

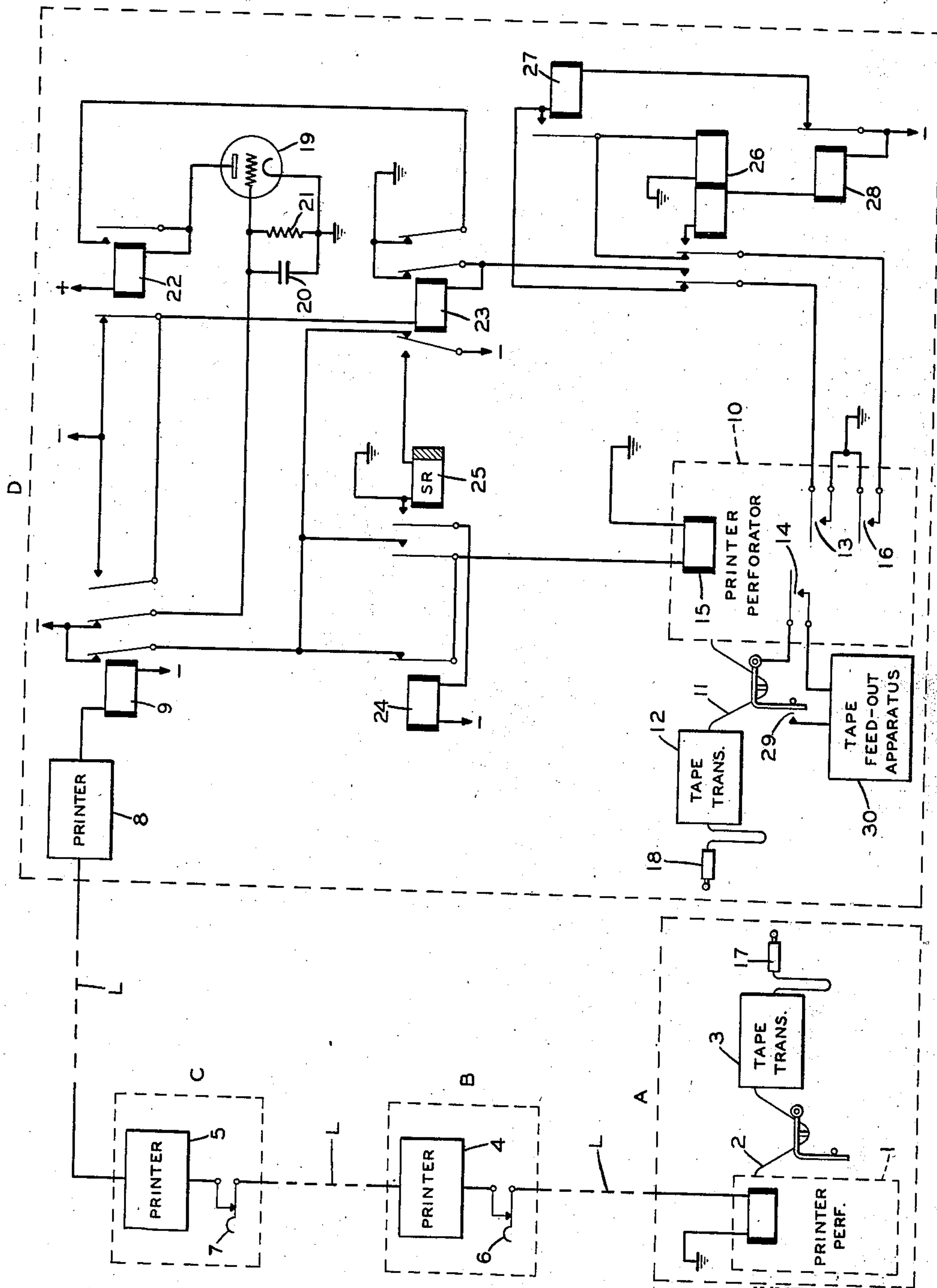
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TELEGRAPH STORAGE AND SWITCHING SYSTEM

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TELEGRAPH STORAGE AND SWITCHING
SYSTEM

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This invention relates to printing telegraph switching systems wherein messages received at a switching station are temporarily stored in perforated tape pending the completion of switching operations whereby the stored messages are re-

laid to their ultimate destinations. In systems of this character each message is usually succeeded by a predetermined end-of-message signal which is also perforated in the tape and is used to control the tape handling apparatus including the perforator and the transmitter. Signals for this function are selected so that the probability of their occurrence in the body of a message is, for all practical purposes, negligible. Systems utilizing signals of this character are disclosed in Patent 2,193,811 granted March 19, 1940 to Blanchard et al., copending application of Blanton, Serial No. 299,408, filed October 13, 1939, now Patent 2,279,295, granted April 4, 1942, and copending application of Light et al., Serial No. 350,402, filed August 3, 1940.

An end-of-message signal generally includes a plurality of characters, some of which, when detected by the transmitter, control the stopping of the transmitter. Other characters control the operation of selector contacts in the perforator which by themselves or in conjunction with other tape controlled contacts control apparatus for feeding out of the perforator enough tape following the stored message so that the last message character will reach the transmitter pins. An illustrative form of apparatus for feeding out additional tape by a perforator is disclosed in Patent 2,252,852 granted August 19, 1941 to Hoover.

In the start-stop system disclosed herein and embodying the instant invention, there is located at a switching station a perforator normally unresponsive to message signals received at that station but which, under the control of special switching signals, may be used to store received message signals in a perforated tape for subsequent retransmission to a remote station. Following each message or series of messages to be retransmitted an end-of-message signal is utilized to actuate selector-controlled contacts in the perforator to render the perforator unresponsive to subsequently received signals. For reasons of uniformity of operating routine the end-of-message signal also includes one or more characters following the disconnect characters to control the feeding out by the perforator of additional tape. It is contemplated that elsewhere in the system there usually will be another perforator which is at all times responsive to line

signals. The tape feed out character or characters of the end-of-message signals will, of course, be received by such a perforator. With respect to the normally unresponsive perforator, however, it is only in the most favorable circumstances that a tape feed out character will be received before the selector mechanism of this perforator is rendered unresponsive under the control of the preceding characters of the end-of-message signal.

Hence, it is an object of this invention to provide a telegraph system in which means are employed for conditioning a perforator for feeding out tape following the disconnection thereof from a signal receiving circuit.

Another object of the invention is to provide means responsive to a disconnect signal to locally control the actuation of a predetermined selector operated contact of a perforator after said perforator has been rendered unresponsive to signals received from a signaling circuit.

A further object of the invention is to provide, in apparatus whereby a telegraph signal receiver is rendered unresponsive to said signals under the control of contacts actuated by the selector of said receiver, means also controlled by said contacts to condition the selector, after being rendered unresponsive to telegraph signals, whereby another contact controlled thereby is actuated.

An additional object of the invention is to provide a relay organization whereby the responsiveness or unresponsiveness of a telegraph signal receiver is controlled and which, after rendering the receiver unresponsive to signals, conditions the receiver for the actuation of a predetermined selector operated contact thereof.

Still another object of the invention is to provide a relay organization operable under the control of selector operated contacts of a telegraph signal receiver to render the receiver unresponsive to further signals and to control the actuation of another selector operated contact of the unresponsive receiver.

Another object of the invention is the provision in a telegraph switching system wherein facilities are employed for operating a predetermined selector controlled contact of a receiving device after said device is rendered unresponsive to telegraph signals of means for delaying the employment of said facilities sufficiently to prevent the mutilation of the last character signal received by said device before being rendered unresponsive.

The attainment of the foregoing and other subsidiary objects of the invention will be evi-

dent from the following description of an illustrative embodiment thereof taken in conjunction with the single figure of the accompanying drawing.

Having reference to the accompanying drawing, there is disclosed a party line start-stop telegraph system extending through stations A, B, C and D. The printing telegraph apparatus at these stations is connected in a series line circuit L. At station A the line circuit is connected to the selector mechanism of a printer-perforator 1 by means of which perforated tape 2, which also contains a printed record of the received signals, is prepared for the control of a tape transmitter 3. Stations B and C are provided respectively with printers 4 and 5 by means of which telegraph signals may be transmitted and received. These stations are also provided respectively with normally closed keys 6 and 7 through which the line circuit is connected. At station D the line circuit is connected through a printer 8 by means of which telegraph signals may be transmitted and received and also through a repeating relay 9. This station is also provided with a printer-perforator 10 which is normally unresponsive to telegraph signals but which may be rendered responsive thereto at certain times in a manner to be described. This printer-perforator also prepares a control form or tape 11 in which predetermined groups of received signals are perforated and also recorded in printed form. The tape 11 is fed through a tape transmitter 12 for retransmission to a remote station connected to station D.

The tape transmitters 3 and 12 respectively at stations A and D may be of the type disclosed in Patent 2,172,269, granted September 5, 1939, to Angel. The printer-perforators 1 and 10 respectively at stations A and D may be of any suitable type, numerous examples of which are to be found in the prior art, such as that shown in patent 2,174,731, granted October 3, 1939, to Dirkes et al., or Patent 2,143,828 granted January 10, 1939, to Dirkes et al. The former patent covers a combination telegraph printer and perforator for use with start-stop signals such as those employed in the instant system, while the latter covers a similar instrument better adapted for use with multiplex signals. Consequently, in the present system, either of the above devices may be used by making suitable obvious modifications therein. The instrument covered by Patent 2,174,731 is susceptible of use in the present system when modified in accordance with the disclosure of Patent 2,143,828 to include selector operated auxiliary contacts.

The printer-perforator 10 includes a normally open contact 13 which is similar to the contact disclosed in Patent 2,143,828 and is closed after a carriage return selection is made by the printer-perforator. A similar contact 14 is closed after an "unshift" or "letters shift" selection is made by the printer-perforator. Both of these contacts are closed under the control of the storage mechanism to which the received signals are transferred by the selector mechanism responding to the selector magnet 15 or equivalent apparatus at the time that the signal immediately following either the carriage return or the unshift signal is being received. Also, the printer-perforator 10 includes a contact 16 which is closed under the control of any cyclically operating member of the printer-perforator. In this case, the contact 16 is momentarily closed by means of a suitable linkage operated by the punch ham-

mer which is actuated for each operation of the selector mechanism to control the apparatus employed to perforate the tape. The contact 16 will be referred to hereinafter as the punch hammer contact, and the contacts 13 and 14, respectively, as the carriage return and unshift contacts of the printer-perforator. The printer-perforator 1 at station A is also provided with auxiliary contacts similar to those of the printer-perforator 10.

Stations A and D are known as switching stations. At station A, for example, where copies of all messages transmitted over the line circuit L are received, facilities are provided similar to those disclosed in the copending application of Blanton, Serial No. 299,408, whereby certain of the messages destined to remote stations, which are connected for communication with station A, are retransmitted to the proper remote station in accordance with the address of the message recorded in the tape 2. For this purpose the output circuit of the tape transmitter 3 is connected to a plug 17 for insertion by an attendant into a jack (not shown) in which is terminated the line connected to the remote station for which the message is destined. This switching operation is made in accordance with the address of the message appearing in the tape.

Such a message for retransmission from station A may originate at any of the other stations in the system. In accordance with the disclosure of the copending application of Blanton referred to, each message is followed by an end-of-message signal in which are included predetermined characters which, when detected by the tape transmitter 3, stop the transmitter and also one or more other predetermined characters by means of which selector contacts of the printer-perforator 1 are actuated to effect the feeding out by the printer-perforator of enough additional tape to insure that the last message character and the transmitter control characters of the end-of-message signal reach the transmitter.

Stations B and C may communicate with one another, or with station D at which the printer 8 responds to the received signals. Station D may also communicate with either or both of stations B and C, and as previously stated stations B, C and D communicate with station A. Also, stations B and C may communicate with station D at times when there are messages to be retransmitted from station D to other remote stations connected thereto in a manner similar to that of station A.

Normally all communications over the system operate only the printer 8 at station D, the printer-perforator 10 at that station being normally unresponsive to the received signals. When it is desired to render the printer-perforator 10 at station D responsive to received signals so that tape may be prepared to control the transmitter 12 for the purpose of retransmitting the signals by means of a connection of the plug 18 to a selected jack (not shown) in which the line circuit from the remote station is terminated, the station originating the signals must first transmit a predetermined signal for the purpose of conditioning the printer-perforator 10 for operation.

At station D the line relay 9 is operated in response to all marking signals including the rest signal which is applied to the circuit while it is idle. When this relay is operated, by means of its second make contact negative battery is applied to the control grid of a vacuum tube 19,

the cathode of which is connected to ground. Consequently, in response to marking line signals, the tube 19 is maintained non-conducting. The input circuit of this tube is provided with a delay circuit comprising the parallel connection of a condenser 20 and a resistance 21 shunted between the control grid and the cathode. The constants of this delay circuit are so chosen that the short releases of the line relay 9 in response to received spacing signals whereby the negative potential is momentarily disconnected from the control grid of the tube are ineffective to start conduction in the tube 19. Consequently, relay 22 is in its released position so that battery is connected through its left hand break contact, the winding of relay 23 and the first right hand make contact of this relay to ground. With relay 23 operated, battery is connected through its left hand make contact, the break contact of relay 24 and through the winding of the selector magnet 15 of the printer-perforator 10 to ground. As a consequence of this connection the operations of the first make contact of relay 9, in response to the received signals are ineffective to produce responses by the printer-perforator.

Assume that station C desires to transmit a message to station D for retransmission to a remote station connected thereto. With the line circuit idle, the operator at station C opens the key 7 for a period of time which is longer than the time required to send a message character. In response to this open line condition relay 9 releases, thereby disconnecting at the second make contact thereof negative battery from the control grid circuit of the tube 19. While this contact is open, the negative potential previously applied to the control grid of the tube is permitted to leak off sufficiently to start conduction in the tube. The space current for the tube is derived from positive battery connected to the winding of relay 22, thereby operating this relay which is immediately locked through its right hand make contact to ground through the second right hand make contact of relay 23. It is noted that this latter relay does not release immediately in response to the opening of the right hand break contact of relay 22 for the reason that this contact is shunted by the third make contact of the line relay 9 which is still released at this time. As soon as the line relay is operated, however, in response to the closure of the key 7 at station C, the holding circuit for relay 23 is opened at the third break contact of the line relay, and relay 23 releases. Substantially concurrently therewith the closure of the second make contact of the line relay 9 renders the tube 19 non-conducting, but the release of relay 22 is not dependent upon this operation but upon the release of relay 23 so that it is after the release of relay 23 that the connection to battery through the left hand break contact of relay 22 is re-established. When this occurs, it is no longer possible to re-energize the locking circuit of relay 23 so that it remains released for the duration of the operative condition of the printer-perforator 10.

The disconnection of battery by the opening of the left hand make contact of relay 23 from the holding circuit through the selector magnet 15 of the printer-perforator conditions it for operation in response to received line signals. It is noted that there is no immediate opening of the circuit through the selector magnet 15 for the reason that battery is applied through the first make contact of relay 9 and the break contact of

relay 24. The closure of the left hand break contact of relay 23 energizes relay 25 which operates to close a circuit from the first make contact of relay 9 through its own second make contact to the selector magnet 15. Also, the closure of the first make contact of relay 25 operates relay 24 to open the other circuit from the line relay to the printer-perforator selector magnet. Now it is seen that subsequent operations of the line relay in response to received message signals cause the selector magnet 15 of the printer-perforator 10 to respond, whereby these received signals are perforated and printed in the tape 11. The attendant at station D places the plug 18 in a jack associated with the circuit connected to the remote station designated in the address of the message, and the message is retransmitted to said remote station by the transmitter 12.

Following the reception of the body of the message at station D, the end-of-message signal is received thereat and, in this case, comprises two successive carriage return signals (only the fourth impulse marking) followed by an unshift signal (all impulses marking). In response to the first carriage return signal the selector operated contacts 13 and 16 are closed momentarily. The closure of the carriage return contact 13 completes a circuit from ground through the second break contact of relay 26, the winding of relay 27, and the break contact of relay 28 to battery. The closure of the punch hammer contact 16 of the printer-perforator connects ground through the first break contact of relay 26 to one terminal of the right hand winding of this relay thereby short-circuiting this winding since the other terminal thereof is also connected to ground. Relay 27 is operated and closes a path through its make contact from its winding to the right hand winding of relay 26. As soon as contacts 13 and 16 open, the short-circuit is removed from the right hand winding of relay 26 which becomes energized by a circuit extending from battery through the break contact of relay 28, the winding and make contact of relay 27, and the right hand winding of relay 26 to ground. In response to the second carriage return signal contacts 13 and 16 are again closed and by means of the punch hammer contact 16 a circuit is completed from ground through the first make contact and left hand winding of relay 26 and the winding of relay 28 to battery. Relay 28 is operated and opens the locking circuit through the winding of relay 27 and the right hand winding of relay 26. Relay 27 releases immediately but relay 26 is maintained operated for the duration of the closure of contact 16 by reason of the energization of its left hand winding. When this contact is opened subsequently, relay 26 also releases to restore it to normal. However, before this occurs, the closure of the carriage return contact 13 of the printer perforator completes a circuit from ground through the second make contact of relay 26, the winding of relay 23 and the left hand break contact of relay 22 to battery, thereby operating relay 23 which is immediately locked to ground through its first right hand make contact.

The closure of the left hand make contact of relay 23 connects battery through the second make contact of relay 25 to the winding of the selector magnet 15 of the printer perforator 10. The opening of the left hand break contact of relay 23 deenergizes the winding of relay 25 but this relay, having a slow-to-release characteristic, does not release immediately, thereby mak-

ing it possible to establish the previously described holding circuit to the selector magnet 15 of the printer perforator.

When this relay does release, relay 24 is de-energized by the opening of the first make contact of relay 25. Substantially simultaneously with the deenergization of relay 24 the holding circuit through the selector magnet 15 of the printer perforator is opened at the second make contact of relay 25. This circuit remains open until the break contact of relay 24 closes to again re-establish the holding circuit. The time elapsing between the opening of the contact of relay 25 and the closing of the contact of relay 24 is approximately the time duration of a start impulse of the start-stop telegraph signals. Consequently its effect upon the selector mechanism of the printer perforator 10 is the same as the effect of a start impulse and causes the mechanism to perform one cycle. Since immediately following the local generation of the start impulse, the winding of the selector magnet 15 is immediately energized and maintained in such condition, the effect upon the selector mechanism is the same as that which would be produced by the reception of an unshift character in which all impulses of the code are marking. The result of this operation is the actuation of the contact 14 which is closed under the control of the selector mechanism in response to the local generation of an unshift signal.

As previously indicated there is a possibility that the unshift character of the end-of-message signal will be received at station D with sufficient promptness to enable the repetition by the line relay 9 of the spacing start impulse and at least a portion of the first of the all marking impulses of the unshift character to the selector magnet 15 of the printer-perforator before the auxiliary contacts 13 and 16 respond to the second carriage return character to operate relay 23. If relay 25 were permitted to release immediately following the operation of relay 23, the locally generated spacing signal would be impressed upon the selector magnet of the printer-perforator while the selecting mechanism controlled thereby is responding to the repeated unshift character. Thus, the selection would be made in accordance with a character signal having a spacing impulse instead of in accordance with an all marking character signal. In that case the unshift contact 14 would not be operated as desired. Hence the release of relay 25 is delayed sufficiently to insure that the selecting mechanism of the printer-perforator 10 will be in a rest condition even though it is caused to respond to an unshift character received from the line at the time that the locally generated unshift character is being prepared for impression upon the selector magnet 15.

The mechanism of the printer-perforator 10 is left in this idle condition with the contact 14 closed. As the tape 11 is fed through the transmitter 12, with no additional tape being prepared for the time being, the loop of tape between the printer-perforator 10 and the transmitter 12 eventually shortens to such an extent that the tape controlled contact 29 is closed and the tape stepping through the transmitter is temporarily interrupted by tape controlled means not shown but which are well known in the art. With the closure of contact 29 a circuit is completed through the closed contact 14 of the printer-perforator to start the operation of tape feed out apparatus 30. As previously indicated, appara-

tus of this general character is disclosed in Patent 2,252,852 to Hoover. Once operated, this apparatus functions to condition the printer-perforator 10 to prepare a predetermined length of tape. In this case, since the selector mechanism of the printer-perforator is locked in accordance with the selection of an unshift character, the additionally prepared tape will have perforated therein a plurality of successive unshift characters. Following the metering out of a predetermined amount of tape, the feed out apparatus 30 restores the printer perforator 10 to its normal idle condition in a conventional manner and by the time that the tape loop again shortens to actuate the contacts controlled thereby to stop the transmitter 12, the last message character will have been stepped through the transmitter.

In the event that in the course of the transmission of the message a single carriage return signal is sent, the contact 13 of the printer-perforator 10 will be closed to operate relays 26 and 27 in the manner described. So long as the following character is anything but a carriage return signal, the contact 13 will not be closed on the following cycle of operation of the printer-perforator but the contact 16 will be closed. As in the previous case, the closure of this contact operates relay 28 momentarily to release relays 26 and 27 thereby restoring them to their idle condition. The failure of the contact 13 to close prevents the operation of relay 23 and thus prevents the printer-perforator from being prematurely rendered unresponsive to the received signals.

The nature of the invention may be ascertained from the foregoing description of an illustrative embodiment, it being understood that changes in the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

What is claimed is:

1. In a printing telegraph system, a signal receiver having a plurality of contacts operable by the selector mechanism thereof, means controlled by one of said contacts responsive to a disconnect signal received by said receiver for rendering said receiver unresponsive to subsequently received signals, and means controlled by said first mentioned means for conditioning the selector mechanism of said unresponsive receiver to operate another of said contacts.

2. In a printing telegraph system, a line circuit means for transmitting over said circuit groups of intelligence signals and an end-of-message signal following each of said groups, a signal receiver having a plurality of selector operated contacts, means for operatively associating said receiver with said line circuit, means including one of said contacts responsive to said end-of-message signal for dissociating said receiver from operative relation with said line circuit, and means controlled by said dissociating means for conditioning the selector mechanism of said receiver for the actuation of another of said contacts.

3. In a printing telegraph system, a tape perforator having a plurality of selector operated contacts, means for impressing telegraph signals including message characters and switching characters upon the selecting mechanism of said perforator, means to operate said perforator in response to said message characters to prepare tape representative of said characters, means including one of said contacts operable in response to said switching characters for rendering the selector mechanism of said perforator unresponsive to subsequently received telegraph signals, means

controlled by said switching signal responsive means for conditioning the selector mechanism of said unresponsive perforator for the actuation of another of said contacts, apparatus to condition said unresponsive perforator for the ejection of a predetermined length of tape, and means including said other selector operated contact for operating said tape ejection apparatus.

4. In a start-stop printing telegraph system, a tape perforator having a plurality of contacts selectively actuated by the selector mechanism thereof, means to render said selector mechanism normally unresponsive to received telegraph signals, means operable to render said perforator responsive to received signals, means responsive to an end-of-message signal for operating one of said contacts, means operable under the control of said contact for rendering the selector mechanism of said perforator unresponsive to received signals, means operable by said contact controlled means for generating locally and impressing upon said selector mechanism a start impulse, means for conditioning locally said unresponsive perforator for ejecting a predetermined length of tape, and means including another of said contacts controlled by said selector mechanism in response to said locally generated start impulse for actuating said tape ejecting means.

5. In a printing telegraph system, a tape perforator having a selector mechanism responsive to telegraph signals, a plurality of contacts, means controlled by said selector mechanism to selectively operate said contacts, means controlled by one of said contacts responding to a switching signal for rendering the selector mechanism of said perforator unresponsive to telegraph signals, means responsive to said contact controlled means for generating locally and impressing upon the selector mechanism of said perforator a signal representative of a predetermined character, means including said selector mechanism to actuate another of said contacts in response to said predetermined character, means to control the ejection of a predetermined length of tape from said unresponsive perforator, and means including said other contact for operating said tape ejection means.

6. In a printing telegraph system, a telegraph signal receiver for recording signals in a tape and having a plurality of contacts selectively operable by the selector mechanism thereof, a telegraph signal repeater, a relay organization, means including said relay organization for controlling the responsiveness or unresponsiveness of said receiver to said signal repeater, means including one of said selector controlled contacts for con-

ditioning said relay organization to render said receiver unresponsive to the repeated telegraph signals, means including said relay organization for generating and impressing upon the selector mechanism of said unresponsive receiver a signal representative of an unshift character, means including said selector mechanism to operate another of said contacts in response to said unshift character, a tape operated contact controlled in part by the cessation of tape feeding by said receiver, means for conditioning said receiver for the ejection of a predetermined length of tape, and means including said other contact of said receiver and said tape operated contact for operating said tape ejection means.

7. In a printing telegraph system, a signaling circuit, a first signal receiver responsive at all times to signals transmitted over said circuit, a second signal receiver responsive only at certain times to signals transmitted over said circuit, each of said receivers employing a record tape for said signals and having selector operated contacts operable in response to predetermined end-of-message signals, means for transmitting end-of-message signals each comprising a plurality of successive characters, means including contacts of said receivers responsive to a last one of said characters to control the ejection of a predetermined length of tape, means including contacts of said second receiver responsive to first ones of said characters when said second receiver is responsive to signals to render said second receiver unresponsive to transmitted signals, and means operable after the unresponsive conditioning of said second receiver to actuate the tape ejection means of said second receiver.

8. In a telegraph system, means for transmitting successively first and second different character signals, a signal receiver having a selector mechanism and first and second contacts operable respectively thereby in response to said first and second character signals, the operation of said contacts occurring at a predetermined time following the receipt of the complete character signal, means including said first contact to prepare for the inoperative conditioning of said receiver, means for delaying said inoperative conditioning for a period of time sufficient to permit the complete reception of said second character signal if transmitted immediately following the first character signal, and means controlled by said inoperative conditioning to generate locally and impress upon said selector mechanism a character signal similar to said second character signal.

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