

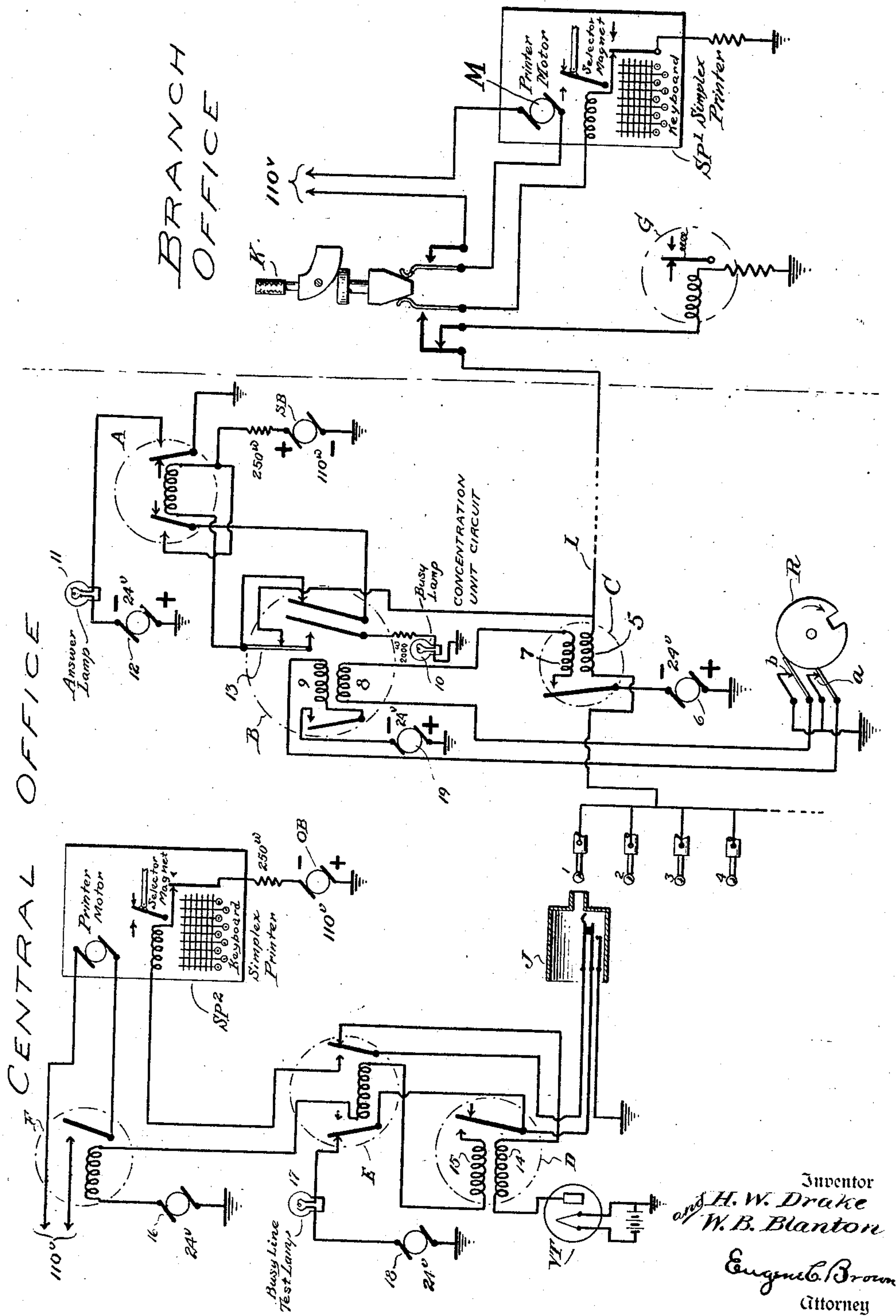
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CONCENTRATION CIRCUIT FOR SIMPLEX PRINTERS

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CONCENTRATION CIRCUIT FOR SIMPLEX PRINTERS

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This invention relates to a circuit arrangement for handling traffic to and from a number of telegraph printers of the start and stop type, such as the well-known simplex printers.

An object of the invention is to devise a circuit arrangement whereby a number of simplex printer lines from outlying branch stations may be terminated at a central station, and the traffic of said lines handled by a smaller number of simplex printers at the central station.

Further objects of our invention will be apparent from the detailed description which follows.

Our invention is illustrated in the accompanying drawing in which, for the sake of convenience, the circuit arrangement is illustrated for only one branch office, and only one simplex printer is shown at the central office.

Referring to the drawing, the equipment at each branch station comprises a simplex printer SP', a key switch K, and a signal relay G. The branch station is connected by a line L to the central station. With the key K in the position illustrated, the line L is grounded through the signal relay G, and in the other position of the key, the relay G is disconnected and the line L is grounded through the simplex printer. Operation of key K also completes the energizing circuit of the printer operating motor M.

At the central station, line L is connected through winding 5 of relay C to line plugs 1, 2, 3 and 4, rigidly located in front of the respective operators. It should be understood that while only four line plugs are shown, there may be more of these plugs connected in multiple with these four, the number of line plugs depending on the number of operators to which it is desired to make this line accessible. The tongue of relay C is grounded through a source of current 6. Winding 7 of relay C is connected from the

contact of relay C through winding 8 of relay B to ground through contacts b on interrupter R. The left-hand tongue of relay B is connected through winding 9 of said relay to ground through the contacts a of interrupter R; and the contact cooperating with this tongue is grounded through a source of current 19. The inner right-hand tongue of relay B is connected to ground through a resistance and a "busy" lamp 10. The outer right-hand tongue of relay B is connected to the left-hand tongue of relay A. The right-hand tongue of relay A is connected to ground, and the back contact of this tongue is connected to ground through an "answer" lamp 11 and a source of current 12. One side of the operating winding of relay A is connected to ground through a signal battery SB, and also to the back contact of the left-hand tongue of relay A. The other terminal of the operating coil of relay A is connected to the movable contact 13 of relay B and to the back contact cooperating with the outer right-hand tongue of relay B. The line L is connected to the stationary contact cooperating with movable contact 13 of relay B. That part of the circuit described in the foregoing paragraph may be called a "concentration unit circuit."

The operator's cord circuit comprises the circuit arrangement interconnecting the jack J with relays D, E and F and with the simplex printer SP². The tip contact in the jack J is connected to the right-hand tongue of relay E, and the back contact cooperating with this tongue is connected through winding 14 of relay D to the plate element of a two-electrode vacuum tube VT; the filament of the tube being grounded. One of the extra contacts on jack J is connected to ground, and the other cooperating extra contact is connected to the tongue of relay D. Winding 15 of relay D and the windings of relays E and F are connected in series in a circuit extending from the contact of relay D to

ground, including a source of current 16. The left-hand tongue of relay E is connected to the tongue of relay D, and the back contact cooperating with this tongue is connected through a busy lamp 17, and a source of current 18, to ground. The contact of relay F is included in the motor operating circuit of simplex printer SP². The operating circuit for this printer extends from the front contact of the right-hand tongue of relay E through the printer to ground through a source of operating current OB.

The operation is as follows:

With the printer at the branch office idle, the circuits are as shown in the drawing, with plus battery normally impressed upon the line L through the operating winding of relay A from generator SB. When the operator at the branch office wishes to transmit to the central office, she operates the key K to connect the printer to the line L and disconnects the signal relay G. She then presses a key on the simplex printer to momentarily interrupt the line. Such interruption de-energizes relay A, and the tongues of this relay fall back upon their back contacts, one energizing the answer lamp 11, and the other short-circuiting the operating winding of relay A through the outer right-hand tongue of relay B. Upon the signal from the answer lamp 11, the operator at the central office plugs her jack J on to one of the line plugs 1 to 4, depending on which one is the most convenient to her. This connects the line L through the right-hand back contact of relay E, winding 14 of relay D, and vacuum tube VT to ground. At the same time the extra contacts of jack J are closed and complete a circuit from ground through the tongue and coil 15 of relay D, and through the coils of relays E and F. The current flowing through the vacuum tube VT from the line L is sufficient to operate relay D but is not sufficient to operate relay C. Operation of relay E connects the printer SP² to the line through its right-hand armature and disconnects vacuum tube VT. Operation of relay F completes the circuit to the operating motor of the printer SP². The increased line current from the generator OB, is sufficient to operate relay C, which in turn energizes relay B through winding 8, and establishes a holding circuit for itself through winding 7. Operation of relay B disconnects the signaling battery SB from the line, and establishes a holding circuit for itself through winding 9 and the contacts *a* on interrupter R. The holding circuit including coil 7 of relay C and coil 8 of relay B, includes also contacts *b* of interrupter R. Operation of relay B removes the short circuit around the winding of relay A, and establishes an energizing circuit for "busy" lamp 10 from the signal battery SB through the winding of relay A. Relay A operates to extinguish the answer lamp 11.

The circuit is now ready for message traffic.

Relay B will remain operated as long as the concentration unit operator has her cord circuit connected to the line, as will now be explained: The circuit interrupter R is rotated at an approximate speed of one revolution in every two seconds, and the direction of rotation is such that the circuit including winding 9 of relay B is opened first. Relay C is locked up through winding 7, and relay B is locked up by both holding circuits through windings 8 and 9. When the interrupter R opens the holding circuit including winding 9, relay B remains operated by reason of the holding circuit including the winding 8. The circuit interrupter R now opens the holding circuit including winding 7 of relay C and winding 8 of relay B, but the latter relay remains operated through the holding circuit including winding 9, which has now been reestablished. Relay C, however, is now under the control of its winding 5 which is included in the line circuit. If during the time that contacts *b* of interrupter R are opened, a printer signal of current is passing over the line circuit, relay C will remain in the operated condition due to its winding 5 being energized. On the other hand, if during the time contacts *b* of the interrupter are opened, a printer signal of no current passes over the line, relay C will move to its unoperated position, and will remain in this position until an impulse of line current again operates it.

Simplex printers operate on a seven unit code, consisting of elements of current and no current in a line batted at one end and grounded at the distant end. The first unit of the code, known as the starting impulse, is always a period of no current. The next five units are periods of current and no current, in accordance with the Baudot code. The seventh unit is always a period of current, which will continue, until another letter is transmitted. These seven units constitute 3½ cycles. The usual speed of operation is approximately 22 cycles per second. It will therefore be seen that the longest period of no current will occur when the code portion is entirely no current. This, added to the starting pulse, will give a total of

$$\frac{6}{7} \times \frac{3.5}{22} \text{ seconds or } \frac{3}{22} \text{ seconds.}$$

Since the longest period of no line current is $\frac{3}{22}$ seconds, relay C will again operate and reestablish the locking circuit for itself and relay B, before the interrupter R rotates to the position for opening the locking circuit including winding 9 of relay B, there being approximately a two second interval between the opening of the locking circuit through relay C and the opening of the locking circuit through the winding 9 of relay B.

Upon the completion of the business, the concentration unit operator removes her jack J from the line plug. The opening of the extra contacts opens the circuit which has been maintaining relays D, E and F in the operated condition thus causing these three relays to move to their unoperated condition. The operator's cord circuit is now in readiness for use on another line. In the concentration unit circuit, however, relay C remains operated until the circuit through the winding 7 of relay C and the winding 8 of relay B is opened by the interrupter. There now being no line current through the winding 5 of relay C, it will remain unoperated. Relay B, however, is still operated due to the locking circuit through its winding 9, and will remain operated until the interrupter opens this locking circuit. Upon release of relay B, contact between movable contact arm 13 is made with the line L before contact is broken in the circuit to the lamp 10, thereby maintaining the continuity of the circuit through relay A during the opening of relay B. When the operator at the branch station shifts key K to the off-position, contact is completed from the line L through the signal relay G before the circuit is broken from the line L to the printers SP', thereby preventing the line circuit from being momentarily opened and registering a call at the central station. The circuit is now in readiness to receive another call from the branch office.

Let us assume that the line shown on the drawing is busy, being operated from another line plug, such as line plug No. 2. The operator in front of line plug No. 1 is handed a message to be transmitted to this branch office, which is busy, and she must be able to test the line for "busy" before sending the message. The operation of the operator's cord circuit is as follows:

The idle condition of the cord circuit is shown on the drawing. All of the relays are unoperated, and the line from the printer is open. The operator plugs her jack on to the line plug of the line wanted, connecting the tip to line and grounding the extra contact. Inasmuch as this line is busy, the signaling battery of positive polarity as been removed from the line and there will be operating battery of negative potential on the plugs associated with this line at each of the turrets. This negative potential will be applied to the plate of the vacuum tube, but since this negative potential will not cause a flow of plate current, relay D will not operate, and consequently, neither E nor F. Thus it will be seen that even though an operator plugs in on a busy line and does not remove her plug immediately, her printer cannot be connected to this line as long as the line is busy. Furthermore, because of the high impedance of the vacuum tube plate

circuit, there is no interference with the printer signals then passing over this line.

A busy lamp 17 connected to a back contact of relay E and receiving its ground from the extra contact of the jack, will light when the jack is connected to a busy line and will remain lighted until the jack is removed or the line becomes idle.

Relay G shown at the branch office is not an essential part of the circuit and has merely been included as a suggested method of permitting the central office operator to call the branch office. A bell or lamp may be connected to the contacts of relay G in such a manner as to allow the general office operator to actuate the bell or light the lamp by depressing a key or keys on her printer thus causing the armature of relay G to move back and forth.

We claim:

1. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple single-contact line plugs at a central station, means for normally applying signal battery to each line, means responsive to interruption of the line at a branch office to display a call signal at the central station, transmitting and recording telegraph apparatus at the central station including a source of operating battery, and a cord circuit for the central station apparatus including means responsive to signal battery for connecting said apparatus and operating battery to the line.

2. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple single-contact line plugs at a central station, means for normally applying signal battery to each line, means responsive to interruption of the line at a branch office to display a call signal at the central station, transmitting and recording telegraph apparatus at the central station including a source of operating battery, a cord circuit for the central station apparatus including means responsive to signal battery for connecting said apparatus and operating battery to the line, and means responsive to the application of operating battery to the line to disconnect the signal battery from the line.

3. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple single-contact line plugs at a central station, means for normally applying signal battery to each line, means responsive to interruption of the line at a branch office to display a call signal at the central station, transmitting and recording telegraph apparatus at the central station including a source of operating battery, and a cord circuit for the central station apparatus including means responsive to signal battery for connecting said

apparatus and operating battery to the line, and to simultaneously display a busy signal and extinguish the call signal.

4. In combination, a printer at a branch station and a line connecting the branch station to multiple single-contact plugs at a central station, means at the central station for normally applying signal battery to the line, said line circuit being normally completed at said branch station, a relay at the central station in circuit with said signal battery and responsive to interruption of the line at the branch station to display a call signal, a printer at the central station and a cord circuit therefor including a source of operating battery, and means responsive to operating battery on the line to disconnect said relay and said signal battery from the line.

5. In combination, a printer at a branch station and a line connecting the branch station to multiple single-contact line plugs at a central station, means at the central station for normally applying signal battery to the line, said line circuit being normally completed at said branch station, means at the central station responsive to interruption of the line at the branch station to display a call signal, a printer at the central station and a cord circuit therefor including a source of operating battery, and means responsive to operating battery on the line to disconnect the signal battery and to simultaneously display a busy signal and extinguish the call signal.

6. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple single-contact line plugs at a central station, means at the central station for normally applying positive battery to each line, and a plurality of printers at the central station each provided with a cord circuit, each cord circuit including means responsive to positive current only from said line to connect the printer to the lines, and whereby when a cord circuit is connected to a line having negative or no battery thereon, the printer of that cord circuit is not connected to said line.

7. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple line plugs at a central station, means at the central station for normally applying positive battery to each line, and a plurality of printers at the central station each provided with a cord circuit, each cord circuit including uni-directional conductive means responsive to positive current only from said line to connect the printer to the line, and whereby when a cord circuit is connected to a line having negative or no battery thereon, the printer of that cord circuit is not connected to said line and does not interfere with the operation of the line.

8. A cord circuit for simplex printers comprising, in combination with the printer, a

jack adapted to connect to multiple line plugs, a circuit connecting the jack and printer including a normally open contact, and means included in the circuit between said jack and printer, responsive only to positive current from said line, to close said normally open contact.

9. A cord circuit for simplex printers comprising, in combination with the printer, a jack adapted to connect to multiple line plugs, a circuit connecting the jack and printer including a normally open contact, means included in the circuit between said jack and printer, responsive only to positive current from said line, to close said normally open contact and testing means connected to said jack which gives a busy line signal when the operator connects the jack to a busy line plug.

10. A cord circuit for simplex printers comprising, in combination with the printer, a jack adapted to connect to multiple line plugs, a circuit connecting the jack and the printer including a normally open contact, and uni-directional conductive means connected to said jack, responsive only to positive current from said line, to close said normally open contact.

11. In combination, a printer line terminating at a central station, a relay in said line provided with a holding circuit, a second relay controlled by the first relay and having a holding circuit, a call signal and a busy line signal controlled by said second relay, and means for periodically opening the holding circuit of both said relays.

12. In combination, a printer line terminating at a central station, a relay in said line provided with a holding circuit, a second relay controlled by the first relay, a call signal and a busy line signal controlled by said second relay, and means for periodically opening the holding circuit of said relay.

13. In combination, a printer line terminating at a central station, a relay in said line, a second relay controlled by said first relay and having a holding circuit, a call signal and a busy line signal controlled by said second relay, and means for periodically opening said holding circuit.

14. In combination, a plurality of transmitting and receiving telegraph apparatus at branch offices with lines terminating in multiple single contact line plugs at a central station, means for normally applying signal battery to each line, means for displaying at the central office a signal in response to a signaling condition from the branch office, transmitting and recording telegraph apparatus at the central station including a source of operating battery, and a cord circuit for the central station apparatus including means responsive to signal battery for connecting said apparatus and operating battery to the line.

15. The combination as defined in claim 14 and including means responsive to the application of operating battery to the line to disconnect the signal battery from the line.

5 16. The combination as defined in claim 14, said means responsive to signal battery operating also to simultaneously display a busy signal and extinguish the call signal.

10 In testimony whereof we affix our signatures.

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