

Feb. 17, 1931.

R. HOOVER ET AL.

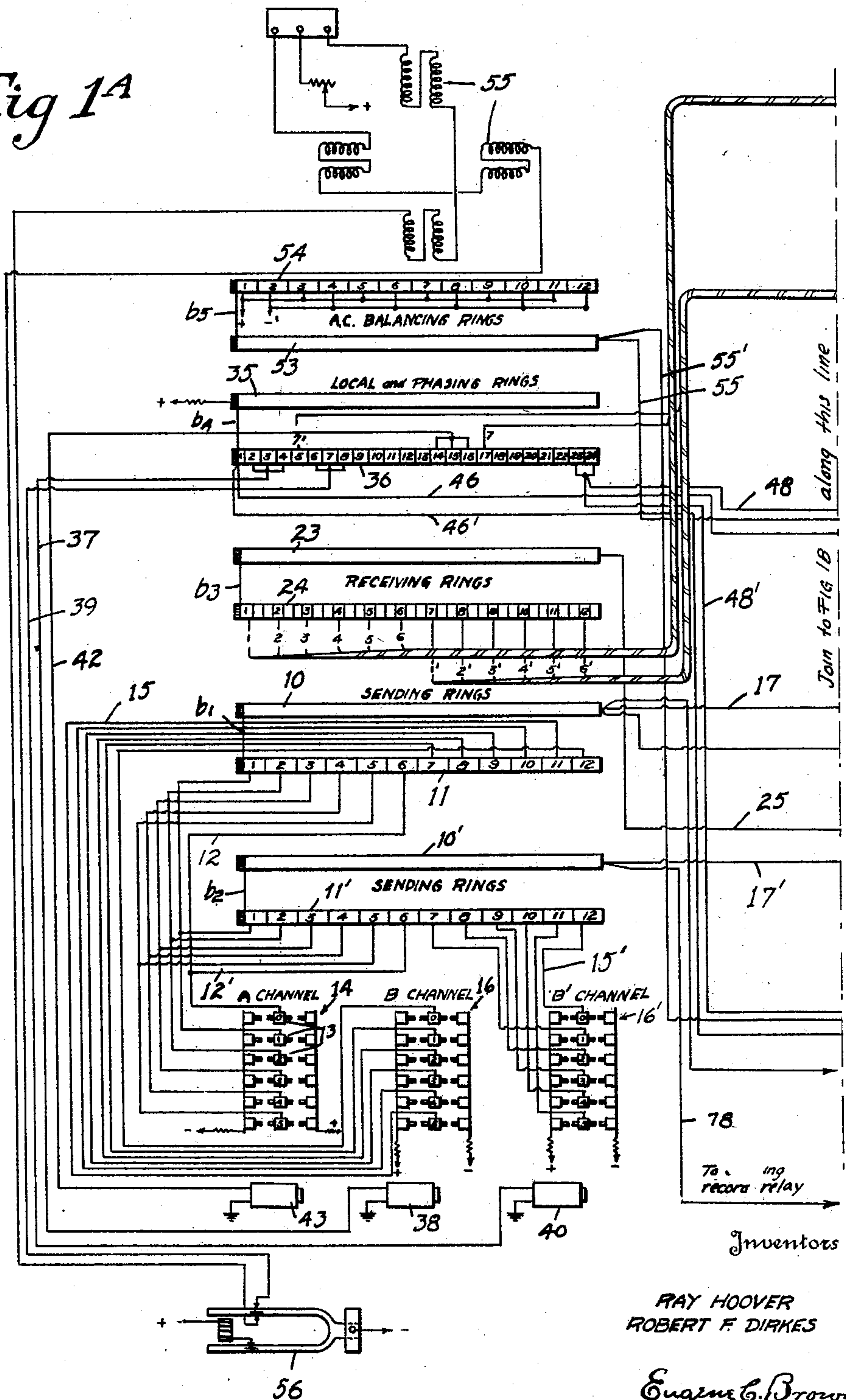
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METHOD OF MULTIPLE TRANSMISSION

Filed April 29, 1930

3 Sheets-Sheet 1

Fig 1^A



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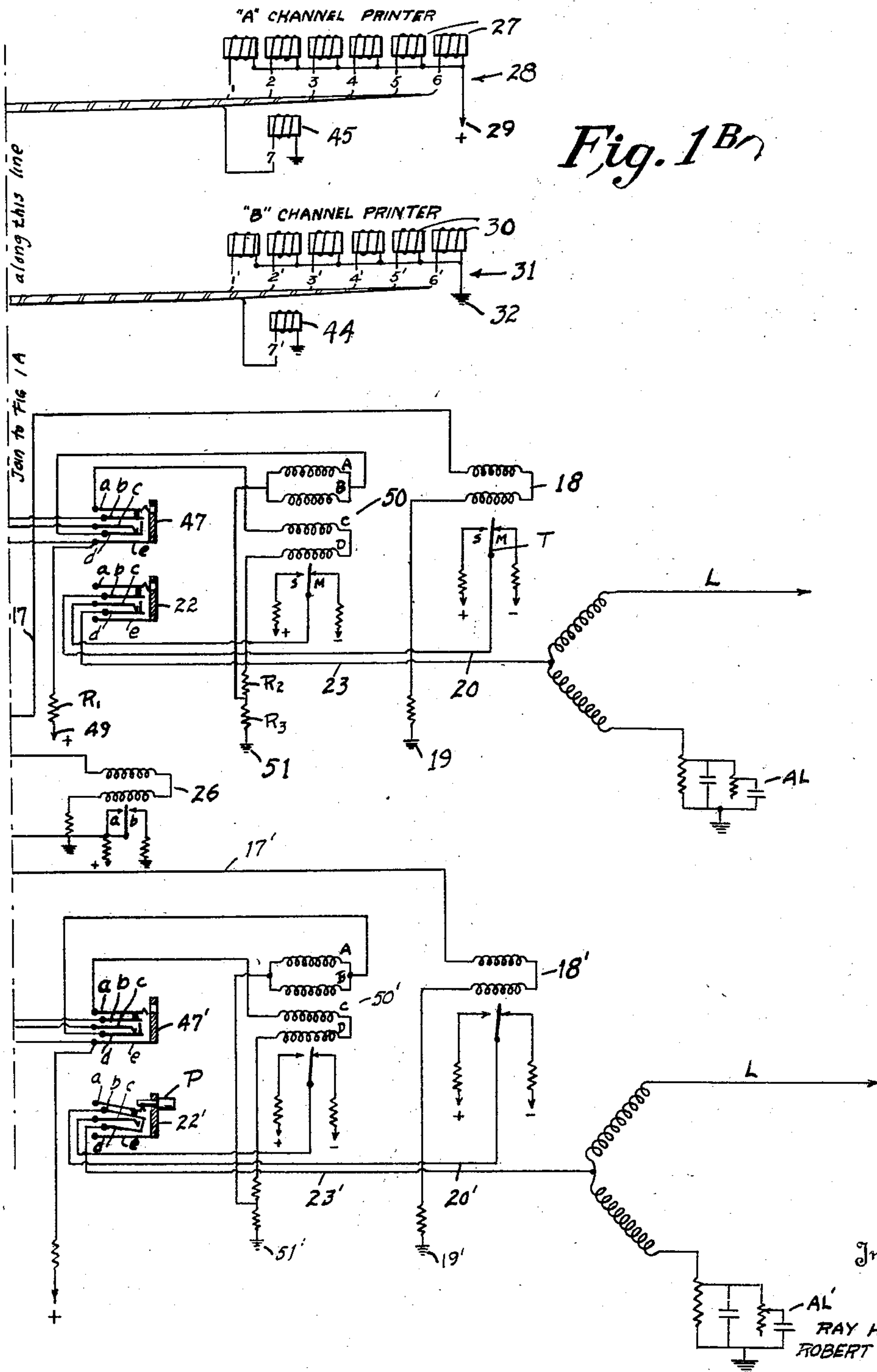
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3 Sheets-Sheet 2



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METHOD OF MULTIPLE TRANSMISSION

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3 Sheets-Sheet 3

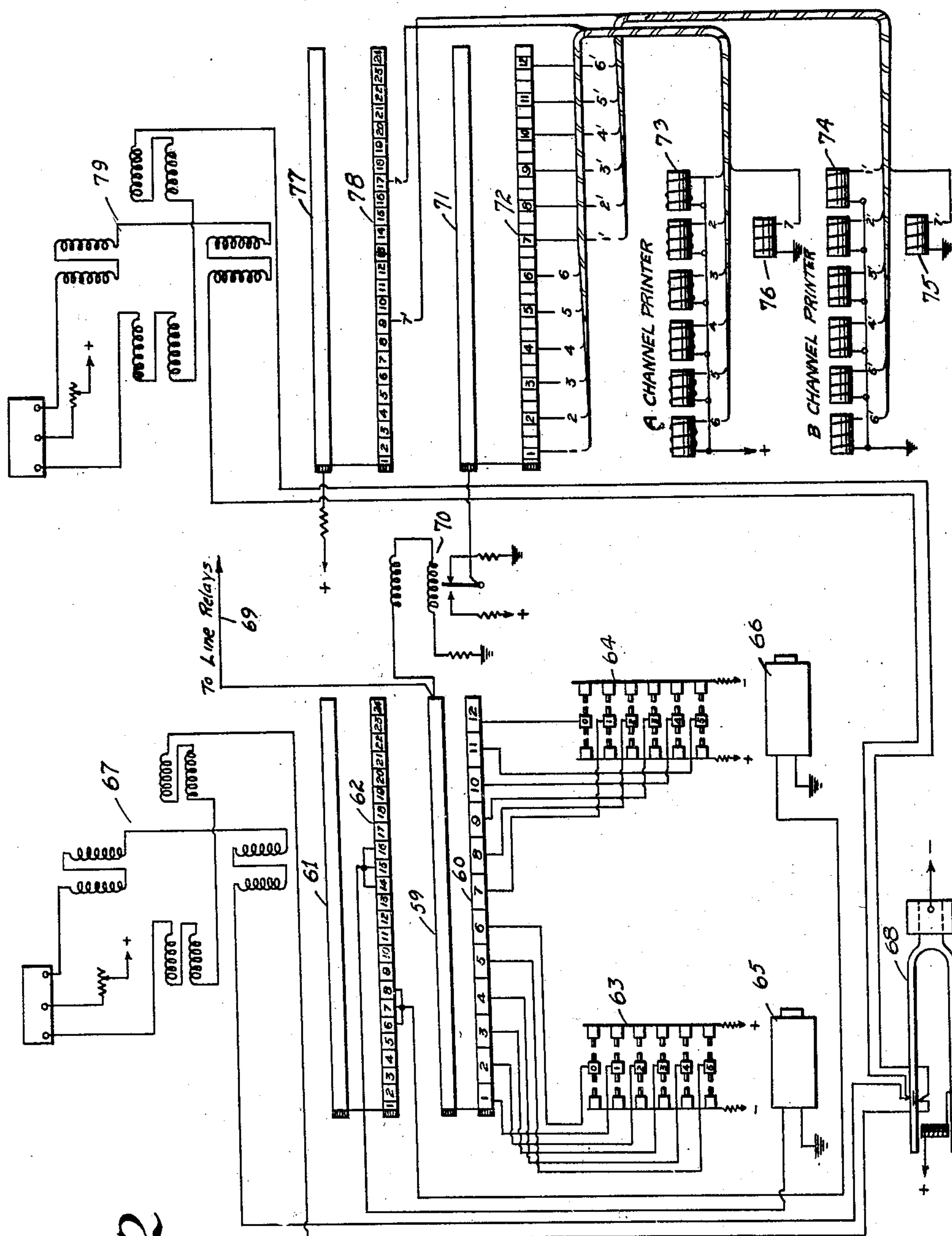


Fig. 2

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METHOD OF MULTIPLE TRANSMISSION

Application filed April 29, 1930. Serial No. 448,370.

This invention relates to a multiplex printing telegraph system and more particularly to a transmission system for a number of outgoing lines in which identical information is to be transmitted over each of the lines through one or more of the multiplex channels, and non-identical information is to be transmitted over the various lines through the remaining channels.

It is often desirable in multiplex telegraphy, in distributing to a large number of points, certain types of "general" information, such as press reports, stocks, bonds, commodity quotations, etc., to utilize one or more channels of each of a number of line circuits for the transmission of such information in identical form, and to utilize the remaining channels of each line for local or individual messages. This "general" information may be distributed irregularly among the various channels of a group of line circuits. For instance, in four channel multiplex systems involving five line circuits, it may be desired to supply stock quotations to all five lines over the first channel, bond quotations to lines one, two, and three, over the second channel, and press reports to lines two and four, over channel three. The unallotted channels may be utilized for local or individual messages.

Heretofore in such cases a separate multiplex distributor has been provided for each line or group of lines over which the same information is to be transmitted and a separate transmitter, such as a tape transmitter, has been used with each distributor for each channel. This has also necessitated the preparation of a separate tape for each transmitter employed for transmitting the common or "general" information to the different lines.

One of the objects of the present invention is to provide a multiplex telegraph system for transmitting identical information over a number of lines through one or more multiplex channels in which there will be a saving of equipment and a reduction in the number of operators required.

Another object is to provide a multiplex system in which a single multiplex distribu-

tor will suffice for the control of a number of lines and in which one channel transmitter only is required for the transmission of the "general" information to each of the lines.

Another object is to provide, in a multiplex system involving a number of lines, or groups of lines, over which different signals are transmitted through at least one channel, means for transmitting the same signals to two or more of the lines through another channel, from a single transmitting apparatus.

Other objects and advantages of the invention will appear from the following description.

Reference will now be had to the accompanying drawings for a complete explanation of the invention wherein:

Figures 1A and 1B taken together illustrate diagrammatically a transmitting system embodying our invention, showing a multiplex distributor and associated apparatus providing facilities for transmitting the same intelligence signals to a plurality of lines over one channel, and different intelligence signals to each line over the other channels; for producing an outgoing record of the signals transmitted over one line or a group of lines; and for transmitting non-intelligence signals over any line without interrupting the transmission of other signals over the remaining lines.

Figure 2 is a diagrammatic view of a modified arrangement for obtaining an outgoing printed record of the transmitted signals.

Referring first to Figures 1A and 1B, a multiplex distributor is shown, having two pairs of sending rings, a pair of receiving rings, a pair of local and phasing rings, and a pair of AC balancing rings, as indicated by the legends on the drawing.

The sending rings each comprise a solid ring 10 and 10' respectively, and a segmented ring 11 and 11' respectively. Rings 10 and 11 are traversed by a brush b1 and rings 10' and 11' by a brush b2. The segmented rings each have twelve segments to provide facilities for two channel multiplex operation. Segments 1 to 6 of each of the rings 11 and 11' are connected by groups of conductors

12 and 12' respectively to the contact tongues 13 of a tape transmitter 14 operating into channel A of the multiplex system, segments 7 to 12 of ring 11 are connected by a group of conductors 15 to the contact tongues of a tape transmitter 16 operating into channel B, and segments 7 to 12 of ring 11' are connected by a group of conductors 15' to the tongues of a tape transmitter 16' operating into channel B'. The tape transmitter 14 thus serves to set-up on the segments of each of the sending rings, identical signal combinations and the transmitters 16 and 16' serve to set-up different signal combinations on rings 11 and 11', for the second channel.

Rings 10 and 11 serve to transmit to a duplex line L and rings 10' and 11' transmit to a duplex line L'. Solid ring 10, for this purpose, is connected by a conductor 17 to one end of the winding of a polarized relay 18, the opposite end of the winding being grounded at 19. The marking and spacing contacts M and S, of the relay 18, are connected to negative and positive battery respectively, the tongue T being joined by a conductor 20 to contact spring b of a pin jack 22. The apex of the duplex line L is connected by a conductor 23 to spring d of jack 22.

When it is desired to transmit from distributor rings 10 and 11 over the line L, a solid pin p (see jack 22') is inserted in the jack 22 to depress the spring b into contact with spring d and thus connect the tongue of the relay 18 to the duplex line. The marking and spacing signal combinations set up on the segments of the ring 11 are thus repeated by the relay 18 directly to the line. Similarly, the signal combinations set up on the ring 11' are repeated to the line L' by polarized relay 18', the tongue of which has corresponding connections through the jack 22' with the duplex line L'.

The receiving rings provide for the production of an outgoing printed record of the signals transmitted through rings 10 and 11, and comprise a solid ring 23 and a segmented ring 24 adapted to be traversed by a brush 23. The solid ring is connected by a conductor 25 to the tongue of a polarized relay 26, the contacts a and b of which are connected respectively to a source of positive potential and to the ground. One terminal of the winding of the relay 26 is connected to the sending ring 10, the opposite terminal being grounded, whereby the relay tongue is caused to engage either one or the other of its contacts in response to marking or spacing signals, and thereby to repeat the marking and spacing signals either as a positive battery or ground potential to the solid receiving ring 23.

The segmented receiving ring 24 is provided with thirty-six segments, every third segment, beginning with the second, being

numbered as 1 to 12. Segments 1 to 6 so numbered, are connected by a group of six cabled conductors 1 to 6 to one terminal of the windings of each of the selecting magnets 27 of an outgoing record printing apparatus 28, the opposite terminals of the magnet windings being connected to a common source of positive potential 29. The segments 7 to 12 of ring 24 are similarly connected by a group of six cabled conductors 1' to 6' to one end of the windings of the selecting magnets 30 of an outgoing record printer 31, the opposite ends of the windings being grounded at 32.

As is usual in multiplex operation, the polarity of the marking and spacing signals for the A channel are reversed with respect to the polarity employed for the B channel, and in the embodiment shown, negative potential is employed for the marking signals of channel A and positive potential for the marking signals of channel B. During the transmission of marking signals over channel A, the tongue of relay 26 moves against its right hand contact b to apply ground to the solid ring 23 and thus complete a circuit for the windings of the selecting magnets 27 of the A channel printer, to positive battery at 29. During the transmission of marking signals through channel B, the tongue of relay 26 is moved to its left hand contact a to apply positive battery to the solid ring 23 and complete the circuit for the windings of the selecting magnets 30 of the B channel printer to the ground 32. The relay 26 therefore serves to set up the marking signals on the receiving rings for both channels A and B, irrespective of the polarity employed for the marking signals, so that the selecting mechanism of the A and B channel printers 28 and 31 will be operated in accordance with the signal combinations transmitted over line L.

No provision is made in Figures 1A and 1B for obtaining an outgoing record of the signals transmitted through rings 10' and 11' to line L' by means of the B' channel transmitter 16', but if such record is desired, it may be obtained by using a third printing apparatus and setting up the marking and spacing signals upon the unemployed segments of the receiving ring 24 with the addition of another solid ring for distribution to such printing apparatus, or if desired, a separate distributor operating in synchronism with the transmitting distributor may be employed for operating the printers to provide a record of the signals transmitted from rings 10' and 11', as illustrated in Figure 2.

The local and phasing rings comprise a solid ring 35 connected to a source of positive potential and a segmented ring 36 having, in the embodiment shown, twenty-four segments. The rings 35 and 36 serve three functions; first to control the operation of

the A, B and B' channel tape transmitters to set up successive code combinations on the sending rings, second to operate the printing magnets of the A and B channel printers, and third to supply phasing signals, if desired, to the lines L or L' to enable the receiving distributors to be adjusted in the proper phase relation to the transmitting distributor. Rings 35 and 36 are traversed by a brush 64.

For the operation of the tape transmitters, segments 2, 3 and 4 are joined by a conductor 37 to one terminal of the winding of the operating magnet 38 of the B channel tape transmitter 16; segments 6, 7 and 8 are connected by a conductor 39 to one terminal of the winding of the operating magnet 40 of the B' channel transmitter 16'; and segments 14, 15 and 16 are connected by a conductor 42 to one terminal of the winding of the operating magnet 43, of the A channel transmitter 14. The arrangement of the segments connected to each operating magnet is such, with respect to the segments of the sending rings, that the A channel transmitter 14, is operated to set up a new code combination on segments 1 to 6 of the sending rings during the time that signals are being transmitted from the B and B' channel transmitters 16 and 16' and these latter transmitters, are operated, through their magnets 38 and 40 to set up a new code combination, during the time signals are being transmitted over channel A, from transmitter 14. It is obvious that magnets 38 and 40 might be connected in series or in parallel so as to operate simultaneously from a single set of segments, as for instance, segments 2, 3 and 4.

For the operation of the printing magnets of the A and B channel printers, segment 5 of ring 36 is joined by a conductor 7' to the operating magnet 44 of the B channel printer 31, and segment 17 of ring 36 is connected by a conductor 7 to the operating magnet 45 of the A channel printer 28. These connections are such that the printing magnet of the A channel printer operates during the time a new combination is being set up by the selecting magnets of the B channel printer and vice versa.

For the purpose of transmitting phasing signals to the line L, segment 1 of ring 36 is connected by a conductor 46 to the sleeve contact *e* of jack 47, associated with the line L, and segments 23 and 24 are joined by a conductor 48 with contact *b* of the jack 47. The sleeve contact *e* of jack 47 also has a source of positive potential 49 connected thereto independently of the distributor, through a resistance R1. The tip spring *a* of jack 47 is connected to the windings C and D in series of polarized relay 50, and thence through resistances R2 and R3 to the ground at 51, and contact *d* of the jack is connected to the windings A and B in parallel, of the relay 50,

and thence to the ground. The marking and spacing contacts of relay 50 are connected to negative and positive battery respectively, and the tongue is joined to spring *c* of jack 22.

When it is desired to transmit phasing signals to the line L, a solid pin P is inserted in jack 47 so as to provide a metallic connection between the tip and sleeve of the jack and to interrupt contact between springs *c* and *d*. During the passage of the local brush 64 over segment 1, positive potential is applied through the sleeve and tip of jack 47 to the windings C and D of relay 50 in such direction as to move the relay tongue against its spacing contact and apply spacing battery to the line through springs *c* and *d* of jack 22. As the brush 64 passes off segment 1, the tongue of relay 50 is held on its spacing contact by positive battery from the source 49 applied through the resistance R1, thus maintaining spacing battery on the line during the passage of the local brush over segments 2 to 22 and thereby leaving these segments free for performing other functions. Upon engagement of the brush with segments 23 and 24, positive battery is applied through springs *b* and *d* to the windings A and B of the relay 50 in a marking direction and of such magnitude as to overcome the spacing bias of windings C and D, thus moving the relay tongue to its marking contact to transmit a marking signal over the line.

Thus for each revolution of the distributor brush 64, a single marking signal is applied to the line, which may be utilized at the receiving station in adjusting the receiving distributor to the correct phase relation to the transmitting distributor. It should be noted that the phasing signals may be transmitted over line L without interrupting the transmission of intelligence signals over the line L'.

The segment 1 and 23, 24 are similarly connected through jacks 47' and 22' and relay 50' to transmit phasing signals to line L'.

The AC balancing rings comprise a solid ring 53 and a segmented ring 54 arranged to be traversed by a brush 65. The odd numbered segments of ring 54 are strapped together and connected to a source of positive potential, and the even numbered segments are similarly strapped together and connected to a source of negative potential. The solid ring 53 is joined by conductors 55 and 55' to contact *c* of jacks 47 and 47' respectively.

If it is desired to transmit AC signals or current reversals to line L for instance, for use in balancing the artificial line AL with the real line, the pin P is removed from both jacks 47 and 22 to leave these jacks in the condition shown in Figure 1B. A circuit is thus completed from the ring 53 through conductor 55, springs *c* and *d* of jack 47 and windings A and B of relay 50 thus causing the relay

tongue to oscillate between its marking and spacing contacts as the brush passes over the balancing rings. Current reversals are thus transmitted from the relay tongue through the contacts *c* and *d* of jack 22 to the duplex line.

It will be evident from the foregoing that by proper manipulation of the pin *P* in the jacks 22, 22', 47 or 47', identical intelligence signals may be transmitted from the sending rings over both lines through channel A, and different signals over each line through channels B and B', and that if desired, either phasing or balancing signals may be transmitted over either line without interfering with the transmission of intelligence signals over the remaining lines. Furthermore, balancing signals may be transmitted over one line and phasing signals over the other.

The distributor is operated by means of a phonic motor, the field windings of which are illustrated at 55, controlled through a driving fork 56 in the usual manner.

It is obvious, of course, that the segmented rings 11 and 11' may be so divided that three, four or more channels may be used with this system. Moreover additional relays may be multiplied to the solid sending rings for transmission from each set of rings into a group of lines, over any one of which intelligence signals, phasing signals or balancing signals may be transmitted. By adding additional sets of sending rings to the distributor connected to the transmitter 14, 16 or 16' or to additional transmitters, still further lines or groups of lines may be controlled from the single distributor with different transmitting assignments as, for instance, the same A channel transmission with still different B channel transmission or with either B or B' channel transmission and different A channel transmission.

The method and apparatus for taking an outgoing printed record of the multiplex signals is described more specifically in our copending application, Serial No. 446,631, filed April 23, 1930, and entitled "Means for taking an outgoing printed record". The apparatus for selectively transmitting either phasing signals or intelligence signals over a number of lines of a multiplex system is covered specifically in our copending application, Serial No. 448,369, filed April 29, 1930, and entitled "Means of phasing". The selective transmission of balancing signals and intelligence signals, over a number of lines, is covered specifically in our copending application, Serial No. 446,630, filed April 23, 1930, and entitled "Means for sending alternating current to a multiplex line".

In Figure 2 we have shown an arrangement for obtaining a printed record of the outgoing signals by means of a separate distributor operating in synchronism with the transmitting distributor. The transmitting distribu-

tor comprises the sending rings 59 and 60, the latter being segmented to provide for two channel transmission and local rings 61 and 62, the latter being segmented for controlling a pair of tape transmitters 63 and 64 through operating magnets 65 and 66 respectively, to set up signal combinations on the sending ring 60 for each channel. The transmitting distributor is operated through a phonic motor, diagrammatically illustrated at 67, controlled through a driving fork 68.

The solid sending ring 59 of the distributor is connected to the outgoing line 69 in the usual manner and also to the windings of a polarized relay 70 for repeating the signals to the distributor controlling the outgoing record printed. This latter distributor comprises the receiving rings 71 and 72, the former being connected electrically to the tongue of relay 70 and the latter being segmented and having connections to the selecting magnets 73 and 74 respectively, of the A and B channel printers. A pair of rings 77 and 78 is also provided for the outgoing record distributor, ring 78 being segmented and having segments 9 and 17 connected to the operating magnets 75 and 76 of the B and A channel printers respectively. The outgoing record distributor is operated by a phonic wheel 79, also controlled from the driving fork 68 so as to operate in synchronism with the transmitting distributor.

The separate outgoing record distributor may be employed for obtaining a printed record of the signals transmitted from rings 10' and 11' over line L' of the embodiment shown in Figures 1A and 1B, by connecting the relay 70 to the solid ring 10', as by the conductor 78.

It is obvious, of course, that numerous changes may be made in the details of the system without departing from the invention, and therefore, we desire to include all such changes and modifications as come within the scope of the appended claims.

What is claimed is:

1. In a multiplex telegraph system, a distributor having a plurality of sets of sending rings arranged for multi-channel transmission, one or more line circuits associated with each set of rings, a single transmitter common to each set of rings for controlling one channel of communication and an individual transmitter for each set of rings for controlling another channel of communication.
2. In a multiplex telegraph system, a plurality of line circuits, a transmitter common to each of said circuits for controlling one channel of communication thereover and a separate transmitter for each of said circuits or groups of circuits for controlling another channel of communication thereover.
3. In a multiplex telegraph system, a plurality of line circuits, a transmitter common to two or more of said circuits for controlling

one channel of communication over each circuit and a plurality of transmitters for controlling another channel of communication over said line circuits.

without interrupting the transmission of intelligence signals over the remaining lines.

In testimony whereof we affix our signatures.

RAY HOOVER.

ROBERT F. DIRKES.

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5 4. In a multiplex telegraph system, a transmitter common to a plurality of line circuits for controlling one channel of communication over each of said lines, a transmitter individual to a part only of said line circuits
10 for controlling another channel of communication thereover and one or more additional transmitters for controlling said last channel of communication over the remaining lines.

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15 5. In a multiplex telegraph system, a transmitter common to a plurality of line circuits for controlling one channel of communication over each of said lines, a transmitter individual to a part only of said line circuits for controlling another channel of communication thereover, one or more additional transmitters for controlling said last channel of communication over the remaining lines, and
20 a single distributor associated with said transmitters for all of said lines.

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25 6. In a multiplex telegraph transmitting system, a plurality of lines and means including a plurality of transmitters and a single rotary distributor for transmitting identical information to all of said lines over one channel and separate information to each of the
30 lines over another channel.

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7. In a multiplex telegraph transmitting system, a plurality of lines, means for transmitting identical information to all of said
35 lines over one channel comprising a single transmitter and means for transmitting separate information to each line over another channel.

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8. In a multiplex telegraph system, a rotary distributor having a plurality of sets of
40 sending rings, one or more lines associated with each set of rings, and means associated with said distributor for transmitting identical information to all of said lines over certain channels and different information to
45 each of said lines or groups of lines over other channels.

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9. In a multiplex printing telegraph system a plurality of line circuits, means comprising
50 a single transmitter for controlling the transmission to two or more said line circuits over one channel, means comprising individual transmitters for effecting separate transmission to each of said line circuits over another channel and means for obtaining an outgoing
55 printed record of the signals transmitted by one or more of said transmitters.

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10. In a multiplex printing telegraph system, a plurality of line circuits, a rotary distributor, said distributor having facilities for
60 transmitting identical intelligence signals to two or more said lines over one channel and separate intelligence signals to said lines over another channel or for transmitting non-intelligence signals to one or more of said lines
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