

June 7, 1949.

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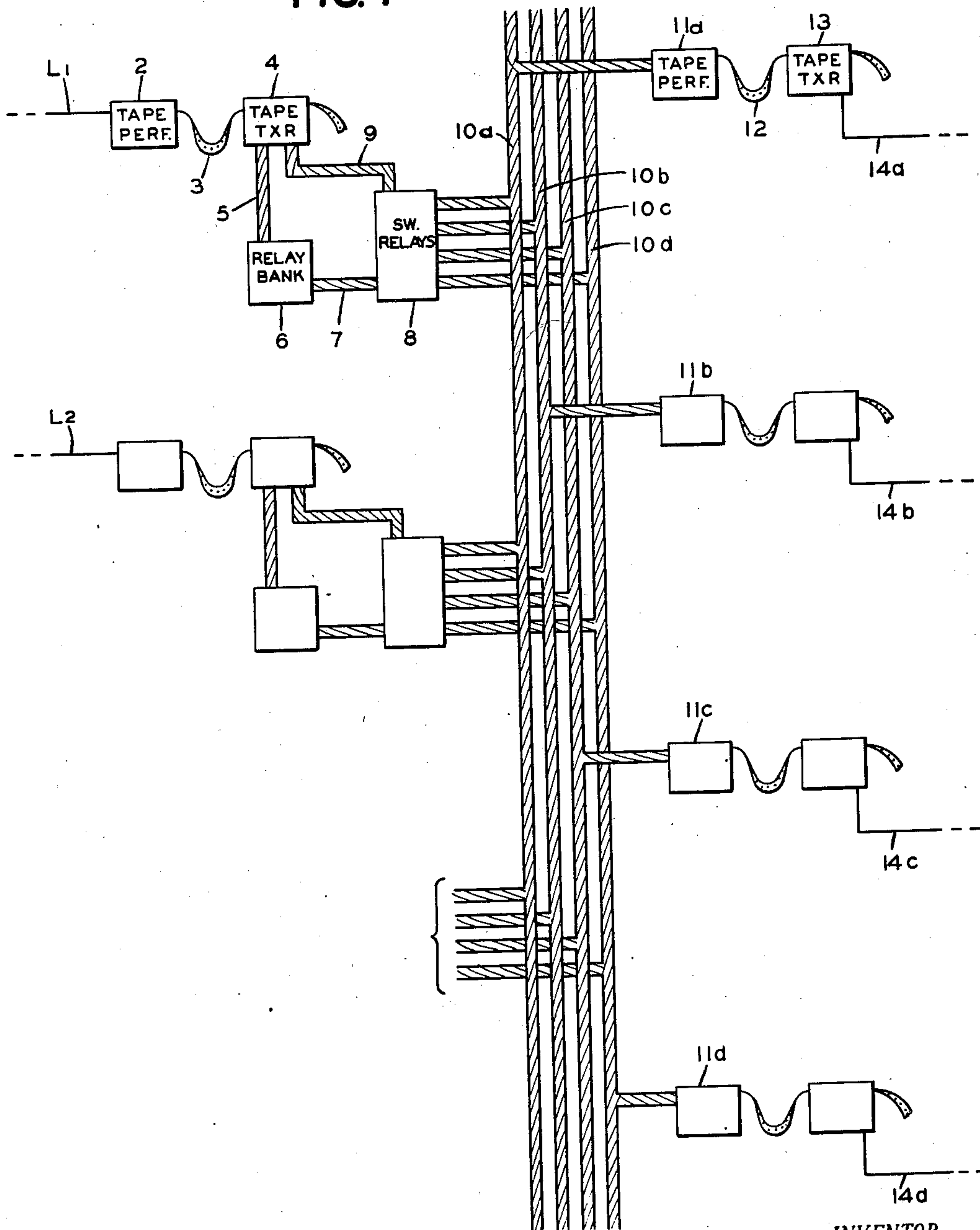
2,472,608

MEANS AND METHOD FOR SWITCHING OF TELEGRAPH MESSAGES

Filed Jan. 12, 1945

2 Sheets-Sheet 1

FIG. 1



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Filed Jan. 12, 1945



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2,472,608

MEANS AND METHOD FOR SWITCHING OF
TELEGRAPH MESSAGES

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Application January 12, 1945, Serial No. 572,499

3 Claims. (Cl. 178—3)

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My invention relates to the relaying of telegraph messages through offices, and in particular to the automatic switching of such messages.

One object of my invention is to reduce the cost of handling messages.

Another object is to reduce the time required for each message to be passed through each office intermediate between the office where the message originated and the office of destination.

Another object is to make use of lines or circuits between offices as efficiently as is practicable, that is, to maintain the lines as well loaded with messages as is feasible or desirable.

It is contemplated that the telegraph operator will include within the message, or will add to the message, a special character or letter, or a small group of special characters, which will cause mechanism to be actuated to switch the message automatically into the desired telegraph line leading toward its destination. By this means the message, if desired, may be guided or switched automatically through a single office or through two or more in turn. At each office there may be a choice of any desired number of circuits, the message being switched automatically into the correct circuit as determined by the special guiding character or characters. Instead of being switched into a circuit leading to a distant point, the message may be switched into telegraph receiving equipment within the same office, or it may be switched into other equipment where the telegraph message may be switched manually by an operator.

If plenty of line circuits to distant points are available, so that when a message is switched it substantially always may find an idle outgoing circuit toward the desired destination, the switching system and equipment would be relatively simplified. However in order that it may not be necessary to furnish a large surplus of circuits, it is here contemplated that the switching equipment will be used in association with equipment for storing the messages temporarily when necessary until a circuit becomes available. Such storage may be accomplished by equipment already available, through the use of paper tape, the tape being perforated by holes corresponding to the message.

Simple limited methods of automatically guiding a message past a junction point into a desired line, by means of a special character or characters transmitted along with the message have been known and used previously. The present application is unique in that it includes in combination means which permit the associated line

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circuits to be used much more efficiently than was possible previously; there is far greater flexibility in the permissible extent of the switching, and in the use of the associated line circuits, each such circuit being available for use for sending messages originating at diversified points.

According to the preferred form of my invention the automatic switching operation is accomplished by inserting in front of the message to be transmitted a "clearing" signal which clears or takes down the connections which had been established to transmit the previous message, and then a "switching" signal which selects and completes the proper connections to the proper outgoing line for the transmission of the message to follow. Furthermore, I prefer to transmit a "ready" signal in advance of the clearing signal in order to prevent operation of the clearing relays unless the ready and clearing signals are received in proper order.

The preferred form of my invention is illustrated in the accompanying drawing in which

Figure 1 is a schematic diagram showing the apparatus necessary for automatically relaying a telegraph signal from two incoming lines to any one of four outgoing lines, and including apparatus for storing the signal at the relaying station until the desired outgoing line is available for transmission; and

Figure 2 is a circuit diagram showing the details of the circuit arrangement required in Figure 1 for relaying the message through a single tape transmitter to a selected one of four different tape perforators associated with the four outgoing lines.

In Fig. 1 a member of incoming lines L1, L2, etc. are shown, each terminating in an individual tape perforator 2 connected by a tape loop 3 to an individual tape transmitter 4. The tape perforators may be of the type shown in the patent to R. F. Dirkes et al., No. 2,174,731, granted October 3, 1939, and the tape transmitter may be in the form shown in the patent to G. R. Benjamin No. 1,298,440, granted March 25, 1914. Associated with the tape transmitter 4 is a relay bank 6 and a switching relay group 8, shown in detail in Fig. 2. The purpose of the relay bank 6 is to respond to predetermined selected characters interposed between each received message to operate desired ones of the switching relays of the group 8, to connect the tape transmitter 4 to any one of a number of tape perforators 11a, 11b, 11c, 11d arranged on the outgoing side of the switching equipment. The perforators 11a, etc. may be of the multi-magnet type such

as is shown in the patent to R. F. Dirkes et al. No. 2,143,828, granted January 10, 1939. Each of the perforators 11a, etc. is connected through the perforated tape 12 to an individual tape transmitter-distributor 13 associated with the outgoing lines 14a to 14d. The transmitter-distributor may be of the form shown in the patent to S. Rothermel No. 1,805,374, granted May 12, 1931. By this arrangement messages may be received over the lines L1, L2 on the tape perforators 2 and stored until the desired cross-office perforators 11a to 11d is available whereupon a connection will be made thereto automatically from the tape transmitter 4 for cross-office transmission. The signals received on the perforators 11a, 11b, etc. are stored in the tape 12 and transmitted directly over the outgoing lines 14a, 14b. If desired, cross-office transmission from the transmitters 4 to the perforators 11 may be at a somewhat higher speed than the line signaling speed in order to compensate for time lost in the switching operation and to reduce the busy time of the cross-office perforators 11a to 11d.

The contacts of the tape transmitter 4 are connected to relay bank 6 through the cabled conductors 5 and also in multiple to the contacts of the switching relays of group 8. The control of the switching relays 8 from the relay bank 6 is over a group of cabled conductors 7. The switching relay assembly 8 comprises a switching relay for each of the tape perforators 11a to 11d, each of these switching relays being connected to its corresponding perforator through the cabled conductors 10a to 10d, these conductors being multiplied to each of the switch relay groups 8.

The detailed circuits comprising the relay bank 6 and switching relay group 8 are shown in Fig. 2 to which reference is now made.

In Fig. 2 the relays comprising the banks 6 are the five code relays 17 to 21 having their contacts pyramided, as shown, to provide a relay selecting circuit, and a group of counting and control relays 27 to 33. The switching relays comprising the group 8 include, as stated, a switching relay for each perforator 11a—11d and a lockout relay associated with each switching relay. In Fig. 2 one switching relay 34a, individual to tape perforator 11a and its associated lockout relay 35, only are shown, the other switching and lockout relays being identical in construction in their circuit arrangements.

The switching signals which control the selection of a desired one of the perforators 11a to 11d comprise three code selections, for convenience termed the A, B and C selection. The first or A selection prepares or renders the relay group 26 to 31 ready to respond to the second or B selection which in turn prepares the relay group to respond to the third or C selection. The A and B selections are invariable and consist of two selecting codes which do not occur together in normal message transmission. The C selection may be any one of a number of regular character selections. The B or second selection in addition to preparing the circuit to respond to the C selection also serves as a clearing signal to break down any previous selection set up through the switching relays 8. The relay 30 serves to prevent operation of the relay chain in response to the B or second selection except where that selection immediately follows a predetermined A selection. It is to be understood that the A, B and C selections referred to do not indicate the

characters A, B or C but may comprise any convenient selecting codes.

The operation of the various relays is timed by means of impulses which may be of any convenient frequency, say, from five to twelve pulses per second, and may be generated in any desired manner (not shown) as for instance, by means of a rotary commutator. All of the circuits connected to such a source of impulses are designated by the letter P in this figure. Impulse devices of this nature for stepping tape transmitters in a switching system are well known in the art.

Assume now that a switching connection has been set up from the tape transmitter 4 through the cable conductor 9 and the contacts of the switching relay 34a to the magnets of the multimagnet tape perforator 11a. The ground at the third outer contact of relay 34a is applied to one wire 42 of the group 10a which operates the lockout magnets 35 associated with switching relay 34a at each of the switching positions and thereby holds open the operating circuit of relay 34a at each position so that these relays can not be selected at a different position from that at which transmission is taking place. The five inner armatures of relay 34a connect the contacts of the transmitter 4 to the magnets of the tape perforator 11a. Upon the generation of each impulse from the impulse device a pulse will be transmitted from the outer armature of the relay 34a and conductor 41 to the tape stepping magnet 26, causing the tape to be advanced one character in the transmitter and the contacts 15 thereof to be closed selectively in accordance with the code perforations in the tape. The corresponding code signals is then transmitted over the conductors 9 and 10a to the tape perforator 11a. These code impulses are received on the selecting magnets of the perforator to set up the desired selection therein whereupon the actuating pulse supplied through the second outer armature of relay 34a effects one cycle of operation of the perforator to record the selection in the tape.

Assume now that the last character of a message being transmitted has reached the pins of the tape transmitter 4 and that the next three characters appearing in the tape are the A, B and C selection codes for the next succeeding message. The first pulse received over the outer armature of relay 34a operates the stepping magnet 26 to step the first or A selection into the transmitter. This causes the selective operation of the relays 17 to 21 to apply battery from the source 40 through the contacts of the relay selector to the operating or left hand winding 36 of relay 27. Relay 27 in response thereto operates and locks from battery at its inner armature and right hand locking winding. It also prepares a circuit from the pulsating source through its outer armature to the operating winding of relay 28. When the second pulse is received by the stepping magnet 26, the B selecting character is advanced to transmitting position in the tape transmitter and causes the B contact of the code relay 21 to be closed through to the battery 40. This same pulse is also supplied through the outer armature of relay 27 to the operating winding of relay 28 causing this relay to operate and at its outer armature preparing the circuit from the B contact referred to the operating winding of relay 29. Relay 28 locks up at its inner armature and applies a short-circuiting ground at its middle armature

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to the locking winding of relay 27 thereby causing this latter relay to release. At the time the operating pulse for relay 28 is received, relay 30 is de-energized since this same pulse operates in the right hand winding of the relay in opposition to the steady battery in the left hand winding thereof. After the pulse terminates, relay 30 operates and shorts the locking winding of relay 28, causing it to release. However, this operation does not occur until the B selection has been set up on the contacts of the code relays 17 to 21, and relay 29 has been operated. However, had the selecting code following the A selection not been the predetermined B selection, relay 29 would not have been operated at the time relay 28 was released. Consequently the interposition of any code between the A and B selections will preclude the operation of relay 29 and hence prevent a false selection.

Upon the operation of relay 29, following the B selection, it locks up through its right hand locking winding and inner armature. At its outer armature it opens the locking circuit for the right hand locking winding of the operated switching relay, such as 34a, and causes this relay to release, thus clearing the previous switching operation. The next impulse from the impulse device is then supplied to the stepping magnet 26 through the second outer armature of relay 29 causing the third or C selection to be set up in the tape transmitter. This causes one of the C selecting contacts 25a to 25c to be closed, setting up the C selection in the code relay bank. The same pulse acts through the second inner armature of relay 29 to operate relay 31 which locks up through its right hand locking coil and inner armature to prepare the circuit from the operated contact (25a to 25c), as for instance, 25a, to the operating winding of the associated relay 32. Relay 31 at its second inner armature short-circuits the locking winding of relay 29 causing this relay to release. Upon such release, relay 32 locks up through its right hand locking winding to the back contact of the outer armature of relay 29 and remains locked up until the next clearing or B selection signal is received in the next selecting code group. Relay 32 at its middle armature now short-circuits the locking winding of relay 31, causing this relay to release.

As a result of the above three selecting characters, relays 27, 28, 29, 31 and 32 were all operated in sequence and all released with the exception of relay 32 which remains locked up. This relay comprises one of a group individual to each of the tape perforators 11a and the selection of one of these relays 32, 33, etc. determines the perforator to be ultimately selected.

Relay 32 is individual to tape perforator 11a and serves to operate relay 34a. Relay 33 is likewise individual to perforator 11b and serves in a similar manner to operate a switching relay 34b (not shown), identical to relay 34a. If it is assumed that perforator 11a is idle, the ground will not be applied to the relay 35 associated with the switching relay 34a at each position, and as a result battery will be supplied through the outer armature of relay 32 and the break contact and armature of relay 35 to the operating winding of relay 34a, causing this relay to operate and to lock up through its locking winding and inner armature to the back contact and outer armature of relay 29. The operation of relay 34a again connects the contacts of the tape transmitter 4 through to the selecting magnets of the

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tape perforator 11a and causes the tape to be advanced through the tape transmitter as heretofore described to transmit the message which follows the selecting codes.

The A and B selecting codes are preferably inserted at the end of each message or each continuous group of messages transmitted over the lines L1, L2, etc. so that the switching relays such as 34a may be released promptly following any sequence of transmission, thus making the perforators controlled thereby available for connection to the tape transmitter in other positions. It will be understood that when such A and B selections are transmitted without the transmission of the C or switching signal, relay 31 will remain locked up until the C selection is later transmitted, and during such time any required stepping pulses for the transmitter 4 will be supplied through the outer armature of relay 31.

It will be understood, of course, that the tape perforators 2 and 11 will be supplied with the usual tape feedout mechanisms to advance the last perforated characters to the tape transmitter and also the tape loops 3 and 12 will be supplied with the usual tight tape control arms for stopping the operation of the tape transmitter upon the event of tight tape.

From the foregoing it will be seen that in front of each message three distinct characters or signals are inserted for the purpose of directing the message to the desired outgoing line at a relay station. These are "ready," "clearing" and "switching" signals. The "ready" signal effects the operation and locking up of relay 28 through relay 27, and relay 28 is periodically released by relay 30. However, if the "clearing" signal B is received before relay 28 is released, relay 29 is operated to clear the previously established switching connections and to prepare relay 31 to be operated by the "switching" signal which follows. The two selections A and B may be alike or different. However, selections B and C must be different and C can be formed of any one of a number of different selections assigned to various outgoing lines.

In the usual printing telegraph code there are a total of thirty-two possible combinations. At least two of these are undesirable for use as a switching character, which leaves thirty different characters which may be available for the purpose. That is, there are about thirty characters which may be assigned under switching character C, permitting a choice of about thirty different outgoing circuits. If two successive switching characters are used, there is a possible choice of about nine hundred circuits.

If a switching character is received wrongly due to an error occurring in its transmission, it may cause a message to be wrongly switched. However if the number of available switching selections is limited to fifteen, it is possible to choose the characters so that no single error in transmission can cause a message to be switched into a wrong circuit. A switch into a wrong circuit may then be caused only if two errors occur in transmission. With this arrangement the occurrence of a single error would cause a character to appear that does not correspond to any of the outgoing circuits. Such messages could be handled by arranging to switch all of them automatically into a local storage perforator, where they would be held until they could be investigated by an operator.

Certain variations from the plan are possible within the scope of the invention, in order to

facilitate the switching, such variations being somewhat parallel to those in telephone switching practice. Thus line 1 may be connected to cause alternate operation of two different perforators, or it may be arranged to select any idle perforator in a group of perforators. If the amount of business to some point beyond is large, there may be two or more lines or channels 14 to that point, with provision to select whichever may be idle.

Another arrangement within the scope of my invention is to have instead of one transmitter 4, two transmitters with the same tape passing through each in turn. One transmitter then would serve to pick out the groups of characters which control the switching operations. The second transmitter working under the control of the first would operate into the perforators 11a to 11d. It then may be of advantage to place the groups of characters controlling the switching at the end instead of at the beginning of the message it controls. Such an arrangement possesses certain advantages under some conditions.

I claim:

1. In a system for the automatic switching of telegraph messages, the combination of a source of telegraph signals including a ready signal, a clearing signal and a switching signal transmitted in advance of the message characters, a plurality of outgoing lines, switching means for connecting said source to any one of said outgoing lines, means responsive to the receipt of said ready signal for preparing said switching means for operation by said clearing signal, means responsive to the receipt of said clearing signal for clearing all connection between said source and said outgoing lines, and means responsive to receipt of said switching signal for completing a connection between said source and a predetermined outgoing line.

2. In a system for the automatic switching of telegraph messages, the combination of a source of telegraph signals including a ready signal, a clearing signal and a switching signal transmitted

between groups of message signals, a plurality of outgoing lines, storage means and transmitting means individual to each outgoing line, switching means for connecting said source of signals to any one of said storage means for transmission over the associated outgoing line, means responsive to the receipt of said ready signal for preparing said switching means for operation by said clearing signal, means responsive to the receipt of said clearing signal for clearing all connection between said source of signals and said storage means, and means responsive to the receipt of said switching signal for completing a connection between said source of signals and a predetermined storage means.

3. In a system for the automatic switching of telegraph messages, the combination of a telegraph code transmitter for alternately transmitting groups of selecting code combinations of impulses and groups of message code combinations of impulses, a source of pulsating current for said transmitter, a plurality of recording devices, switching means for connecting said transmitter to any one of said recording devices, said switching means comprising a series of self-locking relays, means responsive to each code combination of impulses of said group of selecting code combinations for operating said relays in succession to complete the switching connection, and means operated from said source of pulsating current for unlocking each of said relays, before the operation of the succeeding relay.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Disclaimer

2,472,608.—*Joseph W. Milnor*, Maplewood, N. J. MEANS AND METHOD FOR SWITCHING OF TELEGRAPH MESSAGES. Patent dated June 7, 1949. Disclaimer filed Nov. 13, 1950, by the assignee, *The Western Union Telegraph Company*.

Hereby enters this disclaimer to claim 1 of said patent.
[*Official Gazette December 12, 1950.*]