

(Model.)

4 Sheets—Sheet 1.

C. E. SCRIBNER.

TELEPHONE SWITCH BOARD AND PNEUMATIC SIGNAL THEREFOR.

No. 266,320.

Patented Oct. 24, 1882.

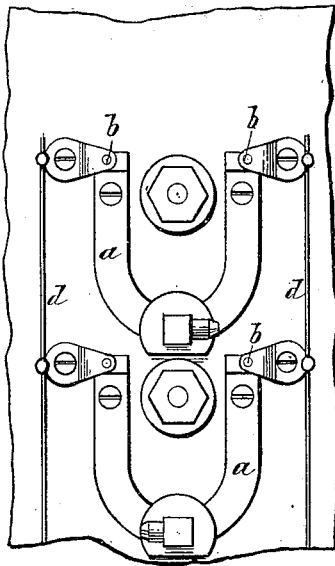


Fig 2

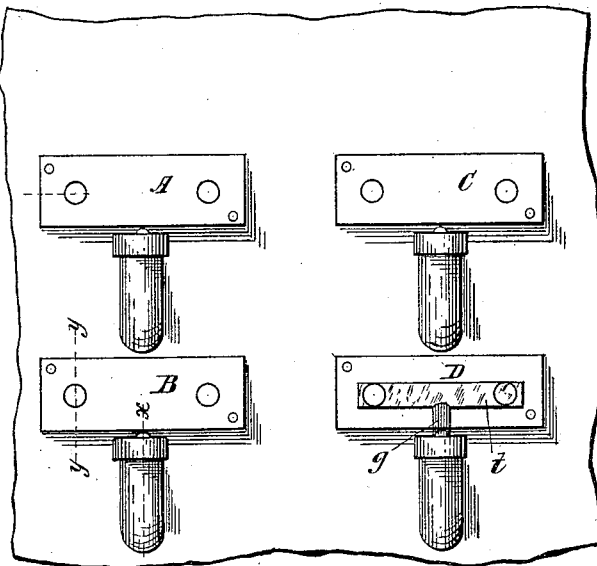


Fig 1

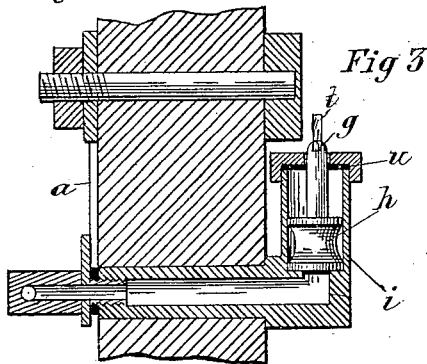


Fig 3

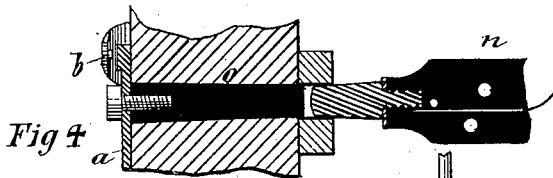


Fig 4

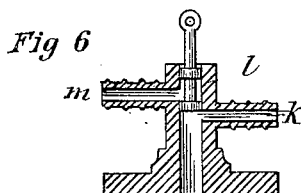


Fig 6

Fig 7

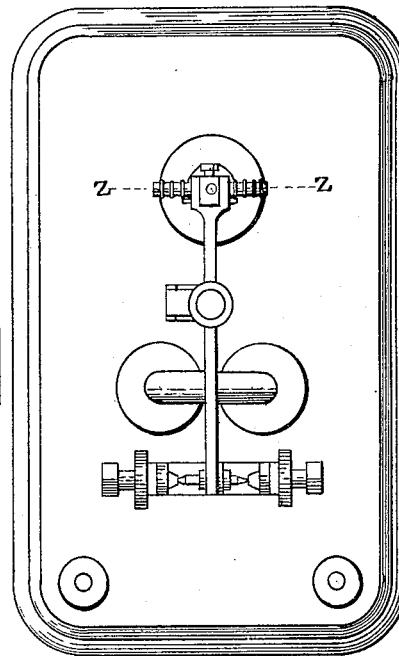


Fig 5

Witnesses

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James L. Baird.

Inventor

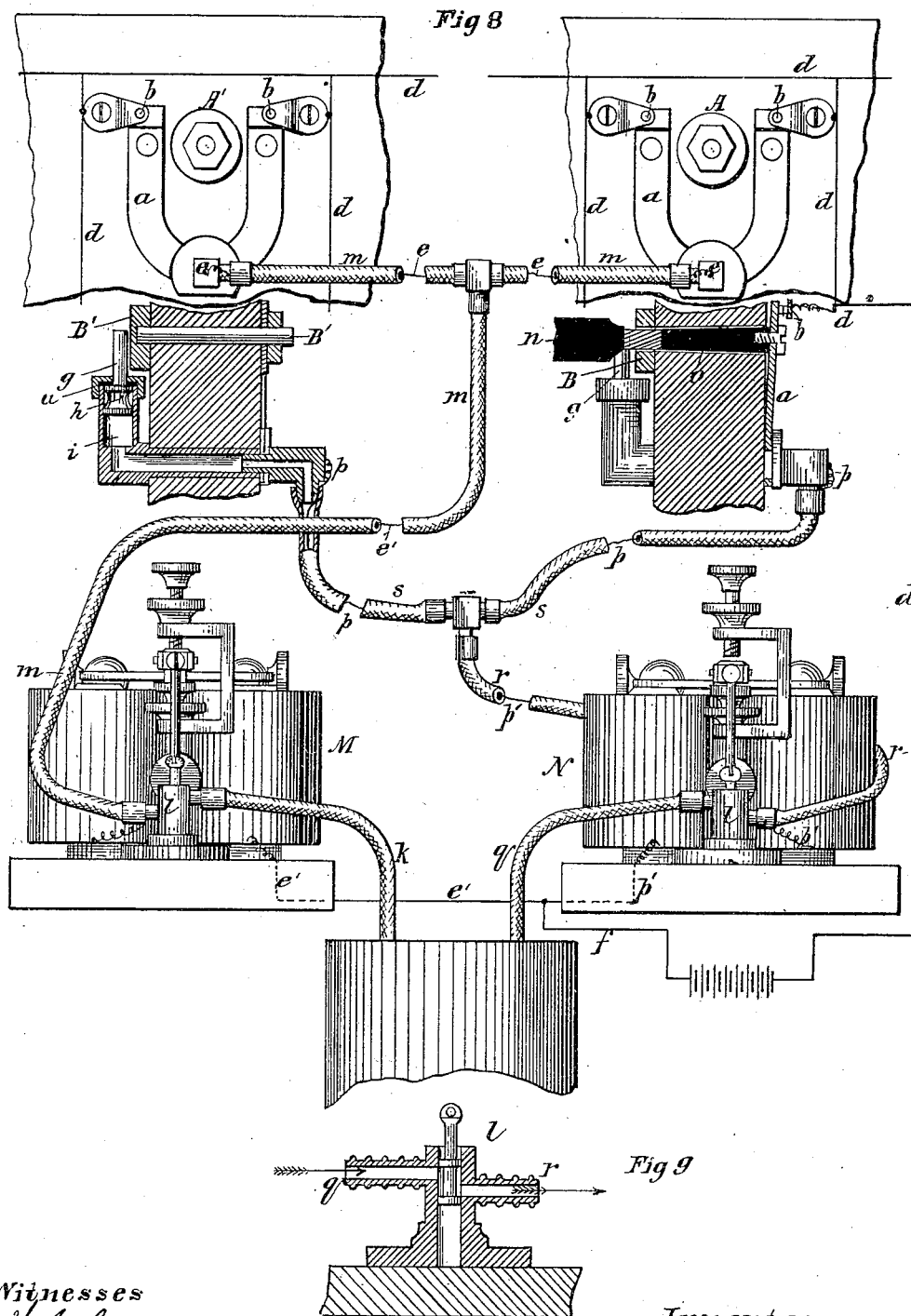
Charles E. Scribner  
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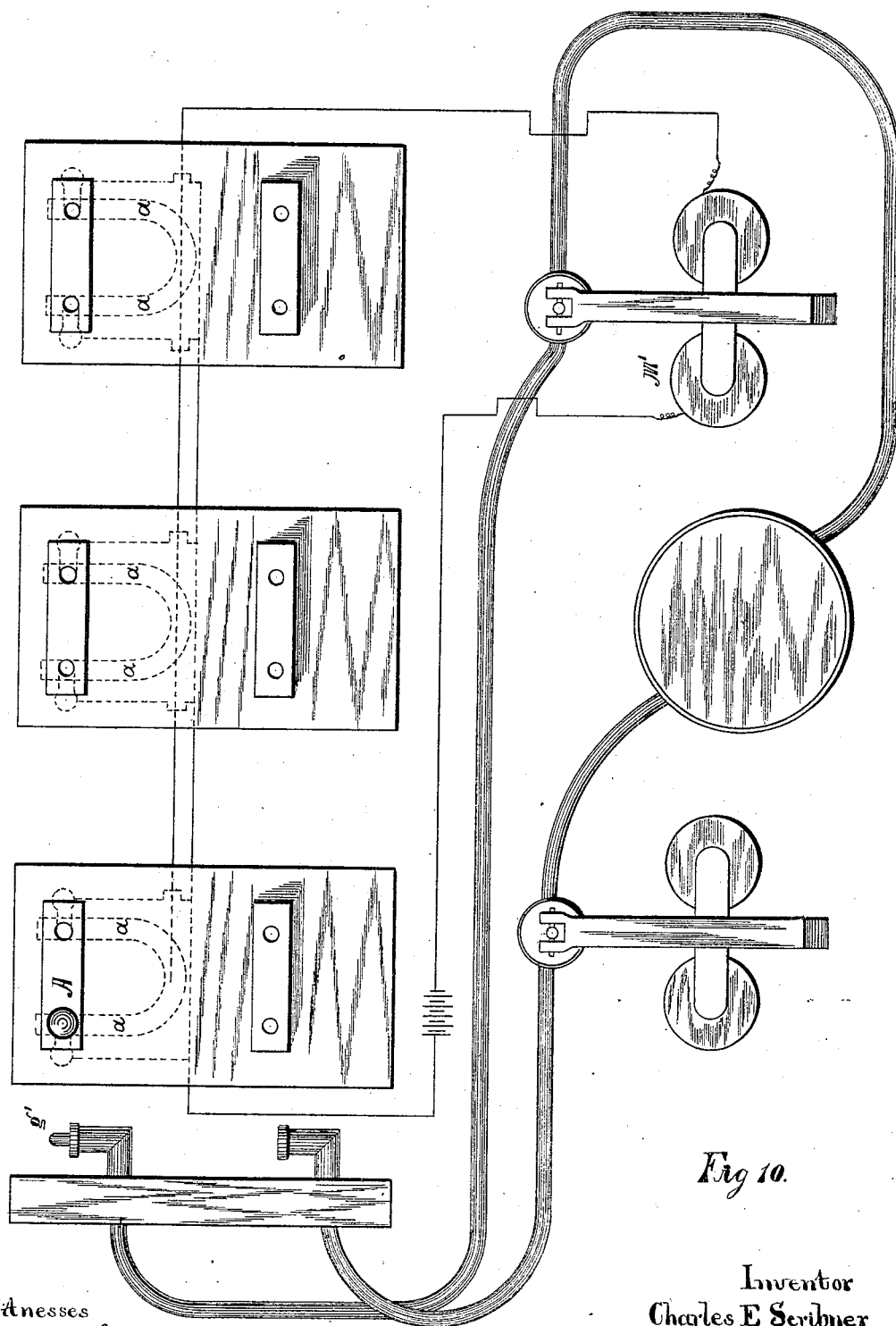


Fig 10.

Witnesses

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(Model.)

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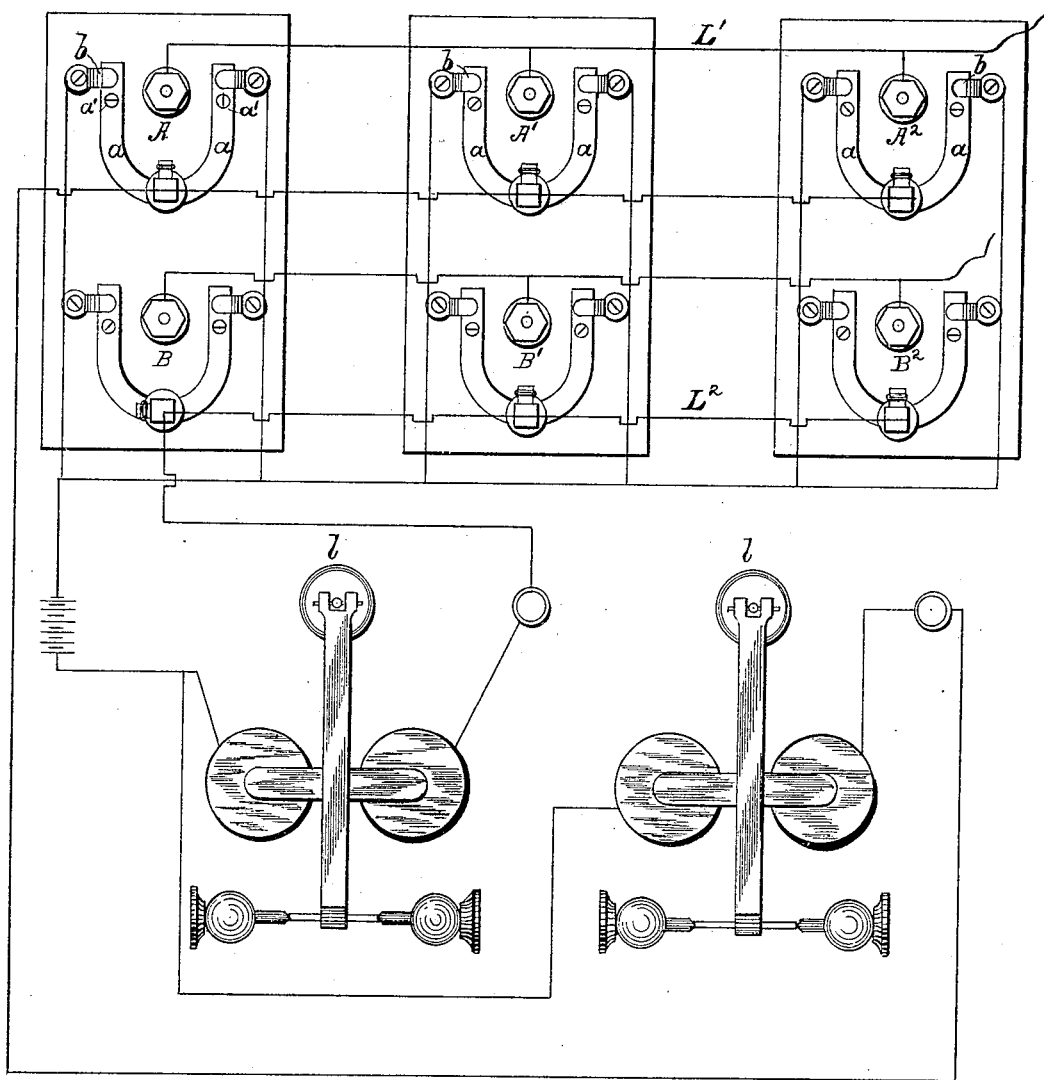


Fig 11

Witnesses

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Millard R. Brown

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# UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

## TELEPHONE SWITCH-BOARD AND PNEUMATIC SIGNAL THEREFOR.

SPECIFICATION forming part of Letters Patent No. 266,320, dated October 24, 1882.

Application filed January 7, 1881. (Model.) Patented in England November 29, 1879.

### *To all whom it may concern:*

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have discovered certain new and useful Improvements in Pneumatic Duplicate Switch-Boards for Telephone-Exchange Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

A telephone-exchange system consists of many subscribers with lines running to a central office, where one subscriber's line may be connected with the line of any other subscriber by an attendant switchman. When the subscribers increase so that a single attendant cannot do the necessary switching, duplicate switch-boards are provided and an attendant placed at each of them.

My invention relates to the connections of the lines upon the several switch-boards, and is designed to prevent confusion by showing the attendant at a given board the lines that are connected at other boards. By the use of my invention each attendant notifies all the others automatically when he makes or breaks a connection.

In the drawings, Figure 1, Sheet 1, is a front view of a switch-board, which may be of any size. Fig. 2 is a rear elevation of a portion thereof. Figs. 3 and 4 are enlarged sections thereof, respectively upon dotted lines *x x* and *y y*. Fig. 5 is a top view of the magnet and valve. Fig. 6 is an enlarged section of the valve on line *z z*. Fig. 7 is a detail view of the piston and connecting-rod of the valve. Fig. 8, Sheet 2, shows the pneumatic tubes and the circuits connecting the battery and magnets with the circuit-closers or keys on the different boards. Fig. 9 is a section of the valve of the magnet at the right of Fig. 8. In Fig. 6 the valve is closed, while in Fig. 9 the piston is down, leaving the valve open.

In the drawings, Sheet 3, Fig. 10, I have shown front elevations of portions of three switch-boards with series of bolts for two subscribers' lines and two targets, one target for each line or series of bolts. Fig. 11, Sheet 4, shows rear elevations of portions of three

switch-boards with two telephone-lines connecting with the two series of bolts. The local circuits through the relays are also shown. The pneumatic tubes may be arranged and connected as shown in Fig. 8.

In Fig. 1 I have shown four bolts, A B C D, on a switch-board. Each bolt belongs to a single subscriber. Thus each subscriber's line is connected with an independent bolt on each of the boards. We will suppose that the subscriber whose line is connected with bolt C has notified the central office that he wishes to talk with the subscriber whose line is connected with bolt B. The problem is to notify attendants at other duplicate boards when the bolts C and B are connected, and thus prevent confusion. This is done automatically, as shown in Fig. 8, in which A is the rear of a bolt, and B the section of a bolt on line *y y* of Fig. 1. Said bolts A and B, we will say, are on the first switch-board. The subscriber who is connected with bolt A of the first board is also connected with bolt A' of the second board, and likewise the subscriber who is connected with bolt B of the first board is also connected with bolt B' of the second. Bolt B' of Fig. 8 is a section, as shown by line *x x* of Fig. 1. I have provided a spring, *a*, and contact-points *b b* near each bolt, as shown.

All contact-points *b b* of the system are connected with line *d*, which connects with one pole of the local battery. Corresponding bolts on the different boards—that is, the series of bolts of a single subscriber's line—have their springs *a* connected with the coils of an electromagnet which operates a valve. Thus in Fig. 8 the springs *a a* of bolts A A' are connected with magnet M by wires *e e*, which unite in wire *e'*, which passes through the coils of the magnet of the relay to the common return-wire *f* of the battery.

The lines L' and L<sup>2</sup> of two subscribers are shown in Fig. 11 connected in the usual manner with their respective series of bolts A A' A<sup>2</sup> and B B' B<sup>2</sup> from the rear of the switch-boards in one of the well-known ways.

The "bolts" (shown in the drawings) consist each of a metallic plate fastened on the front of the board by a bolt which projects at the rear, so as to afford connection for the tele-

phone-line. Each subscriber's line is provided with a single bolt on each duplicate switch-board.

Any two subscribers' lines may be connected for conversation upon either board by means of flexible cords provided with terminal plugs in the usual manner. I prefer to construct the bolts with two plug-holes each, so that two connections may be made at the same time with any given line, as occasion may require.

The springs *a* may be in the form of horse-shoes, as shown. The lower portion or toe of each is attached rigidly to the board.

The rubber pins *o* are attached a short distance from the upper ends or heels of the springs by means of screws *a'*. The contact-points *b b* consist of metallic pieces, which project over the springs *a*. When a plug is inserted in a plug-hole, the point of the plug comes against pin *o*, and the spring *a* is thus brought into contact with its opposing point *b*.

The valve *l* of each relay is operated by the relay-lever, which is attached to the piston. When the battery-circuit is closed through the electro-magnet of a relay, as is well known, the poles attract the armature, which carries with it the lever of the relay. The valve is thus held open, as shown in Fig. 9, as long as the battery-circuit is closed through the relay. The lever of the relay is carried back by a spring, in the usual manner, as soon as the plug is removed and the circuit of the relay broken. The valve of the relay is thereby closed, as shown in Fig. 6.

In Fig. 10, Sheet 3, instead of a target for each bolt, I have placed single targets, one for each subscriber's line, or series of bolts on an annunciator-board in sight of the operators of all the boards. The local-circuit connections are indicated for one series of bolts by dotted lines. The pneumatic tube of each relay operates a single target. The local circuit of the relay of the first series of bolts is shown closed by the plug inserted in bolt A, Fig. 10. The valve of relay M' is thus opened and the pressure of the air in the pneumatic tube raises the target *g'*, as shown.

As shown in the other figures of the drawings, near each bolt I place a target or indicator, *g*, attached to a piston, *h*. The piston is inclosed within a cylinder, *i*.

A pneumatic tube, connected with a tank which contains air under pressure, passes to the valve of each of the magnets, and thence branches to the cylinders of all corresponding bolts—that is, the cylinders of the bolts whose local circuit is connected with the relay that operates said valve. Thus in Fig. 8 tube *k* passes to valve *l*, and thence, as tube *m*, branches to the rear of the first and second boards and connects with the cylinders of bolts A and A' of said Fig. 8.

The local wires *e e'* may be conveniently run within the tubes. Suppose any subscriber—for example, the one connected with bolts C C', &c.—has asked the central office to connect his line with that of the subscriber connected

with bolts B B', &c., and let the connection be made at bolt B, Fig. 8, of the first board. The attendant inserts a plug at the end of a conducting-cord in bolt C, (not shown in Fig. 8,) and plug *n* at the other end of said conducting-cord in said bolt B, as shown. In Fig. 4 the plug is shown just entering the plug-hole. Plug *n* presses against a pin, *o*, which should be a non-conductor, projecting into the plug-hole from the spring *a*. Spring *a* is thus bent or sprung back and touches contact-point *b*. The local circuit is thus established through magnet N as follows: from the battery by line *d*, which connects all points, *b* to spring *a* of bolt B, and thence by line *p p'* through magnet N, and to the common return-wire *f* of the battery. Thus when a plug is inserted in any bolt the local circuit is established through the magnet. The armature-lever is thus moved and the valve of the pneumatic tube connecting with the cylinder of said bolt and its corresponding bolts is opened, and the air under pressure forces itself into the cylinders of the series, and the pistons of the cylinders are driven out, and a target is brought to view near each bolt of the series, as shown near bolts B and B' of Fig. 8. Thus, as indicated in Fig. 8, when the local circuit is established and the valve *l* of magnet N opened by the movement of the armature-lever, the air passes through tube *g*, (see Fig. 9,) as indicated by the arrows, passing through the valve, and by tube *r* and its branches *s s* to the cylinders of bolts B B'. In case there are three boards or four the tube is branched in the same manner to each of them. The target or piston-rod *g* moves freely through the rubber packing *u* in the cylinder.

The upper end of the piston *h* is concave, so that its projecting circumference, when forced against the rubber packing, renders the cylinder air-tight as long as the pressure continues from below. When the pressure is removed the air finds vent around the piston-rod *g* and the piston falls to its normal position. In Fig. 1 I have shown a shield, *t*, attached to the piston-rod *g*, which, when the line of bolt D is in use at another board, covers the plug-holes of bolt D.

As heretofore described, and shown in Fig. 10, instead of a target on each board near the bolt of each line, a single target or indicator for each line may be placed in sight of the operators of all the boards upon an annunciator, in which case the pneumatic tube of each relay, instead of branching, runs directly from the valve of its relay to the cylinder of its indicator upon the annunciator-board.

Instead of the pneumatic tubes for operating the indicators, I have used the electro-magnets to operate directly visual signals. The signal of each magnet is placed in sight of all the boards, and may be of any well-known form. One position of a signal would indicate that the line which it represents is in use and another position of a signal that its line is unoccupied.

There are various methods of connecting subscribers with the central office. One system provides an independent line for signaling the central office. In another system each subscriber is provided with a complete metallic circuit. The ordinary method consists of a line grounded at the subscriber's station, extending to the central office through a switch and an annunciator to ground. Whatever the method or combination of methods used, provision must always be made for connecting any two of the subscribers upon each or either of the two or more duplicate boards. My system may be readily applied to any of the well-known methods, with such modifications as would suggest themselves to any mechanic acquainted with electrical apparatus.

I claim—

1. In a telephone-exchange system, the combination of two or more switch-boards, with each of which the subscriber's lines are connected, and local circuits—one for each subscriber—which are automatically closed or broken as the telephone-lines are connected or disconnected, each of said circuits operating one or more indicators, whereby the attendants may readily ascertain what lines are in use, substantially as set forth.

2. The combination of two or more switch-boards to which the telephone-lines are connected, and a local circuit for each telephone-line, and means, substantially as described, whereby an indication is automatically made when a connection is formed upon either of the boards, substantially as and for the purpose specified.

3. A local circuit which is closed through a magnet when a plug is inserted in a bolt or switch of a given series on the switch-boards, said magnet being combined with a valve in a pneumatic tube, said pneumatic tube being connected with one or more targets, substantially as and for the purpose specified.

4. A local circuit, in combination with one or more circuit-closers corresponding to the bolt or bolts of a subscriber, and an electro-magnet, and means whereby said electro-magnet actuates one or more targets when a plug is inserted in or withdrawn from a bolt.

5. The combination of the circuit, consisting of the wire *d*, extending from one pole of the battery and branching to one or more contact-points, *b*, of each of the circuit-closers upon the different boards, and extending from the other pole of the battery, as indicated by line *f*, and branching to magnets, as indicated by lines *e'* *p'*, each branch being divided, as indicated by *e e* and *p p*, and connected with circuit-closers of a single subscriber's bolts, and means whereby one or more visual signals are automatically obscured or disclosed when a plug is inserted in or withdrawn from a bolt.

6. The valve *l*, consisting of the piston provided with the upper and lower enlarged portions, so adjusted in the cylinder that the lower enlarged portion, when below opening *r*, leaves

the pneumatic tube open, but when raised above said opening closes the tube against the air forced into opening *q*, in combination with an electro-magnet and one or more targets, which are disclosed or obscured when the piston is reciprocated, substantially as shown and described.

7. The combination of the circuits of wires *e'* and *p'*, each connecting with corresponding circuit-closers upon the different boards and passing through magnets *M* and *N*, respectively, to common return-wire *f*, with the battery, substantially as shown, for the purpose specified.

8. In a duplicate switch-board system, a bolt on each board for each subscriber's line, in combination with circuit-closers—one for each bolt—said circuit-closers being placed in local circuits, and an electro-magnet in each local circuit, and means whereby one or more visual signals are automatically disclosed when a connection is made with a bolt, substantially as and for the purpose specified.

9. The combination of independent keys or circuit-closers with the bolts or switches of a switch-board—one key or circuit-closer for each bolt or switch—and means whereby the keys or circuit-closers are opened or closed automatically as connections or disconnections are made with the switches.

10. In combination with duplicate or multiple switch-boards, the targets *g* upon each board, for indicating automatically at any other board or boards the connections and disconnections of each line at any of the duplicate switch-boards.

11. In combination with a series of subscribers' bolts, the several bolts of the series being on different boards, the electro-magnet *M*, said magnet controlling through suitable mechanical devices a visual signal, which, when standing in one position, indicates that the line of said series is in use, and when standing in its other position indicates that said line is not in use.

12. In combination with duplicate or multiple switch-boards, the electro-magnet *M* for each subscriber's line, said magnet controlling through suitable mechanical devices a visual signal, its circuit being closed through a battery by means of local connections when the telephone-line to which it belongs is connected at either of the duplicate boards.

13. A single magnet for each subscriber's line whose circuit is closed through a battery by means of local connections when the telephone-line to which it belongs is connected at either of the duplicate boards, substantially as and for the purpose specified.

14. The combination of piston *h*, packing *u*, cylinder *i*, target *g*, and shield *t*, whereby the plug-holes of a bolt are obstructed, substantially as shown and described.

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Witnesses:

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