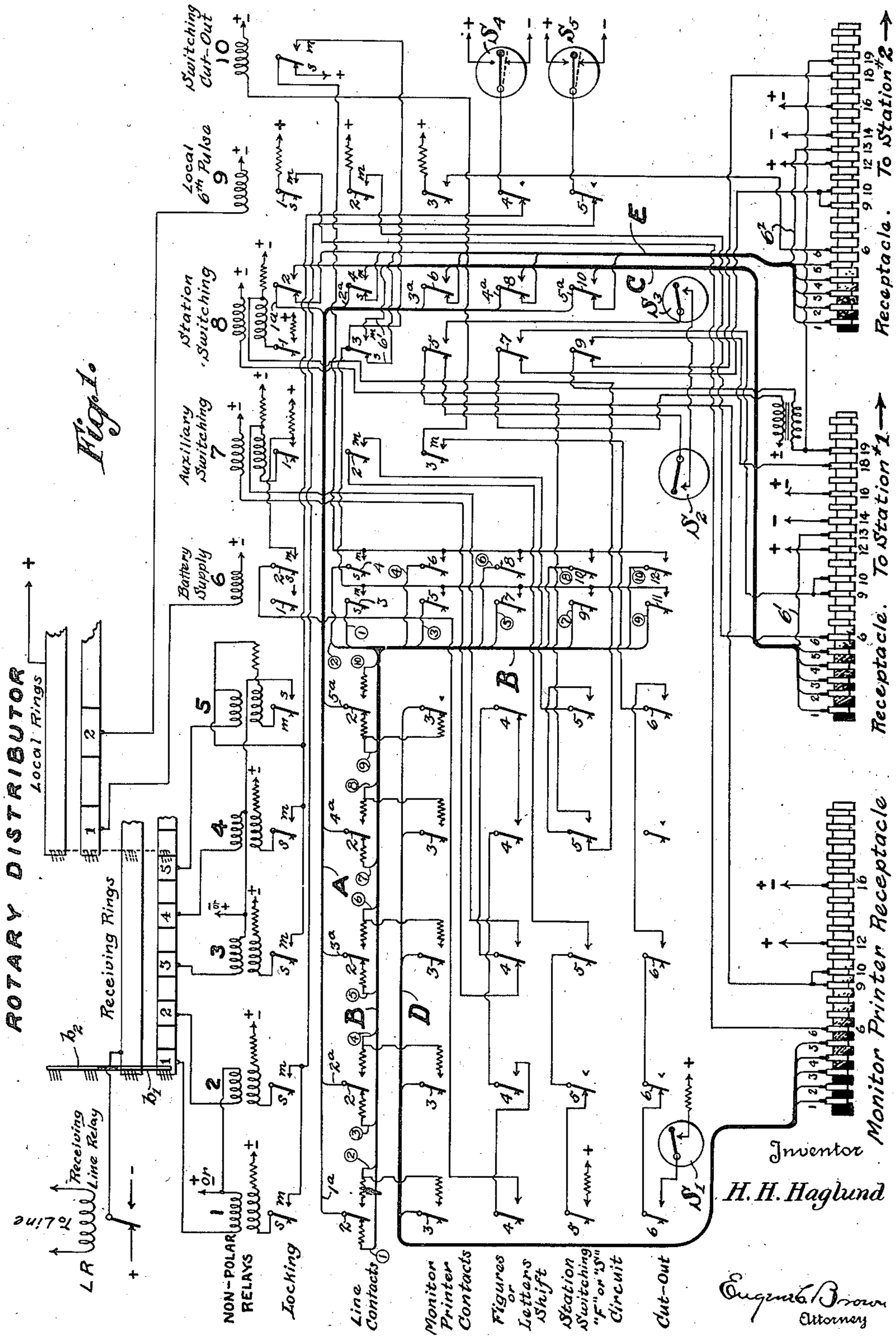
Oct. 20, 1936. H. H. HAGLUND 2,057,680

RECEIVING CHANNEL ASSIGNER

Filed Dec. 17, 1934

2 Sheets-Sheet 1

Fig. 1.



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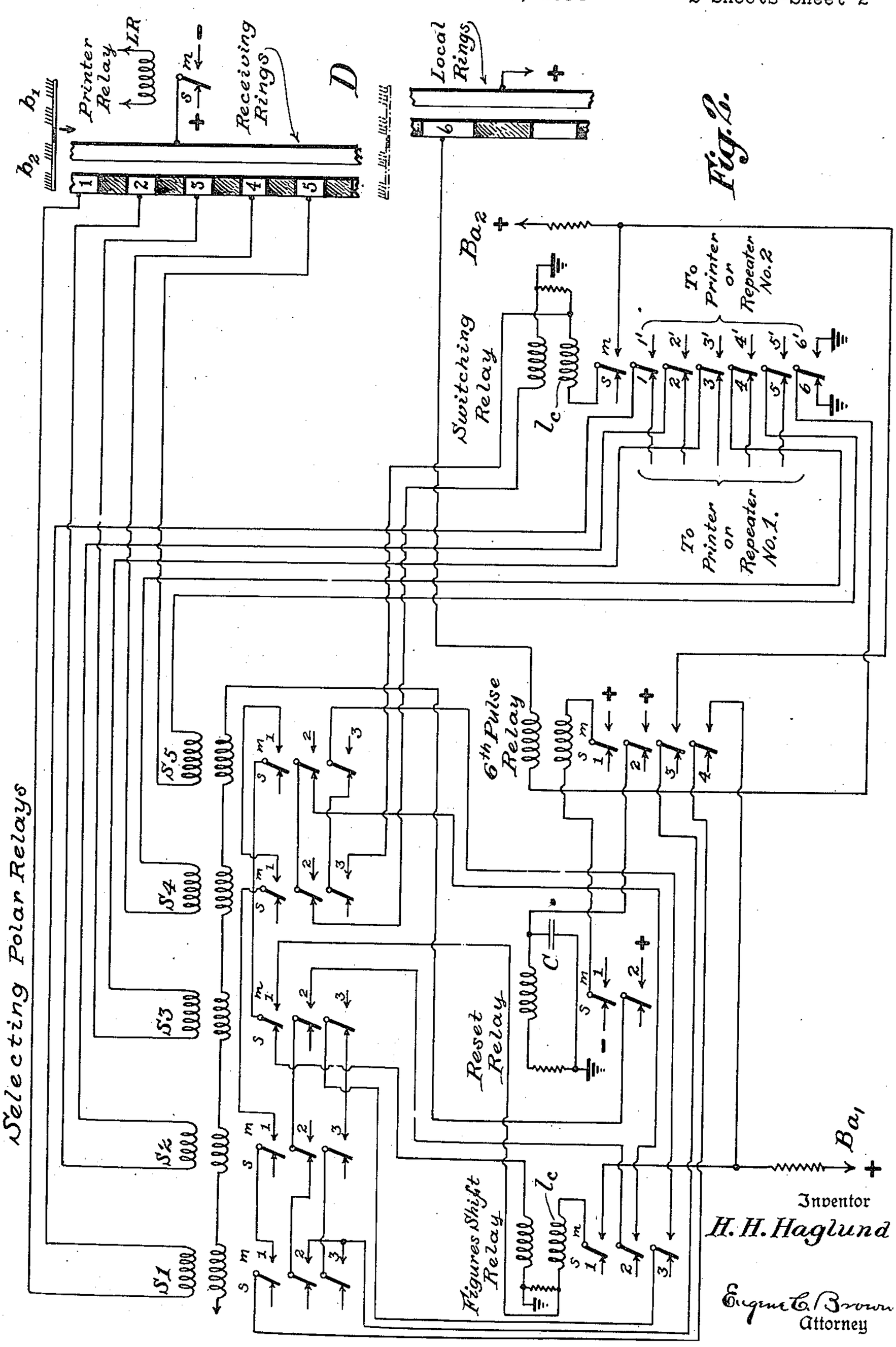

Fig. 2.

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RECEIVING CHANNEL ASSIGNER

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10 Claims. (Cl. 178—52)

This invention relates in general to a method of transferring telegraph messages from one printer or receiver circuit to another receiver circuit.

At the present time most of the telegraphic business is conducted between the larger offices of the telegraph system, the messages being then relayed to the smaller offices by Morse, simplex or multiplex systems or by telephone. However if a small office should develop enough traffic to warrant such an installation, a direct circuit is provided to that office. In the meantime, however, it is desirable to furnish direct service to these smaller offices and thereby save the cost of relaying the message.

The object of my invention is to provide means whereby an operator transmitting over a channel may automatically direct a message over said channel to one of a plurality of stations. For this purpose I have devised a channel assigner unit wherein provision is made to repeat a given multiplex channel into any one of two or more different offices other than the one in which the assigner is located. Provision is also made whereby a leak or monitorial record may be obtained by the office supervising the operation of the unit, which in reality gives the transmitting station three outlets over the same channel.

In the following description I shall refer to the accompanying drawings, in which Figures 1 and 2 are diagrammatic illustrations of circuit arrangements embodying the features of my invention.

Referring first to the channel assigning unit illustrated in Figure 1, I employ 10 multi-contact, non-polar relays. Five of these relays are selecting relays, corresponding to the selecting units of a printer; one auxiliary switching relay and one switching relay, for selecting the proper station; one battery supply relay, one relay to supply the reset impulse for the assigner; while the tenth relay provides a means for preventing the station selecting character from being transmitted thru the assigner to the receiving station.

The five selecting relays are operated from the face plate of a rotary distributor operated in synchronism with the signal impulses, similar to the operation of a printer selector. Each relay is arranged to lock up when it is in the operated position until the operation of the reset relay, whence they are restored to their unoperated or normal position. Each of the five selecting relays has a set of contacts which supply the proper selecting battery, marking or spacing, to five tongues of the switching relay. The contacts of the switching relay are connected to two output receptacles which are to feed into the proper receiving terminal designated as station #1 and station #2. A reference to the drawings will show that the incoming signals operate the line receiving relay LR. As the brushes b_1 pass over the segments 1 to 5 of the receiving rings, selecting relays 1 to 5 are operated in accordance with the operation of the receiving relay LR, and consequently in accordance with the line signals. The circuit may be traced from battery, through contact and tongue of relay LR, receiving rings and brushes b_1 to the main winding of relays 1 to 5 in sequence as the brushes traverse the segments of the receiving rings. The return of the main winding of these relays is either to plus or minus battery, dependent upon the polarity of the channel. I have indicated that the return of relays 1 and 2 may be to minus or plus battery while the return of relays 3, 4 and 5 may be to plus or minus battery, to show the universal character of the assigner, in that it will operate on a split channel where selectors 1 and 2 operate on one polarity while 3, 4 and 5 operate on the opposite pole of battery or the returns of these five relays may be to only one pole of battery for straight channel operation. In the present description, it will be assumed that the negative line impulse is "marking" battery for these relays and that the return of the relay windings is to positive battery.

Due to the combinations chosen as the switching characters, relay 5 always operates on spacing impulses instead of marking impulses and its tongues therefore normally remain on their marking contacts.

For the purpose of explaining the operation of my channel assigner, let us suppose that the transmitting station, not shown, sends the combination for "letters", i. e., five impulses of negative polarity. It is received by relay LR as a negative impulse five units long. As the distributor brushes b_1 pass over the receiving segments 1 to 5, each relay 1 to 4 is operated, due to the fact that the return circuit has been assumed to be positive battery. When these relays are operated, their tongues move to their right hand contacts and the relays lock up on their marking contact, due to the closing of the locking contacts, which established a circuit from split battery through the second coil or winding of the relays and the locking contacts, to the contacts and tongues 4 or 5 of reset relay 9 to switch S_4 or S_5 to battery. Switches S_4 and S_5 are prepositioned to a battery pole corresponding to the

polarity on which the channel is working. In our assumption these switches would be on negative battery. The circuit thru relay 5 is different from the other four relays. The return of the main winding is to switch S_4 or negative battery and hence this relay is not operated. However, since the position of the marking and spacing contacts have been reversed with respect to the other relays, this relay 5 is already on its marking contact. Had the chosen selection been 5 positive impulses transmitted, relays 1 to 4 would have remained inoperative on their spacing or left contact and relay 5 would have been operated to its right or spacing contact.

After the brushes pass over segment 5 of the receiving rings of the rotary distributor, the brushes associated with the local rings make contact with segment 1 of this ring and relay 6 is operated, the circuit being from positive battery through local rings and brushes to winding of relay 6, to the mid-point of the battery, or as it is commonly termed to "split battery". When relay 6 is operated, battery is supplied from spacing contact and tongue 1 of relay 10 to contacts and tongues 4, 6, 8, 10, and 12 of relays 6, through conductors of cable B, to the line and leak or monitor printer contacts of relays 1 to 5. This battery is supplied to the monitor printer receptacle from the monitor printer contacts over conductors of cable D and to the station #1 receptacle or station #2 receptacle, (dependent upon the position of the tongues of relay 8,) from the line contacts of relays 1 to 5 over conductors of cables A and C or E. As illustrated the circuit continues through the spacing contacts of relay 8 to station #2 receptacle. In the operated position of the relay 8, the circuits would be to the station #1 receptacle.

It is evident therefore, that the incoming impulses are transmitted through the assigner to the socket receptacles for the various circuits. The proper equipment is plugged into these receptacles for the recording of the signal in the case of the monitor printer or for retransmission into station #1 or station #2, in which case it may be a reperforator, a channel repeater, a storing transmitter or any other receiving or repeating device adaptable to multiplex operation.

It will be noticed that the marking battery supplied to the three receptacles is positive which is opposite to our assumption of negative battery for the channel under discussion. It is sufficient, however, to state that all circuits in the channel assigner beyond the windings of the selecting relays, operate on or supply positive battery as the marking polarity, for simplicity, and in the case of the line circuits, this change of polarity is corrected in the unit beyond the output of the assigner. This, however, is not to be construed to mean that this is a limitation of the assigner for each circuit may be carried thru the assigner with the same battery polarity output as is received on the input side.

In case the output of the assigner works into a polar device and both marking and spacing battery are required, the spacing battery is obtained from the terminal 14 of station #1 or #2 receptacles, which, thru the added unit that is plugged into these receptacles, establishes a circuit to terminal 13, and by means of conductor 6' in the cable, supplies battery to the contacts of tongue 3 of relay 8. The circuit then continues from tongue 3 of relay 8 to marking contacts of relay 6, tongues 3, 5, 7, 9 and 11 from whence it is furnished to the spacing contacts of the line set of contacts of relays 1 to 5. Since the return circuit of any device plugged into the socket receptacles must be to split battery in order to operate polar devices, the assigner is arranged so that polar devices establish the spacing battery while non-polar devices do not, otherwise non-polar devices would operate on either polarity of battery.

When the brushes b_2 make contact with segment #2 of the local rings, relay 9 is operated. This causes tongues 1, 2, 3 of relay 9 to move to their right hand or marking contact, thereby establishing the sixth or operating pulse for the monitor printer over a circuit from tongue and contact 1 of relay 9 to terminal 6 of monitor printer receptacle, and from tongues and contacts 2 and 3, respectively, to terminals 6 of station #1 and station #2 receptacles. Tongues 4 and 5 of relay 9 also move to the right, thereby breaking the locking circuits to relays 1 to 5 inclusive.

In order to switch the circuit from station #2 to station #1, the combination "figures-shift", F, letters, is sent over the circuit from the transmitting station. To switch back to station #2, the combination, "figures-shift", S, letters, is transmitted. When the combination "figures-shift" is received, it causes the tongues of selector relays 1, 2, 4 and 5 to be positioned to their marking contacts and the tongues of relay 3 to their spacing contacts. The figures-shift is repeated thru the assigner in the manner described above for the "letters" signal. In addition, a circuit is established from tongue 2 of relay 6 to marking contact and tongue 4 of relay 1, to marking contact and tongue 4 of relay 2 to tongue 4 and marking contact of relay 4, to marking contact and tongue 4 of relay 5, to tongue 4 and spacing contact of relay 3 to main winding of relay 7 to split battery. When relay 6 is operated by the passage of brush b_2 over segment 1 of the local rings, tongue 2 is moved to its marking contact which is connected to plus battery and an impulse is sent thru the above described circuit to operate relay 7, which in turn is locked up by means of tongue 1 and contact of relay 7 thru the locking winding to split battery. At this point it may be said that the above circuit is also established as described, except for relay 3 when the "letters" combination is received. For this latter combination, relay 3 is also operated to its marking contact, whence the circuit is from tongue 4 of relay 3 to the return side of the locking winding of relay 7. This circuit places a short circuit around the locking winding, thereby causing relay 7 to return to the unoperated position. It is thus seen that the "figures" combination causes the operation of relay 7 and the "letters" combination returns this relay to normal, and these two functions occur when relay 6 is operated since the battery is received from tongue and contact 2 of relay 6. The operation of relay 9 when brush b_2 passes over segment 2 of the local rings, resets the selector relays 1 to 5 in readiness for the next combination.

When relay 7 is in the operated position, due to the figures-shift combination as above described, and the next selection received on the relay LR from the line is the "F" combination, (i. e., relays 1, 3 and 4 on marking contacts and relays 2 and 5 on spacing contacts) a circuit is established in the fifth group of tongues and contacts designated the S or F switching tongues and contacts. This circuit may be traced from

positive battery through marking contact and tongue 5 of relay 1, to spacing contact and tongue 5 of relay 2, tongue 5 and marking contact of relay 3, to tongue 2 of relay 7. Since this relay is now in operated position, the circuit is continued from tongue 2 and marking contact of relay 7 to tongue and spacing contact 5 of relay 5, to tongue 5 and marking contact of relay 4, and the main winding of relay 8. Relay 8 is therefore operated to the right, thereby establishing the selecting circuits to the receptacle designated station #1. It should be noted that the switching of the selector circuits from receptacle for station #2 to that for station #1 occurred independently of relay 6. Hence, when relay 6 is operated from the local rings, battery is applied to the line contacts of relays 1 to 5, thereby causing the F-combination to be passed to the newly selected station, i. e., station #1 and is not received by the other station.

At this point it might be well to state that the printers at each station are always left in the upper case or "figures-shift" position when the switching occurs. Since the switching combination is passed into the newly selected station, which was selected by that combination, (in this case the F-combination) the printer at the station may have the upper case position of the type slug F equipped with a character or sign which may be used as a channel designation sign. Normally the upper case F and S of the printer have no character sign and are not used in the normal printing of a message. This feature lends itself very well to my purpose, in that no change in the printer is necessary, other than to replace the present F or S type slug with an upper case character.

The third signal in the switching combination is the "letters" signal, which, when received, causes the tongues of all five selector relays to be placed on their marking contacts.

As described above, the "letters" combination causes relay 7 to unlock, due to the circuit established from tongue 2 of relay 6 and the tongues and contacts 4 of relay 1 to 5 as already described. The printer at station #1 is now connected through the channel assignor unit direct to the transmitting station and is ready to receive the message.

When it is desired to switch the circuit to the opposite station, i. e., back to station #2, the transmitting station sends the combination figures-shift, S, letters shift. The function is the same as described above except the difference between the F and S selection. In the F selection, the selectors 1, 3 and 4 are marking, while 2 and 5 selectors are spacing; in the S selection, 1 and 3 selectors are marking while 2, 4 and 5 are spacing. The circuit as described above is therefore the same except for the position of the tongue of the fourth selector relay which for "S" selection will be spacing, and battery thus is applied to the return side of the locking winding of relay 8, which in effect acts as a short circuit around the relay, causing it to fall back to its unoperated position, thereby establishing the selector circuits back to the station #2 receptacle.

The switching function, as above described, requires three characters to complete the operation. There is, however, no loss in line time to perform this operation, due to the fact that each message must be given a channel designation to indicate over which channel it was received and also the number of the message. My method makes the switching and channel designation one and the same selection, which, when followed by the message number, results in the same number of characters as ordinarily required.

No mention has been made of the function of relay 10. This relay is used to prevent the switching combination from being transmitted thru the assigner into the terminal station printers. Whenever a switching combination is sent into the assigner, the "F" or "S" combination causes a circuit to be established thru the 6th group of tongues and contacts of the selector relays and the tongue and contacts 3 of relay 7 to the winding of relay 10. The operation of this relay causes spacing battery to be applied to the marking line contacts of relays 1 to 5 over a circuit from receptacle socket 14 through the plugged apparatus to socket 13, through conductor 6', contact and tongue 3 of relay 8 to marking contact and tongue 1 of relay 10 and to contacts and tongues of relay 6. In this manner spacing battery is sent out to station 1 or 2. If, however, the piece of apparatus that is plugged into the receptacles of station 1 or station 2, as repeaters of the signals, be of the non-polar type relays or the like, spacing battery from terminal 14 is not applied to terminal 13 as in the case for polar-operated devices. Therefore, in the case of a non-polar repeater, no battery is applied to the line contacts of selectors 1 to 5 and the repeater would automatically send out spacing for the switching F or S combination. It is therefore possible to make use of the switching character as a channel designation sign, or prevent its appearance in the message.

In connection with relay 5 and its manner of operation on spacing battery impulses, it will be noted that this relay must be reversed, due to the fact that the switching combination F or S, causes the operation of relay 7 as soon as the F or S selection is established and before relay 6 is operated from the local segment. Since in the combination S or F only selectors 1 and 3 in the former case and 1, 3 and 4 in the latter are marking, either combination requires relay 5 to be on its spacing contact. If the operation of relay 5 were the same as for relays 1 to 4, relay 5 would normally be on its spacing contact and the switching would occur after selection 4 was received and before selection 5 was received. This would cause errors. The reversing of relay 5 to operate on spacing prevents this source of error.

My receiving channel assigner makes it possible to terminate the messages coming in over a multiplex channel on either one of two receivers. These receivers may obviously be two printers located at different parts of an office or one may be a printer located in the office while the second receiver is a channel repeater which transfers the signals received into another multiplex channel to a distant point. The assigner selects which one of the receivers shall be operated according to a predetermined signal transmitted by the sending operator.

In the arrangement shown in Fig. 1, previously described, the upper case position of letters S and F were used to initiate the switching. In the arrangement now to be described, shown in Fig. 2, I employ the upper case position of letter S and the so-called "bell" signal (i. e., upper case position of letter J) as the selecting signals, since it has been established as a routine practice in multiplex operation over some of the Western Union circuits to send a "bell" signal at the end of every message. In the arrangement shown in Fig. 2, the channel assigner switches back to the receiver, which may be designated the normal

receiver, at the end of every message without the use of an additional switching character, but when the operator wishes to send a message into the other receiver, he prefixes the message with the upper case of letter S.

By the use of low resistance polar relays, which are now available, the selecting relay coils of the receiving-channel assigner, may be put in series with the receivers, thereby making it unnecessary to repeat the signals through contacts on the receiving channel-assigner as was done in the arrangement of Fig. 1 previously described. The contacts on the assigner are therefore used only for selecting the switching combination and for operating the switching relay.

On the right hand side of the diagram in Fig. 2, are shown the printer relay or receiving line relay LR and the receiving and local segments of the rotary distributor D. Connection is made from each segment of the receiving distributor, through one of the coils of the selecting relays to the tongues of the switching relay. The five selecting segments are carried through in this manner and the sixth impulse from the segment of the local rings 6 is carried through the sixth pulse relay of the assigner to a tongue of the switching relay in the same manner.

The operation is as follows:—Assume that the switching relay is in the position shown. Messages are therefore being received by the normal printer or repeater connected to contacts 1, 2, 3, 4 and 5 of the switching relay. The selecting relays are being operated by the signal impulses but they have no effect upon the reception unless the combination code characters of "figures shift", "letters" selection, and upper case of letter S, or the upper case of letter J, are received.

If the "figures shift" code selection is received, the selecting relay tongues will be set up or positioned in such a manner (i. e., tongues 1, 2, 4 and 5 on marking and 3 on spacing) that when the sixth pulse relay is operated by the pulse from the local ring, a circuit is established from plus battery Ba_1 through the right hand contact 4 and tongue of the sixth pulse relay, then through the tongues and right hand contacts 1, of selecting relays S1, S2, S4 and S5, the tongue and left hand contact 1, of relay S3, to the upper coil of "figures shift" relay and to ground, thus operating this relay. This relay locks itself in through its locking coil 1c. If the operator now sends from the upper case to send figures or some other function (other than the upper case of S or J), nothing further happens until he sends a "letters" signal. When he does send a "letters" signal (i. e., all five selecting pulses "marking") the selecting relays are set up in such a manner that a circuit is completed exactly as described for the "figures shift" function, except that it emerges on the right hand contact 1 of relay S3, thereby short-circuiting the locking coil of the "figures-shaft" relay through the shunt resistance and restores it to its spacing position.

If, however, instead of "letters" signal, the "figures-shift" signal had been followed by the upper case of "S", (i. e., selections 1 and 3 marking and 2, 4 and 5 spacing) a circuit would have been established from plus battery Ba_2 through the right hand contact 3 and tongue of the sixth pulse relay, through right hand contact 2 and tongue of relay S1, the left hand contact 2 and tongue of S2, the tongue 2 and right hand contact of S3, the tongue 2 and right hand contact of the "figures shift" relay (which as has been described is locked up in the marking position) through the left hand contacts 2 and tongues of relays S5 and S4 to the upper coil of the "switching" relay to ground. This operates the relay and it locks itself in through its locking coil 1c. This switches the output of the channel from the receiving instrument connected to the left hand contacts 1, 2, 3, 4 and 5 of the switching relay to the receiving instrument which is connected to the right hand contacts 1', 2', 2', 4', and 5' and the switching relay remains in this position until the "bell" signal (i. e., upper case "J") is transmitted at the end of the message.

To send the "bell" signal, the "figures shift" selection is operated as previously described and when the letter J selection is operated, a circuit similar to that traced for the letter "S" can be traced for the letter "J" signal except that the circuit is now through the lower set of contacts 3, of relays S1, S2 S3, S4 and S5. The operation of this circuit short-circuits the locking winding of the "switching" relay and its tongues are therefore restored to their left hand or spacing contacts.

The function of the "reset" relay is to restore the selecting relays to their left hand or spacing contacts. The operation of its circuits will be readily understood. The relay coil is shunted by a large condenser C in order to make the operation of the relay quite slow, thereby permitting ample time for the operation of the heavy "switching" relay from the sixth pulse. The "sixth pulse" relay remains locked in until the "reset" relay operates.

This circuit does not avoid sending the switching character to the line as was done by the arrangement of Fig. 1. In the case of the "bell" signal, this has already been taken care of in the printer (as is known by those familiar with this art, the paper carriage in the printer does not step forward on the upper case letter "J", since a contact on the "J" bar introduces resistance in the spacing magnet circuit). The same provision to prevent the stepping of the carriage is readily made on the upper case of letter "S" (or any other letter chosen as a switching combination).

I have not indicated the circuit arrangement to include a monitor printer, as in Fig. 1, as it will be evident to engineers that contacts can be added on the selecting relays for repeating into a monitor printer.

I claim:

1. The method of selective signaling which consists of imparting to a channel of a multiplex telegraph system, code signals of a variety of impulses of different polarity and causing, first, a signal comprising impulses of different polarity to initiate operation of a selecting receiver, then causing another signal comprising impulses of different polarity to selectively connect the receiver with a selected line while preventing the transmission of the last named signal to said line and finally causing still another signal to establish direct communication between said channel and the selected line through said receiver.

2. The method of selective signaling which consists of imparting to a channel of a multiplex telegraph system, code signals of a variety of impulses of different polarity and causing, first, a signal comprising impulses of different polarity to initiate operation of a selecting receiver, then causing another signal comprising impulses of different polarity to selectively connect the receiver with a selected line while preventing the transmission of the last named signal to said line and finally causing still another signal comprising im-

pulses of uniform polarity, to establish direct communication between said channel and the selected line through said receiver.

3. The method of selective signaling which consists of imparting to a channel of a multiplex telegraph system, code signals of a variety of impulses of different polarity and causing, first, a signal comprising impulses of different polarity to initiate operation of a selecting receiver, then causing another signal comprising impulses of different polarity to selectively connect the receiver with a selected line while causing the transmission of a signal of spacing impulses to be transmitted to the selected line instead of said impulses of different polarity, and finally causing a signal composed of marking impulses to establish direct communication between said channel and the selected line through said receiver.

4. In a telegraph system, a line associated with a signaling channel of a multiplex receiving distributor at a main station, a plurality of branch stations having terminal connections at said main station, a station selecting device associated with said distributor, and adapted to be connected to any selected branch station terminal, means for sending code combinations of line impulses over said channel to condition said device for selective operation, means responsive to a selecting code combination to connect said device with the selected station terminal and means to connect said station through its terminal with said signaling channel through the medium of said device.

5. In a telegraph system, a line associated with a signaling channel of a multiplex receiving distributor at a main station, a plurality of branch stations having terminal connections at said main station, a station selecting device associated with said distributor, and connected to one of said branch station terminals, means for conditioning said device upon the reception of the figures-shift code combination over said channel, means for changing the connection of said device from the connected station terminal to another selected terminal upon the reception of a predetermined code character, means for preventing the transmission of said character to said first connected station, and means for effecting direct communication between said channel and said selected station through said selecting device.

6. A printing telegraph system comprising means for transmitting code combinations of signaling impulses over a line to a main station, selecting means for receiving said impulses over a channel of a multiplex distributor operated in synchronism with said impulses, a plurality of branch stations connected to lines extending from said main station, said selecting means being normally connected to one of said branch stations, said means being controlled by certain of said code combinations of impulses received over said channel to first condition the same for a shifting operation, means responsive to a station selecting code combination to shift the connections of said channel to another selected station without transmitting the shifting code combination to said first connected station and means responsive to a third code combination to place said selected station in direct communication with said channel through the medium of said selecting means.

7. A printing telegraph system comprising means for transmitting code combinations of impulses over a line to a main station, means for receiving said impulses over a channel of a multiplex distributor, a plurality of branch stations connected to lines extending from said main station, and means auxiliary to said distributor and controlled by certain of said received code combinations of impulses to divert the impulses received over said channel of the distributor from one branch station to another selected branch station.

8. A printing telegraph system comprising means for transmitting code combinations of impulses over a line to a main station, means for receiving said impulses over a channel of a multiplex distributor, a plurality of branch stations connected to lines extending from said main station, and means auxiliary to said distributor and controlled by certain of said received code combinations of impulses to first transmit a signal causing the printer of a connected branch station to shift to upper case position and to then divert the impulses received over said channel of the distributor from said connected station to another selected branch station.

9. In a printing telegraph system as set forth in claim 7, a printer at said main station, said auxiliary means also causing said main station printer to record all of the intelligence signals transmitted to said branch stations.

10. A printing telegraph system comprising a main station and a plurality of branch stations connected to lines extending from the main station, a multiplex distributor at the main station, means for receiving code combinations of impulses transmitted over a line and impressing them upon one channel of said distributor and a channel diverting device associated with said distributor and responsive to certain of said received code combinations of impulses, said device comprising means responsive to a code combination to cause a branch station printer connected to the main station to shift to the upper case position, means responsive to a station selecting code combination to then shift said channel of the multiplex distributor to another selected branch station and simultaneously transmit spacing signal impulses to said first connected printer and means responsive to a "letters" code combination to place said selected station in direct communication with said receiving means through the medium of said channel of the distributor and said channel diverting device.

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