contact with one of the connection-plates and no other, while, irrespective of length, all the pairs are adapted to make contact with the smaller or line plate. Such switch-boards are adapted by virtue of their peculiar construction to be placed horizontally, and advantageously operated by persons stationed at its several sides.

The object of my present invention, briefly stated, is to provide a switch-board which, with great economy in construction, shall be durable, simple in operation, and much more convenient and commodious than those in common use. I have heretofore obtained Letters Patent of the United States No. 255,056, bearing date March 14, 1882, and No. 296,253, bearing date April 1, 1884, which recite and claim certain inventions and improvements in switch-boards of this class, consisting, first, in the use of alternating very thin connecting and insulating plates made operative by causing a portion only of each plate to project into the plug-hole, the plug being provided, also, with a corresponding projection arranged to meet the same and make contact therewith; and, secondly, in the substitution for the said connecting-plates of conducting strips, bars, or wires, the several strips of each layer being all connected together, so that they collectively constitute a practical equivalent of a complete and continuous plate.

My present invention is an improvement and modification on the foregoing patents; and it consists in the use of wires stretched tight alone, in lieu of any other connection-plates whatsoever in the combination, with such wires, of suitable stretching and straining devices, and in dispensing altogether with the alternating non-conducting plates, using in lieu thereof a space of dry air only. The advantages of this construction are obvious. A better connection can be made when wires only are employed, while they maintain rigidity under circumstances where flat strips would yield. They can, moreover, be tightened with a greater degree of ease. Owing to the absence of the intervening non-conducting plates, the thickness of the mass may be reduced and many of the connecting pins or plugs correspondingly shortened, while the substitution of dry air for the material and more solid plates which I have heretofore employed is otherwise advantageous, seeing that dry air, while one of the best of insulators, (being the first on the list given in Culley's Manual of Telegraphy,) has also a lower specific inductive capacity than nearly every other insulator.

In the drawings which illustrate my invention, Figure 1 is a plan view of the upper surface of the switch-board. Fig. 2 is a partial vertical section on the line *xx* of Fig. 1. Fig. 3 is a horizontal cross-section of the switch-board, showing the several connecting-wires. Fig. 4 is a detail view showing a pair of plug-connectors inserted, one being in place and the other about to be turned into contact with the wire; and Fig. 5 indicates the stretching apparatus and the mode in which it is employed.

In constructing the switch-board, I provide a base-board, and upon it I construct a suitable frame, *C*, by means of which the wires *w*, representing the connecting-plates, are supported, the consecutive layers of wires being transversely disposed with reference to the layer immediately adjacent on either side. As in my prior patent of April 1, 1884, hereinbefore cited, the several wires are so fixed that each one extends across an arc of the series of plug-holes which it crosses, so as to form a chord of the said arc, and each hole, in

virtue of the four chords it thus contains, is practically square. The several connecting-plugs are in like manner made in pairs, to reach through the mass and to connect the
 5 line-plate with any desired connecting-wire, while all of the said connecting-wires on the same horizontal plane are connected together so as to constitute an individual electrical conductor separate from all others and com-
 10 plete in itself, and, as shown in the same patent, (to which reference may be made,) the several connecting-conductors thus formed may, by suitable wires or other continuations, be brought to the surface of the board and
 15 combined with manipulating devices, such as the central-station telephones and signaling apparatus. The walls C of the frame are made necessary by the fact that the connect-
 20 ing-wires *w* are to be stretched taut, all forms heretofore having employed connecting devices merely laid upon the mass without stretching devices, and held in place merely
 by the pressure of the various layers of the board, aided by the clamping-bolts. The sev-
 25 eral connecting-wires are arranged in series of four, *w*, *w'*, *w''*, and *w'''*, as shown, the immediately adjacent neighbor of each wire on either side being transversely disposed with
 30 reference to the said wire. Any desired number of these series of four may be incorporated in a single switch-board, this feature being only governed by the necessity of keeping the
 length of the connecting-plugs down to a practical limit. The several wires of each
 35 layer are of sufficient length to extend through holes bored for the purpose in the walls of the switch-board, the wires *w* and *w''* being supported by the walls C² and C³, while the
 40 transverse wires *w'* and *w'''* are similarly supported by C and C'. Non-conducting supporting cleats or partitions M, having holes through which the wires are passed, are pro-
 45 vided, crossing the entire superstructure from side to side, to prevent the wires from sag-
 ging and making undesigned contacts with one another. Any requisite number of such
 partitions may be provided, as the size of the switch-board may require.

I do not provide any interposed non-con-
 50 ducting plates between the different layers of wires, these being at all times out of contact with one another, and the air is consequently the only interposed dielectric. When as many
 layers of connecting-wires are arranged in
 55 place as are for any individual switch required, the non-conducting top or covering plate A is superposed over the structure, and may be screwed thereto by the bolts B at the
 60 corners and at as many intermediate points as may be necessary. Upon this plate A, I place
 in a manner well understood the several line-plates P, each of which is at all times in contact with and represents a main line, and is
 65 perforated for the reception of the connecting-plug *p*. The arrangement of the connecting-wires with respect to each hole is indicated

by the four lines forming a square therein. The plug-connectors are formed with a cam projection at their lower extremities, and
 70 when the plug is to be inserted in the hole the cam will be so disposed as to pass through the hole at one of its corners until the designed
 connecting-wire is reached, when the plug is slightly turned round, and the cam thereupon
 75 slides under the said wire, making contact therewith and uniting the said wire to the line-plate. To connect any two wires to-
 80 gether, two plugs of the same length are chosen and caused to make contact with the same wire.

I find it very convenient to bring the line-wires to the switch-board by means of multi-
 85 ple cables *f*, which are led along the upper surface of the board, and from which the several line-wires 1, 2, 3, and 4, &c., are
 90 branched to their several line-plates. The cables may alternatively be carried below the sur-
 face of the plate, and the wires reaching the line-plates may be attached to them, either
 95 through the instrumentality of screw-posts *s*, as shown in Fig. 2, or may simply be attached to the side of the plate by soldering. The
 wires of each layer are connected together by
 100 outside wires, *a b c d*, so that all the wires of each layer combine to form of that layer a single
 105 connecting-link accessible to any line-plate of the board. Each wire is maintained taut by the screw end and nut *e*, and to the
 end that, in the operation of tightening, no undue strain will fall upon the nuts and screw-
 110 thread, I prefer to bend the ends *o* of the wires after placing the nut thereon, and I provide a
 special tool, T, which, being inserted below the end *o*, is enabled to pull out the wires un-
 115 til they are completely taut, after which the
 120 nuts are screwed up and the wires are maintained at their proper degree of strain.

Having thus described my invention, I claim—

1. In an electric switch-board, the combina-
 125 tion of connecting-wires stretched taut and arranged in layers, as described, each alter-
 nate layer being transversely disposed with respect to the layers immediately above or
 130 below the same, the line-plates fixed to a non-conducting covering-plate, each of the said
 line-plates being perforated for the reception of a plug-connector, and placed over an inter-
 section-point of the several wire layers, and a series of plug-connectors provided in pairs of
 135 varying length, the said plugs being adapted for insertion through the line-plates and to
 connect the said line-plate with any desired one of the connecting-wires, in the manner de-
 scribed.

2. An electric switch-board consisting of a
 140 non-conducting frame, a series of superposed layers of horizontally arranged connecting-
 wires stretched taut therein, to serve as connect-
 145 ing-links between any two main lines, the said layers being each in different horizontal
 planes and insulated from one another by air

only, a non-conducting plate surrounding the whole, a series of perforated line-plates, each representing a main line, mounted on the said non-conducting-plate, and a series of pairs of plug-connectors, each pair being adapted to extend through the line-plates and to make contact with one of the layers of connecting-wires, as and for the purposes described.

3. The combination, in a horizontal electric switch-board, of the connecting-wires, arranged as herein described, and fastening devices—such as screws and nuts—as indicated, for detachably securing said wires to the frame of the switch-board, so that they can be tightened when necessary.

4. The combination, in a horizontal electric switch-board, of the connecting-wires arranged in horizontal layers of different planes, each alternate layer being transverse to the adjacent layers, and the several wires being provided with hooked ends, and the fastening devices detachably securing the ends of said wires to the frame of the switch-board, so that they can be tightened when necessary, substantially as described.

5. The combination, in a switch-board of the character hereinbefore described, of the inclosing case or frame, the non-conducting covering-plate thereof, the line-plates, each perforated for the reception of a plug-connector, affixed to and supported by the said plate, and the stretched wires arranged in transversely-disposed horizontal layers in the dry-air space within the inclosing-case, so that one wire of each layer crosses an arc of the circle of each of the line-plates, and plug-holes, as described, whereby each layer of wires is caused to serve as a connecting-plate and may by suitable plug-connectors be united with any of the said line-plates, substantially as hereinbefore described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 27th day of June, 1885.

THEO. N. VAIL.

Witnesses:

THOS. D. LOCKWOOD,
GEO. WILLIS PIERCE.