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T. A. & W. P. HAMMOND.  
SWITCHBOARD CONSTRUCTION.

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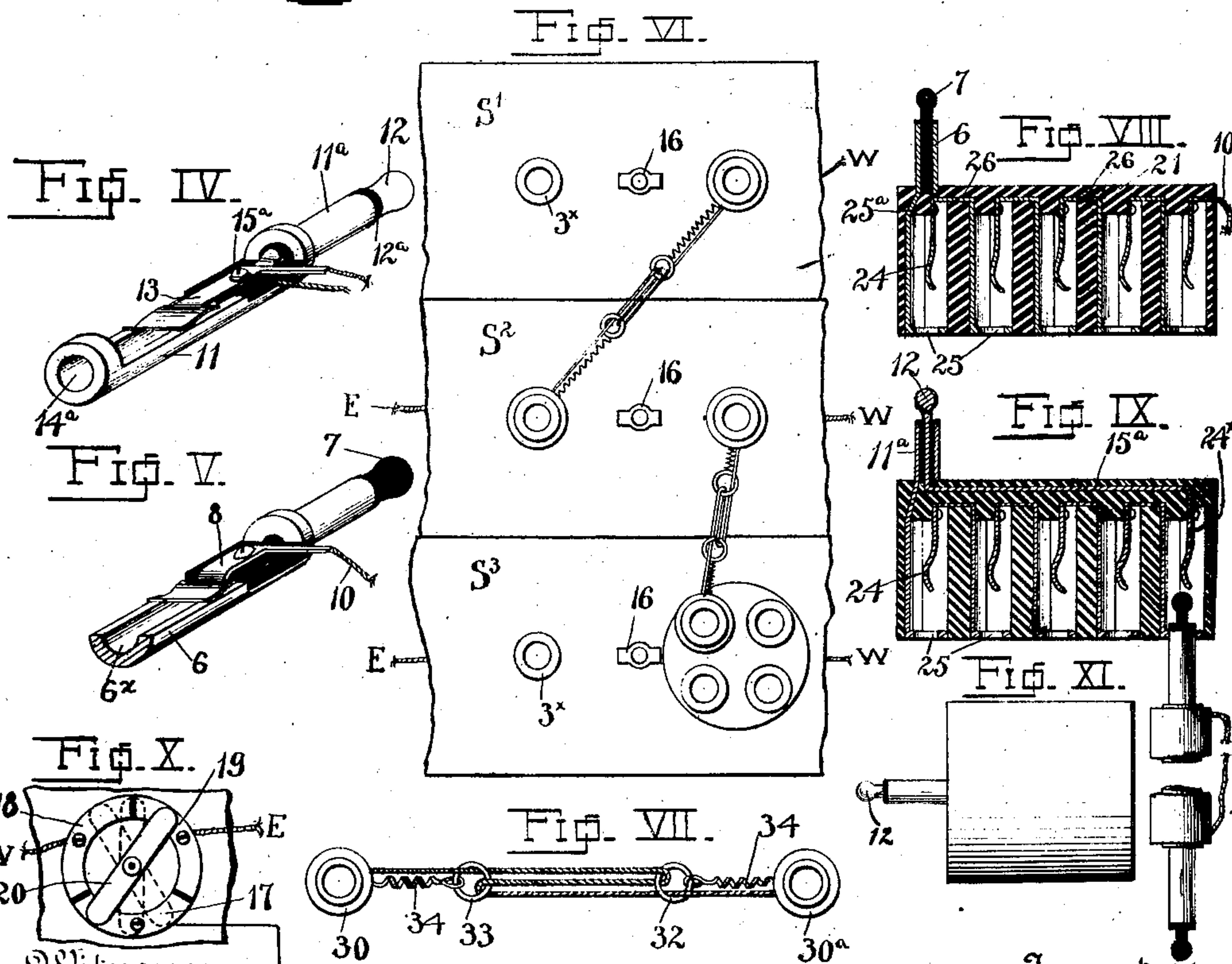
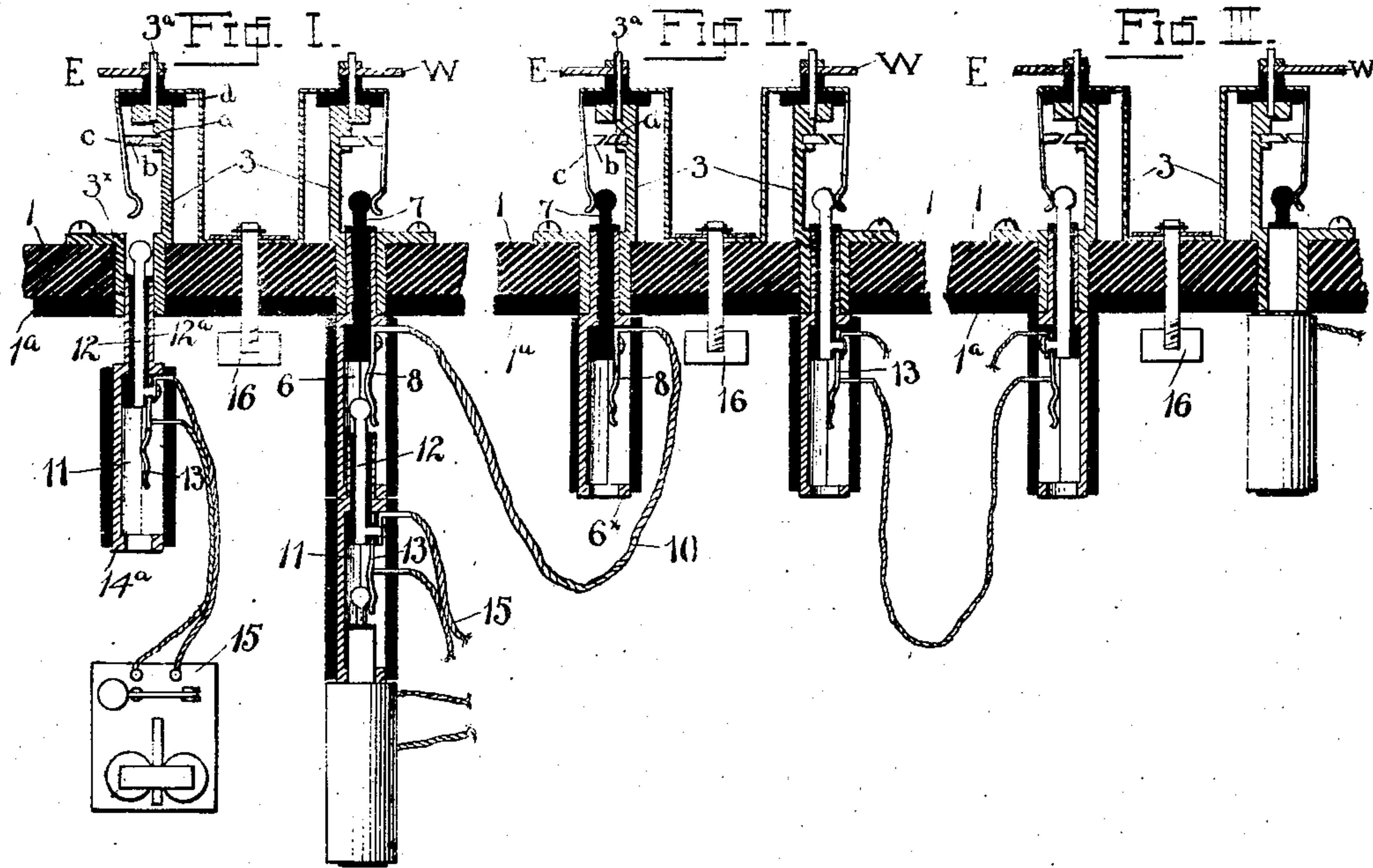


Fig. X. 19  
18  
W  
20  
17  
E  
Witnesses  
S. von Greuter.  
Henry C. Workman

Fig. VII. 34  
30  
34  
33  
32  
30a  
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By their Attorneys Knight Bros.



# UNITED STATES PATENT OFFICE.

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## SWITCHBOARD CONSTRUCTION.

No. 862,072.

Specification of Letters Patent.

Patented July 30, 1907.

Application filed November 18, 1903. Serial No. 181,665.

*To all whom it may concern:*

Be it known that we, THEODORE ALBERT HAMMOND and WILLIAM PIERSON HAMMOND, citizens of the United States, residing in the city of Passaic, county of Passaic, State of New Jersey, have invented certain new and useful Improvements in Switchboard Constructions, of which the following is a specification.

Our invention relates to switchboards and has for its object to provide a switchboard of simplified construction and compactness in dimensions and to provide in connection therewith means for making connections and loops, and other devices whereby the operation of the switchboard may be greatly facilitated and simplified.

A further object of the invention in addition to providing a switchboard of greater simplicity and compactness in dimensions is to enable a greater number of both patching and looping connections to be made thereon with greater facility, readiness and certainty than with switchboards of present known construction.

To the accomplishment of the above mentioned objects and others which will hereinafter appear we have devised plugs of a novel construction to be used in connection with our switchboards whereby a plurality of connections may be made from a single switchboard jack.

We have also provided a convenient grounding switch whereby, in connection with a switchboard constructed according to our invention, the various lines or branches may be grounded or connected to form through lines as desired.

Another object of our invention is to provide a switchboard with the parts and connections to be manipulated thoroughly insulated whereby the danger of short-circuiting is eliminated and the operator's safety from accidental shocks is insured.

As herein illustrated and described our invention is applied to a telegraph system but it is understood that the invention is not limited to this particular application, but on the contrary, may be applied either in part or in whole wherever similar switching connections may be desired, as for instance in telephone systems.

Switchboards in general use at the present are of the disk and strip type involving great complexity and intricacy in construction and wiring and demanding a considerable degree of skill and care in operation. Switchboards of this type present the further objection that for every addition of a line or branch the switching connections are greatly increased thereby increasing the size of the board disproportionately to the number of connections which may be made thereon. Moreover, in boards of this type the terminals of

the line,—that is the disks and the strips are exposed and the operator is liable to short circuit the lines and is also liable to receive shocks in manipulating the board. Furthermore, in boards of this construction, it requires the insertion of a plurality of plugs to make a connection and it requires constant attention and vigilance on the part of the operator to prevent the circuits from being left open. All of these objections are obviated by switchboards and plugs made in accordance with the present invention.

We have illustrated in the accompanying drawings a switchboard and plugs for use in connection therewith embodying our invention.

In the drawings, Figures 1, 2 and 3 are sectional views respectively of a single section or unit of the board with plugs in position to make connections. Fig. 4 is a perspective view of a looping plug with its casing removed to exhibit its interior construction. Fig. 5 is a similar view of a patching plug. Fig. 6 is a front elevation showing a portion of a switchboard made in accordance with our invention and showing plugs inserted therein for making connections. Fig. 7 represents an automatic plug cord take-up. Fig. 8 is a sectional view of a patch plug box. Fig. 9 is a similar view of a looping plug box. Fig. 10 is a view illustrating the construction of the switch. Fig. 11 is a view of a modified form of plug box.

Referring to Fig. 6 the switchboard is built of a series of sections  $S^1$ ,  $S^2$ ,  $S^3$ , arranged one above the other and supported in a suitable frame work (not shown). These sections are formed of suitable insulating material 1 faced with vulcanite hard rubber or any other suitable insulating material 1<sup>a</sup> to give a desired finish to the face of the board. It will be understood that as many of these sections may be employed as may be required to accommodate the number of lines entering a station. The switchboard herein shown and described is designed for an intermediate station but it will be understood that the invention may be applied to terminal stations. Each line entering the station is connected to one of the sections  $S^1$ ,  $S^2$ ,  $S^3$ , etc., the line entering at one side of a section as indicated at E and leaving at the other, as at W. A grounding switch 16 is shown to which each of the branches W and E are connected and by means of which either branch W or E, or both, may be grounded. Two jacks 3, 3, are provided, one connected to each branch E or W of the line to enable patching and looping connections to be made from either portion as required. The switch 16 is of a novel construction and will be more particularly described below. All the line or board jacks 3 are of similar construction so that a description of one will suffice. The jacks consist of the main or stem portion 3<sup>b</sup>



formed with a neck or socket portion 3<sup>a</sup> by which they are fitted to the board or panel 1 and into which the plugs for making the connections are inserted. A binding post 3<sup>a</sup> is fitted to the stem portion 3 by means of which the line is electrically connected with the jack. A spring *c* is carried by the stem portion and insulated therefrom by insulation *d*. Contact points *a* and *b* are provided on the stem and spring respectively and are normally in contact, thus maintaining electrical connection between these parts. These jacks constructed as above described are well-known in the art and ordinarily used for the purpose of making loop connections only. An important feature of the invention consists in means hereinafter described, whereby these jacks which ordinarily can be used only for making looping connections, may also be used according to our invention for making either patching or looping connections or both. In switchboards at present used special patching jacks are required, from which either or both may be made.

The plugs for making the desired connections are of the following construction: For a patch connection,—*i. e.*, for connecting one line to another, a plug of the construction shown in Fig. 5 is employed. This plug comprises a body portion 6, reduced at one end to fit into the socket 3<sup>a</sup> of the switchboard jacks 3 and is provided at its other end with a socket 6<sup>a</sup> for the receipt of other plugs. In its reduced end is fitted a pin 7 of insulating material arranged to contact with and deflect the spring *c* of the switchboard jacks 3. Secured by one end to said pin is a spring 8, the free end of which is enlarged or flanged to contact normally with the body 6 of the plug. A connecting wire or cord 10 is electrically connected with the spring 8 and leads to a plug of similar construction at its other end, it being understood that one such plug is inserted in a jack-socket connected to the line to be patched and the other plug is inserted in a jack-socket connected to the line with which said first line is desired to be connected, in the ordinary manner of making patch connections. This is illustrated in Figs. 1 and 2 where one line *E* (Fig. 2) is shown patched to another line *W*, Fig. 1. When a patch connection is thus made the circuit is as follows: From first wire *E* through the stem 3 of the jack to the body 6 of the plug (the contact at *a* and *b* being broken by pin 7 deflecting spring *c* and forcing contact *b* away from contact *a*), thence to spring 8, thence through line 10 to the patching plug at the other end of said line, to spring 8 of that plug, to body 6 thereof, to stem 3 of the jack, and thence to the line *W* (Fig. 1).

With plugs made in accordance with our invention as above described, a patch and a loop connection may be made upon the same individual switchboard jack, or, if desired, a plurality of loop connections with a patch connection may be made from the same jack, or a plurality of loop connections may be made directly upon the same switchboard jack. Thus, it is frequently required to loop in upon a line which has been patched to another, either with a single loop or with a plurality of loops. It is also required sometimes to insert a number of looping connections upon a single line. With switchboard plugs at present in use this has required special looping and patching switchboard jacks for each connection desired. By means of our invention both looping and patching

connections, or a plurality of looping and a patching connection, or a plurality of looping connections may be made from one and the same switchboard jack. To accomplish this we have invented a novel form of looping plug to be used in connection with our patching plug and switchboard above described.

The construction of our looping plugs is as follows: Fig. 4 shows one of said plugs and in Fig. 1 a looping plug is shown inserted into a patching plug. The looping plugs are formed with a body portion 11 reduced at one end 11<sup>a</sup> to fit the jacks. In the reduced portion is mounted a pin or circuit opening portion 12 insulated therefrom by insulation 12<sup>a</sup>. Mounted on the inner end of said pin, but insulated therefrom, is a spring 13 the free end of which is normally in contact with the body portion 11. In the end of the plug is a socket 14<sup>a</sup> to receive other plugs. Spring 13 is formed so as to be engaged by a plug inserted in this socket and deflected from the body portion. Spring 13 is secured to pin 12 by a screw 15<sup>a</sup> which is insulated from the spring but has electrical contact with pin 12. The terminals of the loop wire are connected one terminal to pin 12 through screw 15<sup>a</sup> and the other terminal to spring 13.

When it is desired to insert a loop connection, a loop plug, as described, is inserted in any switchboard jack-socket. Pin 12 of the loop plug will break contact at *a* and *b* by deflecting spring *c*. The circuit will then be from a wire *E*, through jack stem 3, through loop plug body 11 to spring 13 around the loop 15, back through screw 15<sup>a</sup> to pin 12 and from pin 12 through spring *c* out to the line. (See Fig. 1.)

When a patch connection has been made and a loop is desired to be inserted in the patch, a loop plug is inserted in the socket of the patch plug as shown in Fig. 1. The circuit then is as follows: From line *W* through jack 3 to body 6 of the patch plug, to body 11 to spring 13, around the loop 15 to pin 12 to spring 8 of patch plug, thence through wire 10 to the plug inserted in the jack of the desired line, through spring 8 and body 6 of that plug thence to jack 3 and thence to the line. In a similar manner as many loops as desired may be inserted one upon the other by inserting one plug into the socket 14<sup>a</sup> of its predecessor. Thus as many looping connections may be made as desired from a single switchboard jack or upon a patch connection. It will be apparent that patch connections may be made with looping plugs, if desired, by connecting two such plugs with the usual connecting cord or wire, this wire being connected to that terminal of the loop in each plug which is connected to the spring 13 and the other terminal of the loop being cut out, as shown in Figs. 2 and 3.

In order to obviate the long extension made by a number of looping plugs inserted one upon another, which would be likely to render the management of the switchboard awkward and tend to detract from the simplicity and speed of manipulation, we have devised what we term patch plug boxes and loop plug boxes. These are shown in Figs. 8 and 9 respectively.

Referring to Fig. 8 the box portion 21 is constructed of any suitable non-conductive material, such as hard rubber, vulcanite, etc. In one face of this box is secured a patch plug pin similar in construction to the patch plug above described; *i. e.*, an insulating pin 7



mounted in a conductive stem or sleeve 6. This sleeve has electrical connection with a series of sockets 25, as follows: A connection 25<sup>a</sup> connects stem or sleeve 6 with one of the sockets 25. This socket is normally connected with all the other sockets 25 through springs 24 and connections 26. Each spring 24, except one, is electrically connected to a neighboring socket 25 by a connection 26, and to this excepted spring is connected the connecting wire or cord 10 having a patch plug or a patch plug box connected thereto at the other end.

It will be seen from the above description that this patch plug box may be inserted by means of its pin into any switchboard jack socket and a patching connection made therefrom. Also that one or as many loop plugs as the box will accommodate may be inserted in the sockets 25 without projecting a distance from the switchboard to interfere with its management.

We have devised a looping plug box upon the same principle of construction as the patch plug box above described. Fig. 9 shows a looping plug box. This box is provided with a looping plug having a pin 12 similar in construction and arrangement to the looping plug before described. The connections from this plug to the sockets 25 and to the springs 24 are similar to those in patch plug box; but one of the springs 24<sup>x</sup> is connected by a connection 15<sup>a</sup> to the insulated pin 12 to complete the loop circuit.

It will be obvious from the construction of the looping plug box that both looping and patching plugs may be inserted therein as desired as for instance when it is necessary to have a plurality of loops inserted in two patched line wires. In this case the looping plug box (Fig. 9) is inserted in the jack connected with one of the lines to be patched and a patching plug will be inserted in the socket 25 of said box in which spring 24<sup>x</sup> is situated. The companion patching plug connected to the first mentioned patching plug will be inserted in the jack of the other line with which the patching connection is desired to be made. The circuit in this case will be as follows: from the switchboard jack to the portion 11<sup>a</sup> of the plug box to the first socket 25 connected therewith, thence around the loop inserted in that socket thence to the next socket 25 and around the loop inserted therein and so on through the intervening sockets and loops until the current is conducted to the last socket 25 in which the circuit is broken by said pin and the current is conducted from said last socket through the patching plug and its conducting cord to the other patching plug which is inserted in the jack connected to the other line with which the patch is to be made in the same manner as an ordinary patch connection above described.

The shape or configuration of the plug boxes may be any desired. For securing compactness the cylindrical shape shown in Figs. 6 and 11 is found advantageous. The plug in this case is conveniently secured in the center of the box.

In order to avoid the use of grounding plugs or special grounding jacks we have provided a grounding switch 16 (Figs. 1, 2, 3, 6 and 10). This switch comprises segmental portions 17, 18 and 19, separated one from the other. A two armed contact piece 20 is secured on the stem of the switch. Segments 18 and 19 are connected with wires W and E respectively and segment 17 is connected to ground.

When it is desired to ground either wire W or E the switch is turned so that the contact 20 bridges segments 18 and 17 or segments 19 and 17, respectively (see Fig. 10). Both wires may be grounded by turning the switch so that one arm of contact piece 20 contacts with both segments 18 and 19 and the other arm contacts with ground 17 (see dotted lines Fig. 10).

In order to distinguish our plugs from those at present known and used in the art we shall refer to them in the claims as jack plugs, since they perform the double function of a jack and a plug. Similarly we shall refer to the plug boxes as jack plug boxes.

The advantages attained by our invention will be readily appreciated by those skilled in the art. By our invention we have provided a plug which combines the function of a jack and plug and by this means we are enabled to dispense with special patching and looping jacks on the switch board thus materially reducing the size and complexity of the board and its connections. We have further reduced the size and complexity of the board and its connections by means of our grounding switch.

Having thus described and ascertained the nature of the invention, what is claimed as new and desired to be secured by Letters Patent is:—

1. A single wire circuit switchboard apparatus comprising a plurality of jacks, and means for making either a patching or a looping connection at any individual jack. 90
2. A switchboard apparatus comprising a plurality of jacks, and means for making a patching connection together with a plurality of looping connections at any one of said jacks. 95
3. A single wire circuit switchboard apparatus comprising a plurality of jacks, and means consisting of plugs having conducting wires connected thereto whereby either a patching or a looping connection may be made at any individual jack. 100
4. A single wire circuit switchboard apparatus comprising a plurality of looping jacks, and means consisting of a pair of similarly constructed plugs electrically connected by a conducting wire or cord, said plugs coöperating with the jacks to make a patching connection between any two thereof. 105
5. A single wire circuit switchboard apparatus comprising a switchboard provided with jacks all of which are of similar construction, and means consisting of a plug having a loop circuit connected thereto, said plug coöperating with any of said jacks whereby the loop circuit may be inserted in the line connected therewith. 110
6. A single wire circuit switchboard comprising a plurality of jacks, means for making a patching connection between any two of the individual jacks, and means for imposing looping connections on the patching connection. 115
7. The herein described means for making switchboard connections, said means comprising a pair of plugs, electrical connection between said plugs, each of said plugs comprising an insulated circuit-opening portion, a body-portion of conductive material, the connection between said plugs being normally in electrical contact with the body-portions thereof but said contact adapted to be opened by another plug. 120 125
8. The herein described means for making switchboard connections, said means comprising a pair of plugs, electrical connection between said plugs, each of said plugs comprising an insulated circuit-opening portion, a body-portion of conductive material, the connection between said plugs being normally in electrical contact with the body-portions thereof, but said contact adapted to be opened for the purposes described. 130
9. The herein described means for making switchboard connections, said means comprising a pair of electrically connected switchboard plugs, each of said plugs comprising a circuit-opening portion, and a body-portion insulated from the circuit-opening portion, the electrical connection 135



between the plugs normally connected with their body portions only and said body portions adapted to make electrical contact with the switchboard wires, substantially as and for the purposes specified.

- 5 10. A switchboard comprised of jacks all of which are of similar construction, a plug for making patch connection, said plug comprising a circuit opening portion of insulating material adapted to open a circuit of a switchboard jack, means connected with the plug for conducting electrical currents from said switchboard jack to another  
10 switchboard jack and a socket to receive another plug.
11. A switchboard construction, comprising a through line wire, a switch adapted to divide said wire into two separate branches or circuits, a jack in each branch.
- 15 12. A switchboard construction, comprising a through line wire, a switch adapted to divide said wire into two separate branches or circuits, a jack in each branch, and means to make a patching and a plurality of looping connections from either or both of said jacks.
- 20 13. A switchboard construction, comprising a through line wire, a switch adapted to divide said wire into two separate branches or circuits, a jack in each branch, and means for making one or more looping connections from either or both of said jacks.
- 25 14. In an apparatus of the character described, a closed

circuit jack, means cooperating with said jack for effecting a patching or looping connection or both a patching and looping connection with said jack.

15. In an apparatus of the character described, a closed circuit jack means cooperating with said jack for effecting  
30 a patching or looping connection with said jack and means for grounding the circuit through said jack.

16. A switchboard apparatus comprising a plurality of closed circuit jacks, and plugs cooperating with said jacks for making either a patching or looping connection at an  
35 individual jack.

17. A switchboard apparatus comprising a plurality of closed-circuit jacks, and means for simultaneously grounding the circuits through two of said jacks.

18. A switchboard apparatus comprising a plurality of  
40 closed circuit jacks, and means for grounding the circuit through one of said jacks.

19. A switchboard apparatus comprising a plurality of jacks all of which are of the same construction, and means for grounding the circuit through any one of said jacks.

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