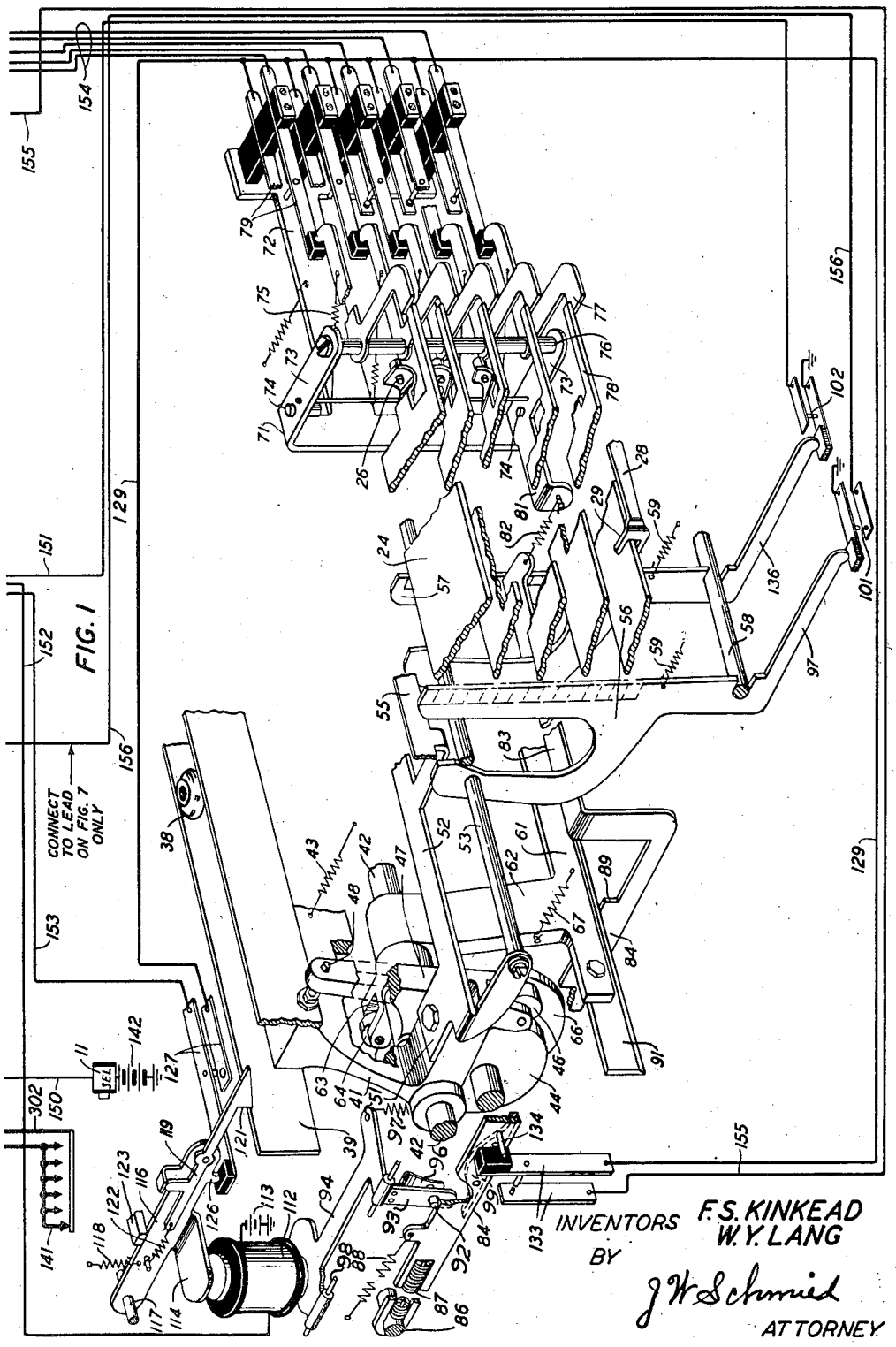
May 15, 1945. F. S. KINKEAD ET AL 2,375,794

TELEGRAPH SWITCHING SYSTEM

Filed March 11, 1942 5 Sheets-Sheet 1



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TELEGRAPH SWITCHING SYSTEM

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FIG. 2

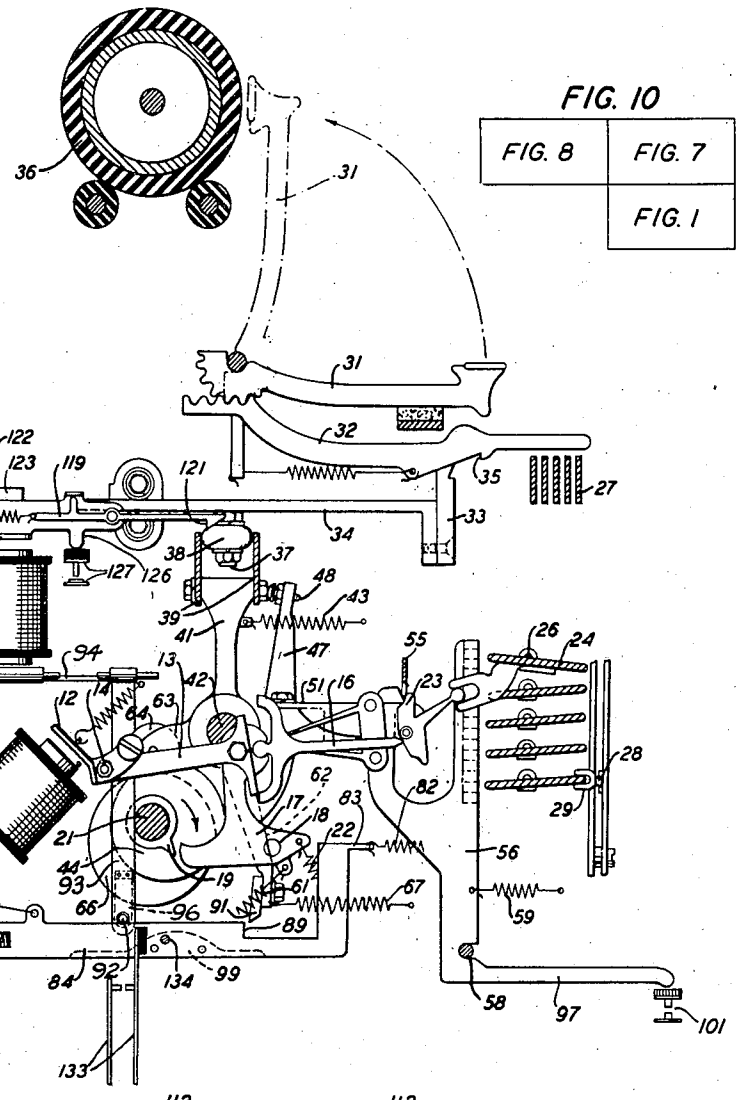

FIG. 9

FIG. 6
FIG. 1

FIG. 10

FIG. 8	FIG. 7
	FIG. 1

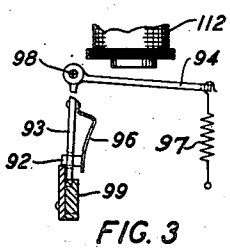

FIG. 3

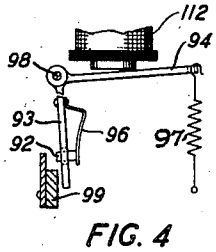

FIG. 4

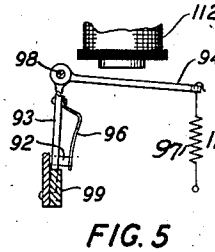

FIG. 5

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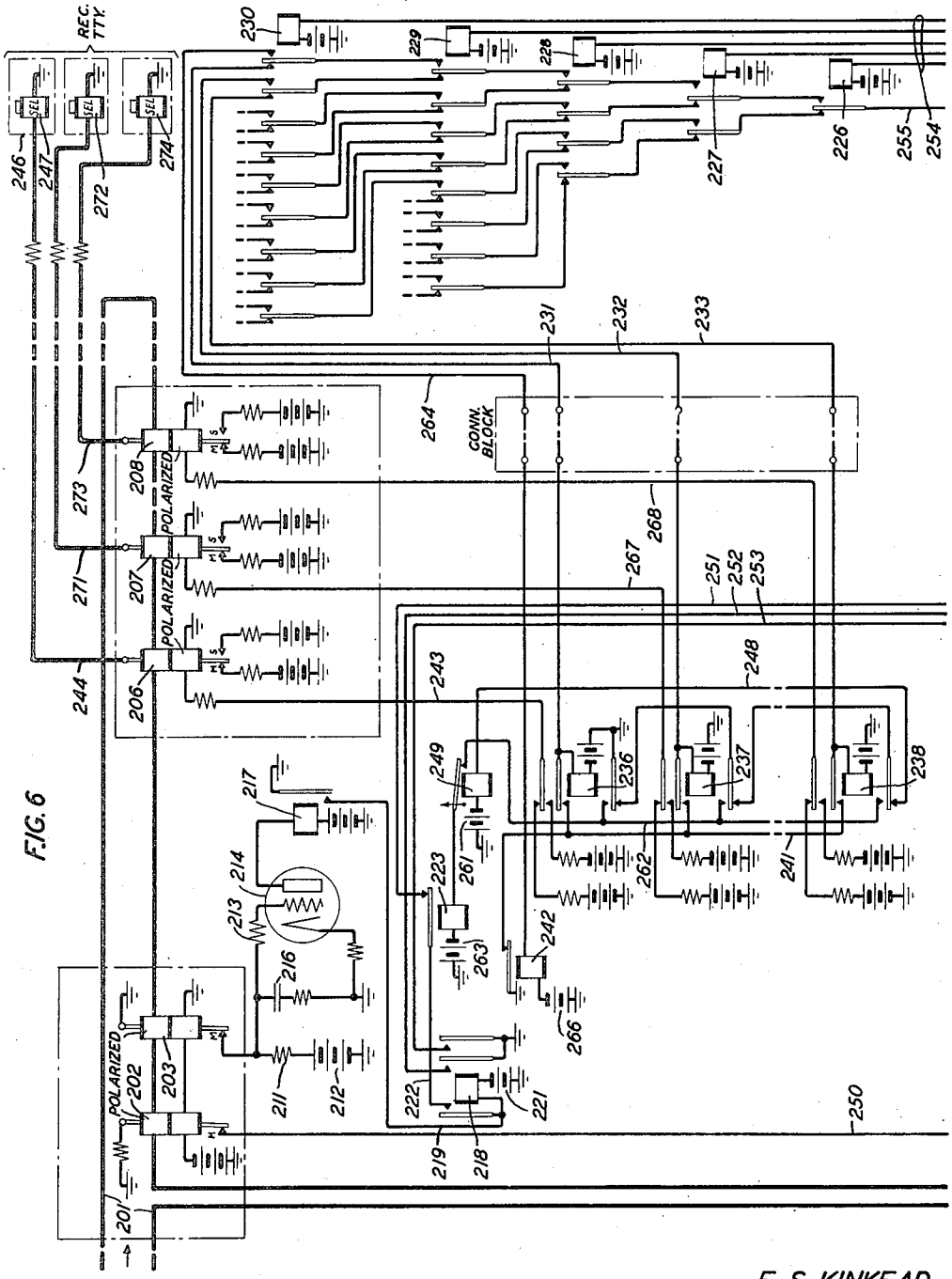

F/G. 6

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TELEGRAPH SWITCHING SYSTEM

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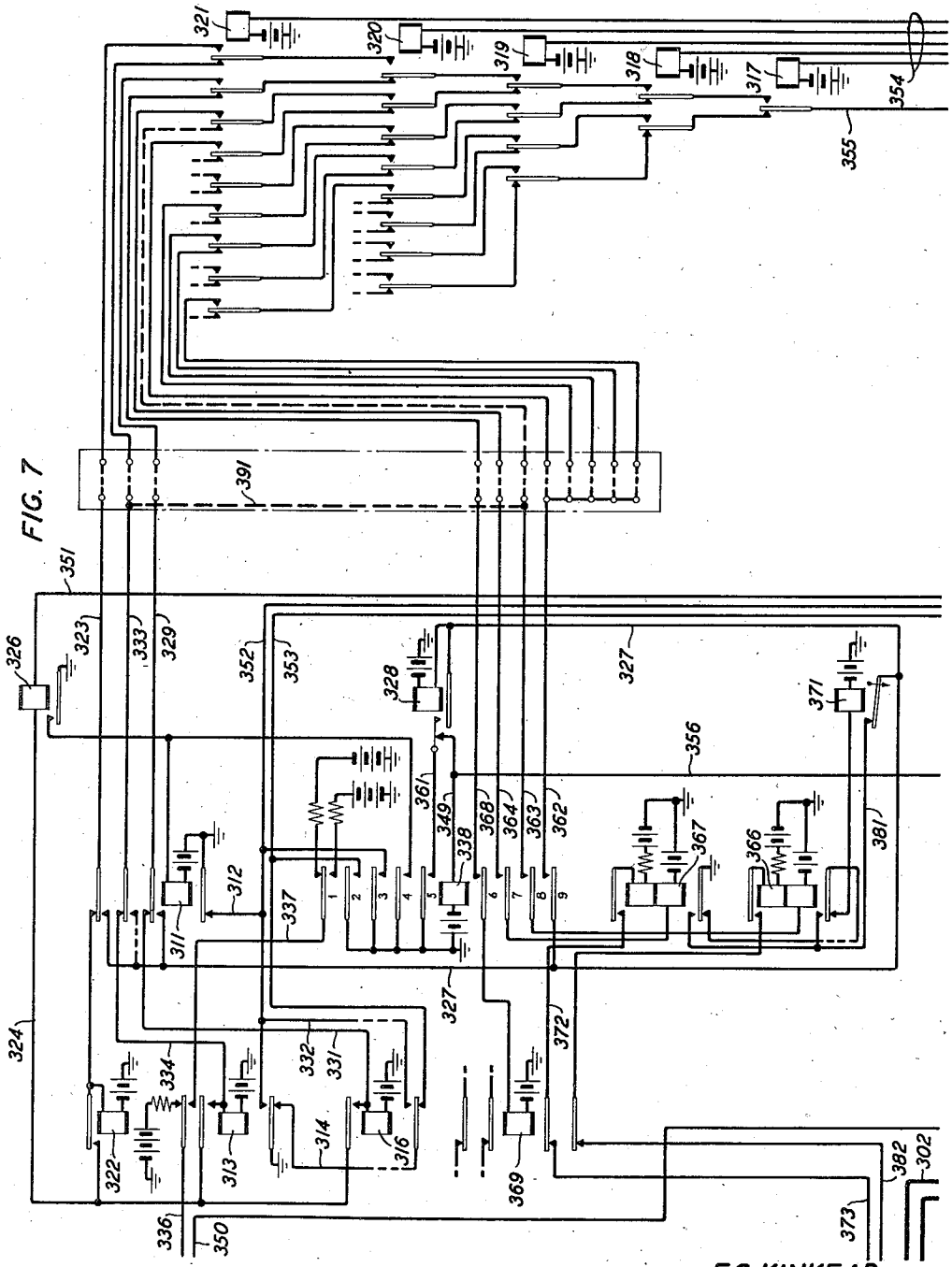
FIG. 7



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TELEGRAPH SWITCHING SYSTEM

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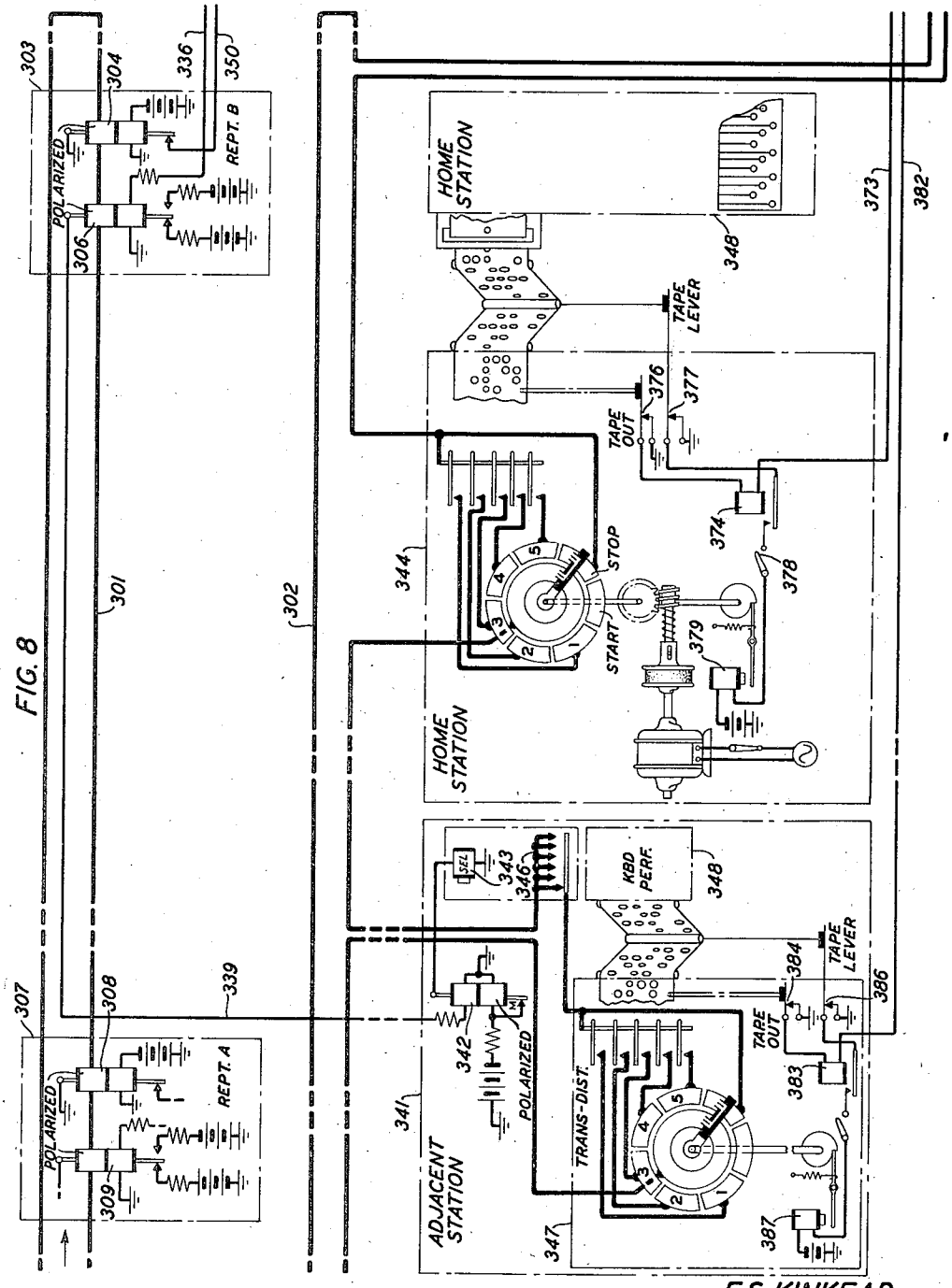

FIG. 8

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Patented May 15, 1945 2,375,794

UNITED STATES PATENT OFFICE

2,375,794

TELEGRAPH SWITCHING SYSTEM

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Application March 11, 1942, Serial No. 434,244

36 Claims. (Cl. 178—4)

This invention relates to printing telegraph apparatus and particularly to switching facilities therefor.

An object of the invention is to provide a telegraph line switching system in which the switching operations are controlled by a telegraph signal receiving instrumentality which is capable of printing or performing switching operations alternatively under the selective control of received signals.

Another object of the invention is to provide a telegraph line switching system in which a plurality of telegraph stations associated with a telegraph line may be selectively rendered responsive to signals on the line by a signal receiving instrumentality also associated with the line which alternatively records received signals or performs switching operation under the control of received signals.

Another object of the invention is to provide a telegraph line switching system including a plurality of lines over which different signals may be transmitted simultaneously in which one of a plurality of receiving recorders associated with one of the lines controls selectively the response of others of said recorders to signals on said line and also controls the transmission of signals on another of said lines.

The invention features a telegraph line switching system having relays for controlling the activation of local and remote telegraph receivers and transmitters, the relays being controlled by a fan circuit system which in turn is controlled by contacts operable by the selector mechanism of a receiving telegraph recorder, the recording mechanism of which is selectively disabled coincident with the conditioning of the contacts to perform switching operation.

Two principal embodiments of the invention are contemplated and each embodiment employs as the line switching controlling instrumentality, a combined switching and recording signal receiving selector mechanism of the type disclosed in copending application Serial No. 398,055 filed June 14, 1941, by W. Y. Lang, now Patent No. 2,318,168, granted May 4, 1943. The disclosure of the Lang application is incorporated herein by reference as part of the present specification. The combined recording and switching mechanism shown in that application comprises a permutation code signal receiving selector mechanism having a set of selector elements for controlling the selection of character printing members to be operated. The selector elements are also arranged to control a set of switching contacts which are brought into cooperation with the selector elements cyclically for each signal combination received after having been conditioned to be operated. A device for suppressing the operation of printing elements selectively conditioned to be operated by the selector mechanism is provided, and such suppressing device is activated coincident with the conditioning of the switching contacts for operation so that the printing of characters will not accompany the operation of the switching control contacts when those contacts are operated in permutational combinations to perform switching operations.

According to one embodiment of the invention a combined recording and switching mechanism is associated with a signaling line as are also a plurality of repeaters for repeating to remote stations signals impressed on the telegraph line. The combined recording and switching instrumentality is always responsive to signals whereas the repeaters are normally inoperative. In the combined printing and switching instrumentality the switching control contacts and the printing suppression device may be normally disabled so that the instrumentality is conditioned to record characters corresponding to signals received over the telegraph line. A timing circuit controlled by signals on the line is operative in response to a long spacing or break signal to activate the print suppressing device and to render operative the set of switching contacts so that in response to signals following the long spacing signal no characters will be printed but the switching contacts will be operated. The switching contacts are operable in permutational combinations according to the setting of the selector elements of the signal receiving instrumentality to effect the permutational operation of fan circuit relays which, through their contacts, selectively complete the energizing circuits for individual ones of a plurality of switching relays. Each of the switching relays is operable to render an associated one of the hereinbefore mentioned repeaters operable in response to signals on the telegraph line and such signals will thereafter be repeated to the outlying station controlled by said repeater as long as a holding circuit for the operated switching relays remains effective. Following the operation of one of the repeater controlling switching relays the combined recording and switching receiver is automatically restored to initial condition with the switching mechanism disabled and the print suppressing device also disabled so that normal recording

operations will thereafter occur in response to signals received.

The system also includes means directly responsive to signals for disabling the switching and print suppressing mechanism independently of the operation of a switching relay. In order to terminate reception of signals by a previously selected remote station the combined recording and receiving device is again placed in switching and non-printing condition by the transmission of a long spacing signal whereupon the reception of a particular signal assigned to disabling of the repeaters which control remote stations will operate the switching contacts to complete the energizing circuit for a relay which will interrupt the holding circuit of any of the repeater controlling switching relays that had been operated, thus restoring the repeaters and the switching relays to inactive condition.

In accordance with another embodiment of the invention the combined recording and switching instrumentality is normally conditioned to perform switching operations and to suppress printing. The system of switching relays contained in this embodiment of the invention includes a relay for disabling the switching contact mechanism without disabling the print suppressing device so that when the particular switching relay has been operated and is maintained operated by its locking circuit the combined recording and switching instrumentality will neither record nor perform switching operations in response to signals on the line. Included among the switching relays is a relay which when operated will disable the switching mechanism and also disable the print suppressing mechanism of the combined recording and switching instrumentality so that it will record received signals but such signals will not be effective to control the switching mechanism. There is also at least one switching relay which will condition a repeater to respond to signals on the receiving line and repeat such signals to a remote printing telegraph receiving device.

The switching mechanism is arranged to control selectively a plurality of switching relays for starting any one of a plurality of transmitters, some of which may be remote from the station at which the combined recording and switching instrumentality is located, to cause such transmitter to impress telegraph signals on a transmitting line which constitutes a separate line from the receiving line and over which different sets of signals may be simultaneously transmitted. In connection with the starting of transmitters the system is so arranged that any repeater which has been conditioned to respond to signals on the receiving line for repeating such signals to a remote recorder is disabled during the reception of the transmitter start controlling signals without disabling the switching relay which controls that repeater so that the repeater will not respond to the transmitter start controlling signals but will respond after the transmitter has been started and transmission of normal message signals intended for the remote station controlled by the repeater has been resumed.

For a complete understanding of the invention reference may be had to the following detailed description to be interpreted in the light of the accompanying drawings wherein:

Fig. 1 is a schematic perspective view of a combined recording and switching instrumentality forming a part of the present invention;

Fig. 2 is a vertical sectional view through the combined recording and switching instrumentality showing the switching contact qualifying and operating mechanism and the printing bail blocking mechanism;

Figs. 3, 4 and 5 are fragmentary elevational views, partly in section, showing the switching contact qualifying mechanism in successive stages of operation;

Fig. 6 is a circuit diagram of a line switching system according to one embodiment of the invention, the complete system being shown by combining Fig. 1 with Fig. 6 with the former positioned below the latter, as indicated in Fig. 9;

Figs. 7 and 8 when placed end to end with Fig. 7 at the right of Fig. 8 form a circuit diagram of a line switching system according to another embodiment of the invention and a complete system is shown by combining Fig. 1 with Figs. 7 and 8 with Fig. 1 positioned below Fig. 7, as indicated in Fig. 10.

Referring now to the drawings, Figs. 1 and 2 show a combined recording and switching instrumentality which is generally similar to that disclosed in copending application Serial No. 398,055 filed June 14, 1941, by W. Y. Lang. Referring now particularly to Fig. 2, the reference numeral 11 indicates a selector magnet the armature 12 of which is carried by a selector lever 13 pivoted at 14. As is fully disclosed in Patent 1,904,164 granted April 18, 1933, to F. Morton et al., the disclosure of which is incorporated herein by reference as part of this specification, since that patent shows a printing telegraph receiving device to which features of the present invention have been added, the selector lever 13 controls a plurality of sword levers 16 which are individually articulated to bell cranks 17 pivoted at 18 and individually rocked in counter-clockwise direction once in each receiving cycle by a cam 19, one of which is shown in Fig. 2, included in a receiving selector cam assembly mounted on and frictionally driven by a power driven shaft 21. Upon being retracted by their bell crank levers 17 the sword levers 16 are rocked into extreme clockwise or counter-clockwise position depending upon the position of selector lever 13 as determined by selector magnet 11, and when they are shifted rightwardly by their bell cranks 17 as the bell cranks are restored to extreme clockwise position by their individual springs 22, the sword levers rock associated T levers 23 into extreme clockwise or counter-clockwise position depending upon the rotative position into which they have been rocked under the control of the selector magnet. The T levers 23 are articulated by means of disc and slot connections to individual selector vanes 24 that are pivotally supported at their opposite ends by trunnions 26 (Figs. 1 and 2).

A movable type basket, full structural details of which are shown in the Morton et al. patent, supports permutationally notched code bars 27 that are indivdually connected to the selector vanes 24 by bell cranks 28, a portion of one of which is shown in Fig. 2. The upwardly extending arm of each bell crank 28 engages one of the code bars 27 and a laterally extending arm of each bell crank 28 terminates in a bifurcated portion 29 which straddles the edge of a selector vane and remains in engagement with the vane while moving along its edge as the type basket moves for character spacing and carriage return operation. The type basket pivotally supports a plurality of type bars 31 which have rack and pinion connection with individual selectable pull

bars 32, the foremost ends of which are disposed above and in close proximity to the code bars 27. The pull bars 32 are normally supported with their foremost ends just out of engagement with the code bars 27 by engagement of a sloping cam surface on the lower edge of each pull bar 32 with a blade 33 carried by a reciprocable printing bail 34 which is mounted on the type basket. Each of the pull bars 32 is provided with a hook 35 near the upper end of the sloping cam surface so that when the printing bail 34 is reciprocated rightwardly as viewed in Fig. 2 and the right-hand ends of the pull bars move downwardly into engagement with the code bars 27, any pull bar which finds an alignment of notches presented to it by the code bars will move still further downwardly at its right-hand end into the alignment of notches, bringing its hook 35 into the path of blade 33 of printing bail 34 so that as the bail continues to be moved farther to the right blade 33 will engage the selected pull bar and reciprocate it rightwardly thus rocking the associated type bar 31 in counter-clockwise direction to bring its type carrying face into printing engagement with paper carried by a printing platen 36.

Printing bail 34 is provided with a depending stud 37 which rotatably supports a roller 38 disposed between a pair of blades 39 supported at the upper end of a printing bail operating arm 41. The roller 38 and blades 39 provide for operative engagement between printing bail 34 and operating arm 41 throughout the path of travel of the type basket by which printing bail 34 is supported. Operating arm 41 which is supported on rock shaft 42 is urged in clockwise direction by a tension spring 43 which supplies the power for operating the arm 41 and thus the bail 34. A printing cam 44 which is included in a main cam assembly carried by the shaft 21 is engaged by a roller 46 (Fig. 1) carried by a pivoted lever 47, the upper end of which supports an abutment screw 48 which engages the right-hand one of the operating arm blades 39 as viewed in Fig. 2. The cam 44 operates through lever 47 to restore operating arm 41 to extreme counter-clockwise position and to hold it in that position in the idle condition of the apparatus. When the main cam assembly is released for rotation by the receiving selector cam assembly a sharp drop off of the cam 44 permits the spring 43 to rock printing bail operating arm 41 sharply in clockwise direction to effect a printing operation, and during the remainder of the cycle of the main cam assembly the cam 44 restores operating arm 41 to extreme counter-clockwise position which in turn restores bail 34 to its unoperated position.

Although only one printing bail operating arm 41 has been referred to in the foregoing paragraph it will be understood that there are at least two such arms located near the ends of rock shaft 42 and that there may be others intermediate those two. Associated with the end ones of the arms 41 are brackets 51 (Fig. 1) interconnected by a bar 52 and supporting the ends of a function selection control rod 53 which extends parallel to the axes of the selector vanes 24. At the rear of the vanes 24 a plurality of selectable function levers such as the levers 56 and 57 are pivotally mounted on a rod 58. Each of the selectable function levers is provided with two spaced upwardly extending arms. The arm of the selectable function lever that is nearest to the rear edges of the selector vanes is provided with permutation code combinations of lugs in registry with marking or spacing positions of the rear edges of the selector vanes in inverse relation to the code to which the function lever is to be responsive. When the selector vanes are positioned in accordance with the code to which the selectable function lever is to be responsive, their rear edges are out of registry with the lugs and the function lever is not blocked but is free to rock in clockwise direction as viewed in Fig. 2. However, the rocking of the function lever is normally prevented by bar 53 carried by brackets 51 associated with the print bail operating arms. The rod 53 cooperates with a cam portion of the rear arm of the function lever. When the printing bail operating arm 41 is operated by spring 43 the rod 53 moves downwardly along the surface of the rear arm of each function lever and permits the function levers to rock in clockwise direction as viewed in Fig. 2 to test the setting of the selector vanes 24. Any function lever which finds no selector vanes blocking its lugs will be rocked in clockwise direction by associated spring 59 to perform or initiate its assigned function as the case may be. The printing bail bar 52 carries an upturned flange 55 which overlies the top of the rear arms of selectable function levers 56 and 57 and which moves down into engagement with the top of the rear arm of either of those levers when they are selected, the purpose of the flange being to block the printing bail mechanism after it has operated far enough to permit the selection of the function levers, in order to suppress operation of any pull bar 32 that may also be selected.

Those functions which require more power for their performance than the springs 59 can supply or the performance of which should be prolonged over a greater interval than that involved in the rocking of its function lever to the extreme clockwise position as viewed in Fig. 2 are performed by a function bail 61 supported by operating arms 62 journaled on rock shaft 42. Associated with one of the function bail operating arms is a cam follower lever arm 63 which supports at its free end a roller 64 which engages cam 66 included in the main cam assembly. When the main cam assembly is rotated the function bail operating arms 62 are positively rocked in slightly counter-clockwise direction by spring 67 under control of cam 66, then in clockwise direction as viewed in Fig. 2 by cam 66 and thereafter the function bail 61 is restored to normal position, which is short of extreme counter-clockwise position, by spring 67. The manner in which function bail 61 operates function performing members will be described hereinafter.

Referring now to Fig. 1, it will be noted that a cradle 71 consisting of a flat plate 72 and parallel arms 73 is pivotally supported by trunnions 74 which engage arms 73 near the inner end thereof. Extending between and supported by the outer ends of arms 73 is a pivot rod 76 which pivotally supports a plurality of bell cranks 77 in alignment with the marking positions of fingers 78 integral with and extending rightwardly from the right-hand ends of the selector vanes 24. The free end of one arm of each of the bell cranks 77 is aligned with the marking position of the fingers 78. The plate 72 of cradle 71 supports a plurality of pairs of normally open electrical contact springs 79, there being a pair of electrical contacts assigned to and aligned with the other arm of each of the bell cranks 77.

Cradle 71 is provided with an operating arm 81 which is connected by spring 82 with the free end of a laterally extending arm 83 of a push

bar 84. Push bar 84 is mounted for reciprocable movement leftwardly, as viewed in Fig. 2, by pin 86 which passes through a slot in push bar 84. The push bar 84 is urged to its extreme forward position (rightward position as viewed in Fig. 2) by a compression spring 87 which is disposed in the slot through which pin 86 extends and which is confined between pin 86 and the opposite end of the slot. A tension spring 88 which is connected to push bar 84, is disposed above the push bar and extends rearwardly from the point of connection thereto, imparts a counter-clockwise moment of torque thereto tending to lift the foremost (right-hand as viewed in Fig. 2) end of the push bar.

Near its foremost end the push bar 84 is provided with a notch in its upper edge which affords a shoulder 89 disposed slightly to the rear of the position occupied by a blade 91 carried by function bail 61 when the bail is in extreme forward position. Push bar 84 is arranged to be held in such position that its shoulder 89 is below and therefore out of the operating path of blade 91 of the function bail by means of a pin 92 (Fig. 3) loosely extending through a depending arm 93 carried by the lower armature lever 94 of an electromagnet 112, the pin being carried by a leaf spring 96 secured to the arm 93 of armature lever 94. When electromagnet 112 is deenergized a tension spring 97 rocks armature lever 94 about its pivot pin 98 into extreme clockwise position as viewed in Figs. 1, 3, 4 and 5, with the end of the depending arm 93 resting against the inner or right-hand side of push bar 84. In this condition of the apparatus pin 92 extends over the top of push bar 84, the upper edge of which is rocked into engagement with pin 92 by tension spring 88 and the pin holds push bar 84 in such position that shoulder 89 is held clear of the function bail blade 91. Push bar 84 has secured to the right-hand side thereof as viewed in Figs. 3, 4 and 5 a cam plate 99 the contour of which is shown in dotted outline in Figs. 1 and 2. The position of cam plate 99 on push bar 84 is such that when the push bar is in the extreme forward position (right-hand position as viewed in Fig. 2) the hump or apex of cam plate 99 will be disposed entirely to the right of the free end of depending arm 93 of armature lever 94. The height or depth of the hump or apex portion of cam plate 99 is such that when push bar 84 is held down with its upper surface resting against pin 92 the highest portion of the hump or apex of cam plate 99 is slightly above the lower end or extremity of arm 93 of armature lever 94. The amount of travel of push bar 84 leftwardly under the control of function bail blade 91 as viewed in Fig. 2 is sufficient to bring the highest portion of cam plate 99 into alignment with or even slightly to the left of the lower end or extremity of arm 93 of armature lever 94.

The locked out condition of push bar 84 described hereinbefore is shown in Figs. 1, 2 and 3. Upon the energization of electromagnet 112 armature lever 94 is rocked in counter-clockwise direction, as viewed in Fig. 3, into the position shown in Fig. 4 and in being so rocked the depending arm 93 of armature lever 94 is retracted away from engagement with the right-hand surface of push bar 84 and out of the path of cam plate 99 and in being so retracted pin 92 is drawn out of blocking relation to push bar 84. When the push bar thus becomes unblocked tension spring 88 rocks the push bar 84 in counter-clockwise direction thus elevating the right-hand end as viewed in Fig. 2 and such counter-clockwise movement continues until the base of the notch which provides the shoulder 89 comes into engagement with function bail blade 91 thus presenting shoulder 89 in the path of the function bail blade.

When the function bail is thereafter rocked in clockwise direction by function cam 66, push bar 84 will be moved leftwardly as viewed in Fig. 2 thus compressing spring 87 and when in completing its cycle the function bail is restored to extreme counter-clockwise position by tension spring 67 push bar 84 will be restored to extreme right-hand position by compression spring 87. It will be understood that compression spring 87 is considerably stronger than tension spring 88 so that it is capable of restoring push bar 84 to the extreme right-hand position which restoration is in fact opposed but not prevented by tension spring 88.

As long as the apparatus remains in the condition shown in Fig. 4 with electromagnet 112 energized push bar 84 will be reciprocated each time the function bail is operated. However, when electromagnet 112 becomes deenergized, tension spring 97 will seek to restore the armature lever 94 to extreme clockwise position and will accomplish this result if push bar 84 is then in extreme right-hand position as viewed in Fig. 2. If push bar 84 should be undergoing a cycle of reciprocation at the time that electromagnet 112 becomes deenergized, tension spring 97 will rock armature lever 94 in clockwise direction until the depending arm 93 of the armature lever comes into engagement with the right-hand side of cam plate 99 as viewed in Fig. 4. This condition will occur because push bar 84 is at this time rocked into extreme counter-clockwise position and the uppermost portion of cam plate 99 will be considerably above the lower end of arm 93 of armature lever 94. However, when push bar 84 returns to extreme right-hand position as viewed in Fig. 2 tension spring 97 will bring depending arm 93 of armature lever 94 into engagement with the right-hand surface of push bar 84, as shown in Fig. 5 with the lower end of the armature lever to the rear of and below the uppermost portion of cam plate 99 and with pin 92 shifted rightwardly with respect to arm 93 of armature lever 94, the leaf spring 96 yielding to permit this movement of pin 92. This is the condition of the apparatus shown in Fig. 5.

Upon the next reciprocation of push bar 84 by function bail blade 91 cam plate 99 will come into engagement with the lower end of armature lever arm 93 and riding against the lower end of the armature lever will cause push bar 84 to be rocked in clockwise direction as viewed in Fig. 2 a sufficient distance for pin 92 to clear the upper edge of push bar 84 and to be thrust into blocking relation to the push bar by leaf spring 96. Shoulder 89 of the push bar 84 will thus be disengaged from function bail blade 91 and the push bar will at once be restored to the initial condition shown in Figs. 2 and 3, namely in extreme right-hand position and with pin 92 holding push bar 84 out of cooperation with function bail blade 91.

When the function bail blade 91 engages shoulder 89 and reciprocates push bar 84 rearwardly of the printer (leftwardly as viewed in Figs. 1 and 2), arm 83 of push bar 84 moves rearwardly with the push bar and imparts through spring 82 clockwise movement to cradle 71 as viewed in Fig. 1. The pairs of contact springs 79 carried

by the cradle 71 are moved in an arcuate path about the trunnions 74 as an axis, and since the bell cranks 77 are held in engagement with their respective contact springs by tension springs 75, which exert insufficient tension to close the springs, the bell cranks 77 are moved arcuately in clockwise direction about the axis of trunnions 74 without rotation on their own axis. After the bell cranks 77 have been rocked through a very short angular distance, those of the selector vanes 24 that are then presented in marking position will block, by means of their fingers 78, further arcuate movement of the bell cranks 77 associated therewith. As the cradle 71 continues to move to its fully operated position with certain of the bell cranks 77 blocked by the selector vanes 24 the corresponding electrical contact springs yield in order to be further moved while their bell cranks are blocked, and in so yielding the contacts are closed. In this way the closing of pairs of contacts 79 in permutational combinations corresponding to the setting of the selector vanes 24 may be accomplished.

Electromagnet 112 is energizable over a circuit and under circumstances which will be described later, to attract its lower armature lever 94 for the purpose of conditioning push bar 84 to be operated and also to attract its upper armature 114 which is carried by a lever 116 pivoted at 117 and biased in counter-clockwise direction as viewed in Figs. 1 and 2 by a tension spring 118. Lever 116 pivotally supports a lever 119 which is provided with a latching shoulder 121 for the left-hand one of the printing bail operating arm blades 39 as viewed in Fig. 2 and with a pointed or tapered end. Lever 119 is normally maintained in a position extending longitudinally of magnet controlled lever 116 by means of a tension spring 122. When magnet 112 is in deenergized condition spring 118 holds lever 116 against a stop 123 with shoulder 121 of lever 119 out of latching or blocking relation to the print bail operating blade 39. When electromagnet 112 becomes energized it rocks lever 116 in clockwise direction to bring shoulder 121 of lever 119 into a position below the upper edge of the rearmost blade 39 of the print bail. If the print bail operating arm 41 is at this time in its normal or unoperated position, the shoulder 121 of lever 119 will be disposed in the path of blade 39 so as to prevent the movement of the printing bail to its operated position which, it should be remembered, is permissive since the bail is operated by spring 43 and is restored by cam 44. If at the time magnet 112 becomes energized the printing bail is partially or fully operated some portion of the tapered or pointed end of the lever 119 will drop into engagement with the top of blade 39 or into the return path of that blade and when the printing bail is restored to its normal or unoperated position the lever 119 will be cammed in counter-clockwise direction by the cooperation of its tapered end with the upper edge of the blade 39 until the blade has been moved clear of shoulder 121. The rocking of lever 119 by blade 39 causes spring 122 to become distended and as soon as blade 39 clears shoulder 121 the spring 122 will restore lever 119 to its normal relation to lever 116 thus presenting shoulder 121 in the path of blade 39 to block the printing bail 34. Thus as long as electromagnet 112 remains energized lever 119 remains in blocking relation to the printing bail operating mechanism so that the printing bail cannot be operated to effect printing. It should be noted that the full operating stroke of the printing bail 34 is not blocked but only that it is blocked sufficiently short of its full stroke to prevent its blade 33 from engaging the hook on any selectable pull bar 32 that may have been selected. The partial stroke of printing bail operating arm 41 that is permitted before blade 39 comes into engagement with shoulder 121 of blocking lever 119 is sufficient to permit rod 63 to move downwardly along the cam surface of the rear (left hand) arms of the selectable function levers such as 56 and 57 to permit the function levers to test the setting of the selector vanes 24 and to permit the selection of any such function lever which is not blocked by the selector vanes.

Instead of providing for blocking of the printing bail by cooperation of shoulder 121 of lever 119 with one of the blades 39, the lever 119 may be arranged to cooperate with and block one of the printing bail operating arms 41. For example, the magnet 112 and lever 116 may be mounted lower in the printer to present the pointed end of lever 119 in alignment with an aperture cut through a print bail operating arm 41. With the arm 41 in the normal or retracted position the foremost or pointed end of lever 119 would extend through the aperture in the arm 41 with the shoulder 121 in position to be dropped into blocking engagement with the arm 41. As in the structure shown in Figs. 1 and 2 the pointed end of lever 119 would guide the lever into the aperture upon retraction of arm 41 from its operated to its unoperated position.

The armature operated lever 116 is provided with a depending lug 126 which engages one of the springs of a normally open pair of electrical contact springs 127. When electromagnet 112 becomes energized and moves lever 116 into its operated position the lever closes electrical contact springs 127 and they remain closed as long as electromagnet 112 remains energized. One of the electrical contact springs 127 is connected by conductor 129 to one spring of each of the pairs of electrical contact springs 79 and the other spring of the contacts 127 and of each of the contacts 79 has electrical circuit connections which will be described later.

The selectable function levers 56 and 57 are provided with forwardly extending arms 97 and 136 respectively, the former of which is arranged to close normally open contacts 101 and the latter of which is arranged to open normally closed contact 102. The contacts 101 have no utility in connection with the switching system shown in Fig. 6 but both sets of contacts 101 and 102 have utility in connection with the switching system shown in Figs. 7 and 8. Additional contacts which cooperate in the control of the switching system are indicated by the reference numeral 133. These contacts are normally open and are arranged to be closed by a pin 134 carried by push bar 84. Preferably the pin 134 is positioned on push bar 84 to close the contacts 133 shortly before push bar 84 reaches the limit of its operating stroke and after it has closed those of the contacts 79 which correspond to selector vanes 24 in marking position. The circuit controlled by the contacts 133 and the reason for this timing of the operation of the contacts 133 relative to the operation of contacts 79 will be described later.

Referring now to the communication system which is exemplified by Figs. 1 and 6 arranged as shown in Fig. 9, the reference numeral 201 designates a line circuit which extends to the station

shown in Figs. 1 and 6 from a remote point at which there may be located in association with the communication line 201 printing telegraph apparatus including a transmitter and a receiving recorder. At the station shown in Figs. 1 and 6 the line circuit 201 includes the operating windings of biased repeater relays 202, 203, 206, 207 and 208, and the transmitting contacts of the transmitter device 141 (Fig. 1) which may be of the keyboard controlled species intimately associated with the combined recording and switching device shown in Fig. 1 or may be a machine transmitter such as one controlled by perforated tape.

The repeater relays 206, 207, and 208 are representative of a class of relays for controlling remote printing telegraph receiving devices and it will be understood that there may be as many more of these relays to control additional remote stations as the code under the control of which the switching mechanism is operated will accommodate.

The relays 202 and 203 are so biased as to be always responsive to signals on the communication line 201. The armature of relay 202 is connected to ground and the marking contact, which the armature engages when marking current is present on the communication line 201, is connected to conductor 250 which extends to and connects with conductor 150 of Fig. 1 and conductor 150 is connected to one terminal of the selector magnet 11 (Fig. 1) the other terminal of which is connected to grounded battery 142. The selector magnet 11 is the signal responsive device which controls the selector mechanism of the combined recording and switching instrumentality previously described with particular reference to Fig. 2. Since relay 202 is always biased to respond to signals on the communication line, the selector magnet 11 follows all such signals.

The armature of repeater relay 203 is connected to ground and the marking contact of that relay is connected through resistor 211 to the positive terminal of grounded battery 212, and is also connected through grid resistor 213 to the grid of an electron discharge tube 214. The electron discharge tube 214 is a delayed action device by virtue of having condenser 216 connected between its grid resistor and its cathode. When the armature of repeater relay 203 is on its marking contact, condenser 216 and the grid of discharge tube 214 are grounded and no current will flow in the plate circuit of the discharge tube. When the armature of relay 203 leaves its marking contact, condenser 216 begins to charge by current from battery 212 flowing through resistor 211. Resistor 211 and condenser 216 are of such values that condenser 216 will not become charged sufficiently to raise the potential of the grid of discharge tube 214 to that positive potential at which tube 214 will be rendered conductive until the armature of relay 203 has remained away from its marking contact continuously for an interval exceeding the longest spacing interval involved in ordinary transmission of telegraph signals. When relay 203 is responding to ordinary telegraph signals the armature will oscillate between marking and spacing positions but the potential of the grid of discharge tube 214 will not be raised sufficiently during any interval that the armature of the relay is off its marking contact to render the tube conductive. However, when a long spacing interval is impressed upon communication line 201, tube 214 will be rendered conductive and relay 217 including in its plate circuit will be operated.

Upon the operation of relay 217 its single grounded armature engages its front contact to complete the energizing circuit for a relay 218 through conductor 219, winding of relay 218 to grounded battery 221. Relay 218 completes a holding circuit for itself from battery 221, winding of relay 218, left-hand armature and front contact, conductor 222, armature and back contact of a relay 223, conductor 251 extending to and connecting with conductor 151 of Fig. 1, and over the conductor 151 and normally closed contacts 102 to ground. The inner right-hand armature of relay 218 engages its front contact to complete a circuit from ground through the armature and front contact, conductor 252 extending to and connecting with conductor 152 of Fig. 1 and through conductor 152 and the winding of print suppressing magnet 112 to grounded battery 113, whereby the magnet becomes energized and attracts its upper and lower armatures. As previously described, the magnet 113 conditions push bar 84 to be operated by function bail blade 91, blocks the print bail blade 39 to suppress printing, and closes the normally open contacts 127. The outer right-hand armature of relay 218 extends a ground connection through its front contact, through conductor 253 which extends to and connects with conductor 153 in Fig. 1 to the upper spring of contacts 127, and these contacts now being closed, the ground connection is extended over conductor 129 to one contact of each of the pairs of contact springs 79 and to the right-hand spring of the normally open contacts 133.

The other spring of each of the five pairs of contacts 79, is connected to one of five conductors 154 which extend to and connect with five conductors 254 in Fig. 2 which extend to five relays 226, 227, 228, 229, and 230, each of which has connection to grounded battery. The relays 226, 227, 228, 229, and 230 control a fan circuit system involving progressively doubling sets of armatures and contacts. Thus the relay 226 has one armature operable between a back and a front contact. Relay 227 has two armatures operable between two front and two back contact, the armatures being connected to the back and front contacts of relay 226. Relay 228 has four armatures connected to the two front contacts and two back contacts of relay 227 and eight contacts which may be connected to a maximum of eight armatures of relay 229. Relay 229 has a maximum of sixteen contacts some or all of which are connected to a maximum of sixteen armatures of relay 230 which cooperate with thirty-two contacts, sixteen of which are front contacts and the remaining sixteen are back contacts. With this arrangement any one of a maximum of thirty-two conductive paths may be completed from the armature of relay 226 to one of the thirty-two contacts of the relay 230 by the selective energization of the relays 226 to 230 in permutational combination.

From certain of the contacts of relay 230 conductors 231, 232, and 233 extend to the windings of relays 236, 237, and 238, respectively, each of which is connected to a grounded battery. From the left-hand spring of contact 133 (Fig. 1) a conductor 155 extends to and connects with conductor 255 of Fig. 6 which is connected to the single armature of the first relay 226 in the fan circuit system.

Following the energization and locking of re-

lay 218 as previously described and the resulting operation of electromagnet 112 the system is in condition to receive signals for performing switching operations, the operation of the printing bail having been suppressed. Relay 203 will follow the switching control signals and upon first reengagement of the armature of relay 203 with its marking contact, condenser 216 will be discharged, discharge tube 214 will be restored to non-conductive condition and relay 217 will be released. This will have no effect upon relay 218 since that relay is now maintained energized through its holding circuit. Relay 202 will also follow the switching control signals and will cause the operation of selector magnet 11 to effect the setting of the selector vanes 24 in correspondence with the received signal. Following the setting of the selector vanes 24 function bail 61 will be operated and since push bar 84 has been brought into cooperation with the function bail blade 91 the push bar will be reciprocated to effect the closure of those of the contacts 79 which correspond to selector vanes now in marking position and upon the closure of certain ones of the contacts 79 their associated ones of the relays 226 to 230 will be energized over the path from ground at the outer right-hand armature of relay 218 through the outer right-hand front contact, conductor 253, conductor 153, contacts 127 now closed, conductor 129, those of the contacts 79 that are closed, corresponding ones of the conductors 154 and 254 to corresponding ones of the relays 226 to 230. After the closure of contacts 79 and energization of certain ones of the fan circuit relays, and specifically near the end of the operating stroke of push bar 84, contacts 133 are closed by pin 134 to complete a conductive path following the one just described down to the contacts 79 but continuing over the conductor 129, closed contacts 133, conductor 155, conductor 255, and through the fan circuit path previously completed by the relays 226 to 230 through one of the conductors 231, 232, or 233 and thence to one of the relays 236, 237 or 238, which becomes energized. It will be understood that the three relays 236, 237, and 238 and their associated conductors 231, 232, and 233 have been shown merely by way of exemplifying the invention and that there may be as many as thirty-one such relays connected by conductors to thirty-one of the contacts of relay 230, it being preferable not to use the extreme left-hand back contact of relay 230 since a path is complete from the armature of relay 226 to this contact of the relay 230 when the fan circuit system is in the idle condition whereby a selective switching operation might be performed in response to the all-spacing signal and also in response to the long spacing signal by which electron discharge tube 214 is rendered conductive to initiate the operation of the switching mechanism.

Upon the energization of any one of the relays 236, 237, or 238 a holding circuit therefor is established from grounded battery through the winding of the relay, inner upper armature and front contact, conductor 241, back contact and armature of relay 242 to ground.

For the purpose of completing the description of a switching operation it will be assumed that the relay 236 has been energized and is held through the holding circuit just described. The upper outer armature of relay 236 is connected by conductor 243 to one terminal of the biasing winding of repeater relay 206 the other terminal of which is connected to ground. The back and front contacts with which the outer upper armature of relay 236 cooperate, are connected to battery of opposite polarities. The battery connected to the back contact is of such polarity as to render the relay 206 unresponsive to signals on the communication line 201. However, when relay 236 is energized the battery connected to the front contact and therefore to the biasing winding of relay 206 biases the relay oppositely and renders it responsive to signals on the communication line.

The armature of relay 206 is connected to one end of a telegraph line 244 extending to a remote station 246. The remote station 246 has been indicated symbolically by selector magnet 247 of a receiving printer or other recorder. Telegraph line 244 has been indicated for polar operation by virtue of the connection of battery of opposite polarity to the marking and spacing contacts of repeater relay 206. It will be understood that if it is desired to operate the telegraph line 244 and the station 246 according to a neutral system, this may be accomplished by connecting the marking contact of relay 206 to battery and by connecting the spacing contact to ground instead of to a battery of opposite polarity. With relay 236 energized, repeater relay 206 will oscillate its armature between the marking and spacing contacts and repeat telegraph signals received over line 201 from the transmitter 141 or from a remote transmitter to the telegraph line 244 and such repeated signals will be received at the station 246.

The lower armature of relay 236 is connected to ground and when none of the relays 236, 237 and 238 is energized a circuit is completed from the grounded lower armature of relay 236 through its back contact, lower armature and back contact of relay 237, lower armature and back contact of relay 238, conductor 248, and winding of a slow release relay 249 to grounded battery 261. From this it will be apparent that relay 249 is normally energized. When relay 236 is energized and also when any one of the other relays 237 or 238 is energized, the series circuit through their lower armatures and back contacts from the ground on the lower armature of relay 236 to the winding of relay 249 is interrupted so that the relay 249 becomes deenergized and after an interval releases its armature. The lower front contact of each of the relays 236, 237, and 238 is connected to conductor 262 which extends to the front contact of relay 249 the armature of which is connected to one terminal of relay 223, the other terminal of which is connected to grounded battery 263. Thus the relay 236 when energized transfers the ground at its lower armature from the energizing circuit for the relay 249 to the energizing circuit for the relay 223 which becomes energized through the armature and front contact of relay 249 in the interval between the interruption of the energizing circuit for relay 249 and the release of the armature of that relay. In this way the holding circuit for the relay 218 is interrupted and the relay is released incident to a switching operation. The relay 218 upon being released opens the energizing circuit for electromagnet 112 whereby the suppression of printing is terminated and the push bar 84 is restored to disabled condition.

At the conclusion of the transmission of message material intended for the remote station 246, relay 236 having remained energized during the transmission of message material to that

station, the relay 236 may be released by a series of operations paralleling those by which the relay 236 was selectively operated. A long spacing signal is impressed upon the communication line 201 to effect the operation of electron discharge tube 214 and the operation and locking of relay 218. At this time the holding circuit for relay 218 will again be established because relay 223 which previously interrupted the holding circuit for relay 218 was released following the release of slow release relay 249 and the relay 249 has remained in released condition. Following the operation and locking of relay 218 and the consequent conditioning of the switching mechanism and suppression of printing a code combination is transmitted which operates the fan circuit system to extend a conductive path from the armature of relay 226 to the extreme right-hand front contact of relay 230 and thence over conductor 264 to one terminal of relay 242 the other terminal of which is connected to grounded battery 266. Relay 242 operates and interrupts at its armature and back contact the holding circuit for relay 236 which releases, thus restoring the original polarity to the biasing winding of repeater relay 206 and rendering that relay non-responsive to signals. At its lower armature, the relay 236 in releasing first disconnects ground from the front contact of relay 249 and then completes the energizing circuit for that relay so that the relay 249 becomes operated. However, the relay 223 will not become energized incident to the release of relay 236 because ground connection is removed from conductor 262 before relay 249 becomes energized to prepare a path for the energization of relay 223. The relay 218 will therefore remain energized.

As previously stated the holding circuit for the relay 218 which extends through the armature and back contact of relay 223 includes also the normally closed contacts 102 (Fig. 1). The contacts 102 are arranged to be opened momentarily by the selectable function lever 57 when that function lever has been selected by the selector vanes 24. Upon the opening of contacts 102 by selectable function lever 57 the holding circuit of relay 218 will be interrupted independently of relay 223 to effect the release of the relay 218. It will be understood that the code combination which is assigned to the selection of selectable function lever 57 should not complete a path through the fan circuit system to a switching relay of the class represented by the relays 236, 237, and 238 since the selectable function lever 57 performs a disabling operation and should not also perform a switching operation. Accordingly, there will be no conductor extending from the contact of relay 230 to which a conductive path is extended from the armature of relay 226 when the relays 226 to 238, inclusive, have been energized in the permutational combination corresponding to the code which effects the selection of the selectable function lever 57.

It should be noted that after the release of the relay 236 and before the operation of contacts 102 the apparatus is in condition to perform switching operations and a code combination for selecting one of the other of the relays 237 or 238 may be transmitted and rendered directly effective. This gives rise to the possibility of a different mode of operation from the standpoint of normal and off-normal condition than that heretofore described. It is feasible if desired from an operating standpoint under the condition that a large percentage of traffic on communication line 201 is intended for outlying stations controlled by the switching mechanism to permit relay 218 to remain energized and held as the idle or normal condition. The switching mechanism will then be immediately responsive to switching signals without the intervening delay of impressing a long spacing signal on the communication line to effect the operation of electron discharge tube 214. Under these circumstances the recording portion of the combined recording and switching instrumentality will be normally disabled but may be readily activated for recording purposes merely by the transmission of the code combination for selecting the function lever 57 whereby contacts 102 will be opened and the holding circuit of relay 218 will be released. If the system is operated upon this basis presumably the activation of the recording mechanism would be an off-normal condition and accordingly at the conclusion of message transmission intended to be recorded only by the printing mechanism (Fig. 2) of the combined recording and switching instrumentality the system should be restored to switching and non-printing condition by the transmission of a long spacing signal to effect the operation of electron discharge tube 214 and the operation and locking of relay 218.

Thus far the system has been described only with reference to relay 236. The outer upper armature of each of the relays 237 and 238 is connected by conductors 267 and 268, respectively, to the biasing windings of the repeater relays 207 and 208, respectively. The front and back contacts with which these armatures cooperate are connected to battery of opposite polarity to hold the relays 207 and 208 non-responsive to signals when relays 237 and 238 are deenergized and to render the relays 207 and 208 responsive to signals when relay 237 or 238 is operated. The armature of relay 207 is connected to telegraph line 271 which extends to remote telegraph station 272 and the armature of relay 208 is connected to telegraph line 273 which extends to remote telegraph station 274.

The front contact associated with the lower armature of each of the relays 237 and 238 is connected to conductor 262 so that in the case of energization of the relay 237, the energizing circuit for relay 223 will be completed from the grounded lower armature of relay 236 through its back contact, the lower armature and front contact of relay 237 to conductor 262, and when relay 238 is energized the circuit will be completed from the grounded lower armature of relay 236 through its back contact, the lower armature and back contact of relay 237 and the lower armature and front contact of relay 238 to conductor 262. When either of the relays 237 or 238 is energized the energizing circuit for the relay 249 will be interrupted at the lower armature and back contact of the energized one of the relays 237 or 238. From this it will be apparent that the relays 236, 237, and 238 similarly control the extension of a communication channel over individual telegraph lines and that the three relays are interlocked from the standpoint of control of the relays 223 and 249. As many additional relays as there are additional telegraph lines to be controlled may be included in the system up to the limit of the selective switching possibilities afforded by the code and such

additional relays may be interlocked with the relays 236, 237, and 238 in the same manner.

Referring now to the embodiment of the invention which is shown in Figs. 1, 7 and 8 when arranged as shown in Fig. 10, and particularly to Fig. 8, the reference numeral 301 designates the receiving line and 302 designates the transmitting line of a telegraph communication channel which is sometimes designated as a full duplex system by virtue of the fact that simultaneous two-way transmission of telegraph signals may be accomplished. At a point where switching operations are to be performed the communication line 301 extends through a repeater station 303 which has a repeater relay 304 for controlling the switching instrumentality and one or more relays for controlling individual telegraph lines extending to other printing telegraph stations. As will be hereinafter described the effectiveness of the repeater relay or relays 306 is controlled by the switching instrumentality. The operating windings of all of the repeater relays included in the repeater station 303 are connected in the communication line 301 in series.

At one or more other points in the telegraph line 301 there may be other repeater stations such as the repeater station 307 similar to the repeater station 303 and having a repeater relay 308 for controlling another switching instrumentality and one or more relays 309 for controlling telegraph lines extending to other printing telegraph stations.

The repeater relay 304 has its biasing winding connected to battery of such polarity that the relay always follows telegraph signals received over telegraph line 301 and the grounded armature of relay 304 in the idle condition engages the left-hand or marking contact of the relay to which is connected conductor 350 which extends to and connects with conductor 150 of Fig. 1 and conductor 150 is connected to one terminal of the winding of selector magnet 11 the other terminal of which is connected to grounded battery 142.

The switching mechanism controlled by the contacts 79 of Fig. 1 is shown in Fig. 7 in the normal or idle condition and in such condition an energizing circuit for the print suppression magnet 112 may be traced from the grounded lower armature of relay 311 through the back contact of the relay, conductor 312, conductor 352 which extends to and connects with conductor 152 of Fig. 1, through conductor 152, winding of electromagnet 112 to grounded battery 113. Through this circuit electromagnet 112 is normally energized and its attracted lower armature lever 94 holds detent pin 92 out of engagement with push bar 84 so that the push bar is conditioned to operate. Its upper armature 114 holds lever 119 in blocking relation to print bail operating blade 39 and holds contacts 127 closed. The contacts 127 prepare a circuit which will be subsequently extended through the switching contacts 79, the circuit extending from ground at the lower armature of a relay 313 through the lower back contact of that relay, conductor 314, lower armature and back contact of relay 316, conductor 353 extending to and connecting with conductor 153 of Fig. 1, closed contacts 127 and conductor 179 to one contact spring of each of the five sets of contacts 79 and also to the right-hand spring of the contacts 133.

The other spring of each of the five sets of contacts 79 is connected to one of five conductors 154 which extend to and connect with five conductors 354 which extend to five relays 317, 318, 319, 320 and 321, each of which has connection to grounded battery. As in the previously described embodiment of the invention the relays 317 to 321, inclusive, control a fan circuit system involving progressively doubling sets of armatures and contacts. The single armature of relay 317 which is at the apex of the fan circuit is connected to conductor 355 which extends to and connects with conductor 155 of Fig. 1 which in turn extends to the left-hand spring of the contacts 133 that are operated by push bar 84 near the end of its stroke after it has closed those of the sets of contacts 79, the bell cranks 77 of which find selector vanes 24 in marking position.

As an introduction to the operation of the system shown in Figs. 1, 7 and 8 assume that it is desired to condition the combined printing and switching instrumentality shown in Fig. 1 for recording a message. The appropriate code signal combination will be impressed upon the telegraph line 301 at some remote point and will be received by the selector magnet 11 to cause the positioning of the selector vanes 24 in permutational positions corresponding to the received signal. Following the setting of the selector vanes, push bar 84 will be operated by function bail blade 91 to close corresponding ones of the contacts 79 whereby corresponding ones of the relays 317 to 321, inclusive, will be energized through the circuit from ground at the lower armature and back contact of relay 311 and through the closed contacts 127 and certain ones of the contacts 79. Thereafter contacts 133 will be closed to establish ground connection from the same ground to the single armature of relay 317 and thus through the fan circuit path prepared by the energized one of the relays 317 to 321, inclusive. The reason for providing for the closure of contacts 133 after the contacts 79 have been closed is to permit the fan circuit relays 317 to 321, inclusive, or in the case of the system shown in Fig. 6, the relays 226 to 230, inclusive, to become operated before a conductive path is established through the fan circuit armatures and contacts in order that no false path shall be established momentarily while the fan circuit controlling relays are attracting their armatures, since the relays may not all attract their armatures at exactly the same time.

In response to the signal for causing the combined printing and switching instrumentality to be placed in printing condition, a path is established through the fan circuit for the energization of a relay 322 from ground extended through contacts 127, momentarily closed contacts 133, armatures and contacts of the fan circuit, through the extreme right-hand front contact of relay 321 and thence over conductor 323, uppermost armature and back contact of relay 311, and winding of relay 322 to grounded battery. A holding circuit for relay 322 is established from the grounded battery through its winding, its armature and front contact, conductor 324, winding of relay 326, conductor 351 which extends to and connects with conductor 151 of Fig. 1, and over conductor 151 and normally closed contacts 102 to ground. Relay 326 becomes energized over the holding path just described and establishes an energizing circuit for relay 311 from the grounded armature and front contact of relay 326, through the winding of relay 311, to grounded battery. Upon the operation of relay 311,

which remains energized as long as relays 322 and 326 remain energized, ground at its lower armature is disconnected from conductor 352 and thereby from the winding of electromagnet 112 which releases its armatures to disable the mechanism for operating switching contacts 79 and to terminate the detention of printing bail operating blade 39. Thereafter as long as relay 322 remains energized the combined recording and switching instrumentality will operate as a telegraph signal receiving printer but not as a switching device, responding to signals on the telegraph 301 and printing message material corresponding to signals received. It will be noted that the relay 311 at its uppermost armature transfers conductor 323 from the energizing circuit for relay 322 to conductor 327 which extends through the winding of a relay 328 to grounded battery. This apparent preparation of an energizing circuit for the relay 328 has no utility at this time because the switching control contacts 79 are disabled and an energizing circuit for the relay 328 cannot be completed through the fan circuit system.

When the transmission of message material to the combined recording and switching instrumentality has been concluded and it is desired to restore that instrumentality to normal condition this may be accomplished by the transmission of the code combination to which the selectable function lever 57 is responsive. The function lever will respond by momentarily opening the contact 102 thereby interrupting the holding circuit for relay 322 which extends through relay 326. Both relays will be released and relay 326 removes ground from the energizing circuit for relay 311 which also releases, reestablishing the path over conductor 323 to the winding of relay 322 and at the lower armature and back contact of relay 311 restoring the ground connection for energizing print suppression magnet 112 over conductors 352 and 152. The combined recording and switching instrumentality is thus restored to condition for performing switching operations and for the suppression of printing.

Assume now that it is desired to place the combined recording and switching instrumentality of Fig. 1 in condition in which it will neither print nor perform switching operations. This is accomplished by the transmission over telegraph line 301 from a remote point of the code combination which will cause the contacts 79 to operate to establish a conductive path from ground through the fan circuit system and through the second armature of relay 321 counting from the right, and its front contact, conductor 329, innermost upper armature and back contact of relay 311, conductor 331, and winding of relay 316 to grounded battery. Relay 316 establishes its own holding circuit from the grounded battery through the winding of the relay, upper armature and front contact to conductor 324, and thence through the winding of relay 326 to ground at the normally closed contacts 102 as previously traced. This results in the energization of relay 326 which completes the energizing circuit for relay 311 thereby removing the ground connection to conductor 352 at the lower armature and back contact of that relay. However, a substitute ground connection for the conductor 352 is completed from the grounded lower armature and back contact of relay 313, through conductor 314, lower armature and front contact of relay 316 and conductor 332 to conductor 352 and thus to the winding of electromagnet 112 to hold that magnet energized to suppress printing. The substitute ground connection for the conductor 352 is transferred by relay 316 from conductor 353 over which the ground connection had previously been supplied through conductor 153 and closed contacts 127. From this it will be apparent that although electromagnet 112 remains energized and causes contacts 79 to be operated in permutational combinations in response to each signal thereafter received, no switching operations will be performed because the energizing circuit for the relays 317 to 321, inclusive, and the circuit to the apex armature of the fan circuit system remains open at the lower back contact of relay 316. It will be noted that upon the operation of relay 311 the conductor 329 is transferred at the innermost upper armature and front contact of the relay to conductor 327 which extends to the winding of relay 328. By this transfer an apparent circuit for the energization of relay 328 is prepared but such circuit cannot be completed over the conductor 329 at this time because ground connection for the switching control relays 317 to 321 and for fan circuit paths has been removed at the lower armature and back contact of relay 316.

The restoration of the combined recording and switching instrumentality to switching condition is accomplished in the same manner as hereinbefore outlined, namely, by the signal responsive selection of function lever 57 which causes contacts 102 to be opened momentarily. These contacts interrupt the holding circuit for the relay 316 and both relays 316 and 326 release. The relay 326 releases 311 which restores the ground connection through its lower armature for continuing the suppression of printing and the relay 316 removes the substitute ground from the circuit of the magnet 112 and restores that ground to the conductor 353 thus reconditioning the fan circuit to be effective.

Another and primary function of the switching mechanism is to render a remote receiving printer responsive to telegraph signals on the telegraph line 301. This is accomplished by the energization of the relay 313 over the fan circuit system from the right-hand back contact of relay 321, conductor 333, intermediate upper armature and back contact of relay 311, conductor 334, and winding of relay 313 to grounded battery. The relay 313 completes its own holding circuit from the grounded battery through the winding of the relay, inner upper armature and front contact, conductor 324, winding of relay 326, conductor 351 and thence over conductor 151 to ground at the normally closed contacts 102. Again the relay 326 completes the energizing circuit for relay 311 which removes ground at its lower back contact from conductor 352. However, the relay 313 transfers a substitute ground to the conductor 352 at its grounded lower armature and front contact so that electromagnet 112 remains energized to suppress printing.

It will be noted that by virtue of the transfer of the ground connection on the lower armature of relay 313 from the back contact to the front contact, ground is removed from conductor 353, which is the feeder circuit to contacts 79 and 133, so that although electromagnet 112 remains energized while relay 313 is energized and contacts 79 are operated in permutational combinations responsive to signals thereafter received, the switching relays 317 to 321 are not operated and no conductive path through the fan circuit system is completed. Upon the operation of relay 311 its upper middle armature transfers conductor 333

from conductor 334 to conductor 327 which extends to the winding of relay 328. Relay 328 cannot become energized over this circuit during the reception of signals thereafter received for the reason that relay 313 has operated to prevent the energization of any of the relays 317 to 321, inclusive, or the completion of a conductive path through the fan circuit system.

It will be noted that the back contact for the upper outer armature of relay 313 is connected to positive battery and that the armature is connected by conductor 336 to one end of the biasing winding of repeater relay 306, the other end of which is connected to ground. The battery connection which is applied to the biasing winding of relay 306 when relay 313 is deenergized is such as to bias relay 306 against response to telegraph signals traversing the telegraph line 301 and accordingly the armature of relay 306 will not oscillate between its marking and spacing contacts but will remain on the marking contact regardless of changes in the current through its operating winding due to telegraph signals. The front contact which is engaged by the upper outer armature of relay 313 when the relay is energized is connected by conductor 337 to the armature 1 of a relay 338, which is normally deenergized, and the back contact which is engaged by that armature is connected to negative battery. Thus when relay 313 becomes energized the polarity of the biasing potential applied to relay 306 is reversed and this renders the relay 306 responsive to signals on telegraph line 301 so that the armature oscillates between marking and spacing contacts which are connected to batteries of opposite polarities. The armature of relay 306 is connected to a telegraph line 339 which extends to a remote station 341 and at the station 341 the telegraph line 339 is connected to the operating winding of a receiving line relay 342. Relay 342 has a biasing winding which is biased by the proper polarity of battery to permit the armature of relay 342 to oscillate in response to telegraph signals impressed upon telegraph line 339 by relay 306 and the marking contact with which the armature of relay 342 cooperates is connected to grounded battery. The armature of relay 342 is connected to one terminal of the winding of a selector magnet 343 which represents symbolically a receiving telegraph printer. When relay 313 conditions the relay 306 to respond to telegraph signals, such signals will be repeated to telegraph line 339, will be received by line relay 342, and will operate selector magnet 343 to cause the receiving printer represented by the selector magnet to record message material transmitted over telegraph line 301. During the time that signals are being received by the line relay 342 the combined recording and switching instrumentality of Fig. 1 will be neither printing nor performing switching operations in response to such signals due to the fact that relay 313 is operated.

The channelling of telegraph signals to the station 341 may be terminated by the same means as that employed for terminating signal responsive printing operation or for terminating total disablement of the combined recording and switching instrumentality of Fig. 1, namely, by the signal responsive operation of selectable function lever 57 which will open the normally closed contacts 102, thus releasing relays 313, 326 and 311, restoring the disabling bias to repeater 306, restoring the ground at the lower back contact of relay 311 to the circuit 352 of print suppression magnet 112 and transferring the substitute ground from conductor 352 to the feeder conductor 353 for the switching relays 317 to 321, inclusive, and for the fan circuit path.

It will be understood that it is within the contemplation of the present embodiment of the invention to provide additional relays similar to the relay 313 and operable through additional armatures and contacts of the relay 311 from others of the back or front contacts of the final switching relay 321 for controlling other repeating relays corresponding to the relay 306 for repeating telegraph signals traversing telegraph line 301 to other telegraph lines corresponding to the line 339 extending to other remote telegraph stations. It will also be understood that it is within the contemplation of the present embodiment of this invention to provide for the selective disablement of the print suppression mechanism of the combined recording and switching instrumentality shown in Fig. 1 in connection with the selective operation of the relay 313 or any additional relay of its class for the purpose of causing the combined printing and switching instrumentality to monitor or print for other useful purpose message material corresponding to signals repeated to remote stations by repeater relay 306 or other relays of that class, such monitoring having been described in connection with the embodiment of the invention shown in the combination of Figs. 1 and 6.

The present embodiment of the invention also contemplates the control by the switching mechanism, of transmitters for impressing telegraph signals upon the sending line 302. Accordingly, the telegraph line 302 has in series therewith keyboard controlled transmitting contacts 141 (Fig. 1), the transmitting contacts and distributor rings of a perforated tape controlled machine transmitter 344 local to the combined recording and switching instrumentality of Fig. 1, but shown in Fig. 8, similar keyboard controlled transmitting contacts 346 and perforated tape controlled machine transmitter 347 at the remote station 341, and keyboard and tape controlled transmitter at as many other remote stations as may be desired up to the limit of the selective switching possibilities afforded by the code upon which the system is operable. The keyboard controlled transmitters 141 and 346 are fully disclosed in the previously identified patent to Morton et al and being manually operable there is no occasion for subjecting them to control by the switching mechanism. The tape controlled transmitter may be of the type disclosed in Patent 2,055,567 granted September 29, 1936, to E. F. Watson, and the disclosure of this patent is incorporated herein by reference as part of the present specification. At each of the stations which is provided with a tape controlled transmitter there is a tape perforator 348 which may be similar to that shown in Patent 1,182,179 granted May 9, 1916, to C. L. Krum et al., by means of which message material may be stored in the form of perforations in a tape which will subsequently pass through and control the tape transmitter for impressing signals corresponding to the stored message material upon the transmitting line 302. Each of the tape transmitters is motor driven through a friction clutch and is provided with a distributor stop mechanism controlled by an electromagnet which in the idle condition of the apparatus is deenergized whereby a stop lever is presented in blocking relation to a cam carried by the distributor shaft of the transmitter.

Referring now to Fig. 1 a pair of normally open contacts 101 is operable momentarily by the selectable function lever 56 when the selector vanes 24 have been set under the control of a received signal for the selection of the lever 56. One of the contacts 101 is connected to ground and the other is connected to conductor 156 which extends to and connects with conductor 356 of Fig. 7 which extends a conductive path through conductor 349 to one terminal of relay 338, the other terminal of which is connected to grounded battery. Upon being energized the relay 338 establishes its own holding circuit from grounded battery through the winding of the relay, conductor 349, contacts operable in make-before-break manner by the armature of relay 328, conductor 361, front contact and armature 5 of relay 338 to ground.

Relay 338 performs a number of functions. At armature 1 it reverses the polarity of battery applied to the outer upper front contact of relay 313 so that if the relay 313 is then energized to qualify repeater relay 306 to repeat signals to the telegraph line 339 the relay 306 will be disabled and prevented from following or repeating to line 339 signals received over telegraph line 301 immediately following the energization of relay 338, since such signals pertain to switching operation involving transmitters, as will presently appear, and might cause the printing of erroneous characters if permitted to be repeated to the telegraph line 339. The armatures 2 and 3 of relay 338 are connected to ground and their front contacts are connected to the conductors 353 and 352, respectively, for the purpose of supplying ground to energize electromagnet 112 to suppress printing if that magnet has not been energized, and for the purpose of supplying ground to the feeder conductor 353 for the switching relays 317 to 321, inclusive, and for the fan circuit system. Armature 4 is also connected to ground and its front contact is connected to the winding of relay 311, so that if that relay is not at this time energized it will become energized and by means of its upper armatures will interrupt the conductive paths from fan circuit conductors 323, 329 and 333 to the relays 322, 316 and 313, respectively, and will connect those paths to conductor 327, as previously set forth. Each of the lower armatures of relay 338 is connected to a fan circuit conductor extending from one of the contacts of the final switching relay 321. Armature 9 is connected to fan circuit conductor 362 and its front contact is connected to conductor 327 which extends to the relay 328. Armatures 8 and 7 are connected to fan circuit conductors 363 and 364 and their front contacts are connected to the operating windings of transmitter controlling relays 366 and 367, respectively, the circuits through such windings being completed to grounded battery. Armature 6 of relay 338 is connected to fan circuit conductor 368 and its front contact is connected to one end of the winding of relay 369, the other end of which is connected to grounded battery.

The condition of the apparatus which exists following the operation of the normally open contacts 101 is that relay 338 is energized, relay 311 is energized from the grounded armature 4 of relay 338 whether or not the relay 311 had been held in energized condition by the relay 326 prior to the operation of the contact 101, the print suppression magnet is energized from the ground on the armature 3 of relay 338 and ground for feeding the fan circuit controlling relays 317 to 321, inclusive, and for establishing a conductive path through the fan circuit system is supplied at the armature 2 and front contact of relay 338. A relay 371 is also energized at this time, this relay being normally in energized condition from ground at the lower armature of relay 367 through the lower back contact of that relay, lower armature and back contact of relay 366 through the winding of relay 371 to grounded battery.

The system is now conditioned to perform a switching operation for controlling a transmitter. It will be assumed that the signal received is that which will complete a circuit over the fan circuit conductor 364 whereby the relay 367 will be energized. This relay establishes a holding circuit from grounded battery through the upper or holding winding, upper armature and front contact, conductor 372, inner lower armature and back contact of relay 369, conductor 373 extending into Fig. 8, winding of relay 374 and tape-out contacts 376 to ground, these contacts being closed if there is tape in the transmitter 344 awaiting transmission. The relay 374 completes a circuit from ground through the slack tape contacts 377 of transmitter 344 which will be closed if there is a loop of perforated tape between perforator 348 and transmitter 344 awaiting transmission, armature and front contact of relay 374, switch 378 which will presumably be closed manually as one of the operations incident to starting up the system on each business day, and winding of transmitter start magnet 379 to grounded battery. Thus the start magnet 379 will be operated to release the transmitting distributor shaft for rotation and the shaft will rotate continuously to effect the transmission of signals stored in the tape until the slack in the tape between perforator 348 and transmitter 344 has been taken up, at which time the slack tape contacts 377 will be opened to interrupt the energizing circuit for the start magnet 379 which becomes deenergized and stops the transmitter shaft.

If the tape, instead of being left connected to the unperforated supply of tape in the perforator 348 had been severed, there will be no loop capable of operating the slack tape contacts 377, but in that event the tape will be advanced step by step through the transmitter as the signals are transmitted, until the severed end of the tape has run out of the transmitter, permitting the tape-out contacts to open. Under these circumstances the holding circuit for relay 367, which includes the winding of relay 374, will be interrupted and both relays will be released, the relay 374 interrupting the circuit for the start magnet 379, which releases to arrest the transmitting distributor shaft.

At the time that relay 367 operated and completed its holding ciircuit through relay 374, it also transferred the ground connection on its lower armature from the lower back contact to the lower front contact. This interrupts the energizing circuit for relay 371 which is a slow-release relay, and completes an energizing circuit for the relay 328 from the grounded lower armature and front contact of relay 367, conductor 381 front contact and armature of slow-release relay 371 and winding of relay 328 to grounded battery. Relay 328 thus becomes energized before the relay 371 releases its armature and first establishes a holding circuit through its armature, make-before-break contact controlled by the armature, conductor 361, front

contact and armature 5 of relay 338 to ground. Thereafter the armature of relay 328 breaks the holding circuit for relay 338 which releases all of its armatures and in so doing releases the holding circuit for relay 328 which releases its armature to again prepare the holding circuit path for relay 338 through the make-before-break front contact of relay 328. The releasing time for relay 371 is such that that relay has released its armature before the holding circuit for the relay 328 is interrupted, so that the relay 338 shall not be reenergized from ground supplied over the conductor 381 at the instant that the movable front contact of relay 328 has reclosed to the stationary contact and the armature of relay 328 has not moved out of engagement with the movable front contact.

The release of relay 338 results in disconnection of the fan circuit paths extending through the four lower armatures of relay 338 to the relays 366, 367, 369 and 328. At the armatures 2, 3 and 4 of relay 338 the ground connections are removed from the relay 311 and from the conductors 352 and 353 so that the combined recording and switching instrumentality and the relay 311 are restorted to the condition which prevailed prior to the energization of relay 338. Also the battery connection extending to the upper outer front contact of relay 313 is restored to negative polarity to recondition the relay 306 to respond to signals on the telegraph line 301 if the relay 313 is at this time energized.

The operation of the tape transmitter 344 may be terminated under the control of the switching mechanism by the signal responsive operation of the contacts 101 to effect reenergization of the relay 338, followed by the operation of the fan circuit system in response to the proper signal to complete a conductive path through the fan circuit conductor 368 to the winding of relay 369 which is connected to grounded battery. The relay 369 will attract all of its armatures and interrupt at the inner lower armature the holding circuit for the relay 367, which includes the conductor 373 and the winding of relay 374 associated with tape transmitter 344. Even though the holding circuit for the relay 367 had been interrupted automatically by operation of the tape-out contact 376 this might not have become known at the transmitting station from which signals for controlling the switching instrumentality are transmitted and, accordingly, it would probably be a standard operating routine to stop the tape transmitter 344 under signal control after a reasonable time for the transmission of message material had elapsed or in any event it would be necessary to stop the transmitter in order to permit another station to transmit message material to the transmitting line 302. Upon the release of relay 367 its lower armature reestablishes the energizing circuit for relay 371 but it also removes ground connection from conductor 381, so that relay 328 does not become energized automatically and the holding circuit for relay 338 is maintained. The apparatus is thus placed in condition for starting another tape transmitter, which may be accomplished by the signal responsive operation of the fan circuit system to complete the energizing circuit for another transmitter controlling relay such as the relay 366. This relay establishes a holding circuit similar to that of relay 367 through the lower outer armature and back contact of relay 369, conductor 382 extending into Fig. 8, winding of relay 383 at station 341 to ground at the tape-out contacts 384. Transmitter 347 has slack tape contacts 386 and a transmitter start magnet 387 similar to corresponding elements of transmitter 344, and the transmitter 347 will be started if the tape-out contacts 384 and slack tape contacts 386 are both closed. At its lower armature the relay 366 transfers the ground connection supplied from the lower armature and back contact of relay 367 from relay 371 to conductor 381 and thus to the winding of relay 328 whereby relay 328 is energized, relay 338 is released and then relay 328 is released.

If after the operation and locking of relay 338 and the operation of relay 369, it had been desired to start no other transmitter, the transmitter controlling mechanism could have been restored to normal by signal responsive operation of the fan circuit system to complete a fan circuit path through conductor 362 and through the armature 9 and front contact of relay 338 to conductor 327 and thus to relay 328. Relay 328 releases relay 338 which in turn releases relay 311 if that relay was not operated at the time that contacts 101 were operated.

Reference is now made to the previously mentioned fact that all of the upper front contacts of the relay 311 are connected to conductor 327 which extends to relay 328 so that when relay 311 is in the energized condition if ground is connected through the fan circuit to any one of the conductors leading to the upper armature of relay 311, relay 328 will be energized. It was also pointed out previously that when the relay 311 is in the energized condition due to the energization of one of the relays the circuit of which includes an upper back contact of relay 311, these being the relays 322, 313 and 316, a path through the fan circuit system cannot be completed due to the fact that the mechanism for operating the switching contacts 79 is disabled or ground connection for operating the fan circuit controlling relays 317 to 321, inclusive, and for completing a conductive path through the fan circuit system is removed. However, when relay 338 becomes operated through the closure of contacts 101, ground for the fan circuit controlling relays and for the fan circuit system is applied from the grounded armature 2 of relay 338, so that in response to signals thereafter received the switching relays 317 to 321, inclusive, will be operated and a conductive path through the fan circuit system may be completed. Relay 311 is operated by relay 338 whether or not it had previously been in energized condition so that the conductive paths extending to the upper armatures of relay 311 are extended to conductor 327. It is to be noted that contacts 101 in all of the combined recording and switching instrumentalities associated with line 301 are operable in response to the same code signal so that at all switching stations the relay 338 will be operated.

As indicated in Fig. 7, all fan circuit paths which are not assigned to the control of the switching operation are extended to and connected with the conductor 362 which when relay 338 is energized is connected to conductor 327. From this it will be apparent that when relay 338 is energized the completion of any fan circuit path except over the conductors 363, 364 or 368 to the relays 366, 367 or 369, respectively, will be completed to the relay 328 either through the conductor 362 or through one of the conductors 323, 329 or 333, since relay 311 is energized when relay

338 is energized. The reason for this is that code combinations which are not assigned to control switching operations at the switching station shown in Fig. 7 or which are assigned to operate relays 313, 316 or 322 at that station, may be assigned to control the operation of transmitter controlling relays at other switching stations, such as, for example, one which might be controlled by the repeater relay 308 in the repeater station 307. Since the operation of a transmitter starting relay at any switching station such as the relays 366 and 367 at the station shown in Figs. 7 and 8 causes the operation of relay 328 and the release of the relay 338, it is desirable that a signal which causes the operation of a transmitter starting relay at any switching station shall directly cause the operation of the relay 328 and the resulting release of the relay 338 at all other switching stations. The circuits prepared through the armatures and front contacts of relay 311, and through armature 9 of relay 338 accomplish this result.

Not only is it possible in accordance with the present invention to assign to the control of one signal combination the operation of a relay for controlling the reception of signals over the communication line 301, such as one of the relays 313, 316 or 322, at one station and to control a transmitter starting relay, such as one of the relays 366 or 367 at another station as set forth in the foregoing paragraph, but it is also possible to control a relay in each of the two sets at one station by means of one signal combination. For example, if it is desired that the relay 313 which controls the effectiveness of repeater relay 306 and the relay 366 which controls the tape transmitter at station 341 shall be alternatively selectable in response to a single code combination, this may be accomplished by the omission of the connection from the upper middle front contact of relay 311 to conductor 327, which is the reason that this connection has been shown dotted, and by connecting conductor 333 to the conductor 363 as indicated by the dotted line connection 391. With this arrangement the relay 313 can be energized from its fan circuit path only when relay 311 is in deenergized condition, which is the proper condition for selection of one of the relays 313, 316 and 322. When relay 338 has been energized under the control of contacts 101, the relay 311 becomes energized whether or not it had previously been energized and the common signal for selecting relay 313 or relay 366 will cause a fan circuit path to be completed for the energization of the relay 366 over the strapping conductor 391 to conductor 363. With conductors 333 and 363 interconnected by the strapping conductor 391 only one conductor from a contact of relay 321 would be employed to complete circuits over the conductors 333 and 363 which is the reason that the conductor from the third back contact of relay 321, counting from the right, to conductor 363, has been indicated by a dotted line. It will be apparent that that contact of relay 321 could be assigned to the control of some other switching function.

Although only one relay 313 for controlling a remote telegraph receiver has been shown, it will be understood that there may be many such relays for controlling other remote receiving stations. Similarly, although only two relays 366 and 367 have been shown for starting tape transmitters, there may be many such relays, and the holding circuits for such relays would be completed over additional armatures and back contacts of relay 369, two unused ones being shown in Fig. 7. The fan circuit system is not shown developed to its full extent either in Fig. 6 or Fig. 7, since it will be noted that seven contacts of the relays 229 and 320 have been left unconnected. These contacts would extend to seven additional armatures of relays 230 and 321 respectively, each of which would have a front and a back contact so that a maximum of thirty-two selective points, namely, the sixteen front and sixteen back contacts of relays 230 and 321 are available to control switching relays in response to a five-unit code for controlling the five relays 226 to 230, inclusive, or 317 to 321, inclusive.

Although two specific embodiments of the invention have been shown in the drawings and described in the foregoing specification, it is to be understood that the invention is not limited to those specific embodiments but is capable of modification and rearrangement without departing from the spirit of the invention and within the scope of the appended claims.

What is claimed is:

1. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal responsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism, switching mechanism also controlled by said selector mechanism, signal responsive means for disabling said printing mechanism and for conditioning said switching mechanism to be operated, and means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel.

2. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal responsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism, switching mechanism also controlled by said selector mechanism, signal responsive means for disabling said printing mechanism and for conditioning said switching mechanism to be operated, means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel, and means controlled by said selector mechanism for restoring said other telegraph stations to non-responsive condition.

3. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal responsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism, switching mechanism also controlled by said selector mechanism, signal responsive means for disabling said printing mechanism and for conditioning said switching mechanism to be operated, means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel, and means controlled by said switching mechanism for restoring said other telegraph stations to non-responsive condition.

4. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal re-

sponsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism, switching mechanism also controlled by said selector mechanism, signal responsive means for disabling said printing mechanism and for conditioning said switching mechanism to be operated, means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel, and means controlled by said selector mechanism independently of said switching mechanism for restoring said other telegraph stations to non-responsive condition.

5. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal responsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism, switching mechanism also controlled by said selector mechanism, means normally effective to disable said printing mechanism and to condition said switching mechanism to be operated, means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel and for disabling said switching mechanism, and means controlled by said selector mechanism for restoring said other telegraph stations to unresponsive condition and for restoring said switching mechanism to operative condition.

6. In a communication system, a communication channel, means for impressing telegraph signals on said channel, a plurality of telegraph stations associated with said channel, a signal responsive selector mechanism at one of said stations, telegraph message printer mechanism controlled by said selector mechanism switching mechanism also controlled by said selector mechanism, means normally conditioned to disable said printing mechanism and to condition said switching mechanism to be operated, means controlled by said switching mechanism for qualifying others of said telegraph stations to receive signals impressed on said channel, and means controlled by said qualifying means for disabling said switching means and for maintaining said printing means disabled.

7. In a communication system, a communication line, means for impressing telegraph signals on said line, a plurality of signal repeating devices in said line, a plurality of telegraph stations each having signal responsive means controlled by one of said signal repeating devices, a telegraph message printing mechanism controlled by each of said signal responsive means, means at one of said stations for suppressing response of the printing mechanism thereat to its signal responsive means, and means controlled by the signal responsive means at said one station for controlling the signal responsive operation of the signal repeating devices in said line other than that by which it is controlled.

8. In a communication system, a communication line, means for impressing telegraph signals on said line, a plurality of signal repeating devices in said line, a plurality of telegraph stations each having signal responsive means controlled by one of said signal repeating devices, a telegraph message printing mechanism controlled by each of said signal responsive means, means at one of said stations for suppressing response of the printing mechanism thereat to its signal responsive means, and means controlled by the signal responsive means at said one station only when said suppressing means has operated for controlling the signal responsive operation of the signal repeating devices in said line other than that by which it is controlled.

9. In a communication system, a communication line, means for impressing telegraph signals on said line, a plurality of signal repeating devices in said line, a plurality of telegraph stations each having signal responsive means controlled by one of said signal repeating devices, a telegraph message printing mechanism controlled by each of said signal responsive means, means at one of said stations for suppressing response of the printing mechanism thereat to its signal responsive means, and means controlled by the signal responsive means at said one station for selectively rendering responsive or unresponsive to telegraph signals the signal repeating devices in said line other than that which controls the signal responsive means at said one station.

10. In a communication system, a communication line, means for impressing marking and spacing signals on said line, a telegraph station associated with said line having signal responsive means, a selector mechanism controlled by said signal responsive means, and a telegraph message printing mechanism controlled by said selector mechanism, means at said station for recognizing spacing signals exceeding a predetermined duration, and means controlled by said recognizing means upon recognizing spacing signals exceeding a predetermined duration for rendering said printing mechanism unresponsive to said selector mechanism.

11. In a communication system, a communication line, means for impressing marking and spacing signals on said line, a plurality of telegraph stations associated with said line, signal responsive means at each of said stations, a telegraph message printing mechanism controlled by each of said signal responsive means, switching means at one of said stations for controlling the signal responsive means at others of said stations, means at said one station for recognizing spacing signals exceeding a predetermined duration, and means controlled by said recognizing means upon recognizing spacing signals exceeding a predetermined duration for rendering the printing mechanism unresponsive to the signal responsive means at said one station and for conditioning said switching means to be operated.

12. In a communication system, a communication line, means for impressing marking and spacing signals on said line, a telegraph station associated with said line having signal responsive means, a selector mechanism controlled by said signal responsive means, and a telegraph message printing mechanism controlled by said selector mechanism, means at said station for recognizing spacing signals exceeding a predetermined duration, means controlled by said recognizing means upon recognizing spacing signals exceeding a predetermined duration for rendering the printing mechanism unresponsive to the selector mechanism, and means controlled by said selector mechanism independently of said recognizing means for restoring said printing mechanism to responsive condition.

13. In a communication system, a communication channel, a plurality of telegraph equipments each having telegraph apparatus associated with said channel, including a signal controlled selec-

tor mechanism, switching means at one of said equipments controllable by the selector mechanism thereat, means associated with and controlled by said switching means for activating the telegraph apparatus at others of said equipments selectively, and means controlled by said last-mentioned means for disabling said switching means.

14. In a communication system, a communication line, means for impressing telegraph signals on said line, a plurality of telegraph stations associated with said line, signal responsive means at each of said stations, switching means at one of said stations controlled by the signal responsive means thereat, means controlled by said switching means for controlling others of said telegraph stations, means controlled by said last-mentioned means for disabling said switching means, and means controlled by the signal responsive means at said one station for disabling said switching means independently of the controlling means for said other stations.

15. In a communication system, a sending channel and a receiving channel, a transmitter associated with said sending channel, a receiver associated with said receiving channel, signal controlled switching means for controlling said receiving and said transmitter selectively, and means for disabling said receiver during intervals of signal responsive operation of said switching means to control said transmitter.

16. In a communication system, a sending channel and a receiving channel, a transmitter associated with said sending channel, a receiver associated with said receiving channel, signal controlled switching means for controlling said receiver and said transmitter selectively, signal responsive means for preliminarily conditioning said switching means to control said transmitter, and means controlled by said conditioning means for disabling said receiver during signal responsive operation of said switching means to control said transmitter.

17. In a communication system, a sending channel, a receiving channel, a transmitter associated with said sending channel, a first receiver associated with said receiving channel and responsive to all signals on said channel, switching means controlled by said first receiver, a second receiver associated with said receiving channel, means controlled by said switching means for controlling the response of said second receiver to signals on said receiving channel, means also controlled by said switching mechanism for controlling said transmitter, and means controlled by said first receiver for disabling said second receiver during intervals of operation of said switching means to control said transmitter.

18. In a communication system, a sending channel, a receiving channel, a transmitter associated with said sending channel, a first receiver associated with said receiving channel responsive to all signals on said channel, switching means controlled by said first receiver, a second receiver associated with said receiving channel, means controlled by said switching means for controlling the response of said second receiver to signals on said receiving channel, means also controlled by said switching mechanism for controlling said transmitter, means controlled by said first receiver for preliminarily conditioning said switching mechanism to control said transmitter, and means controlled by said conditioning means for disabling said second receiver during operation of said switching means to control said transmitter.

19. In a communication system, a sending channel, a receiving channel, a transmitter associated with said sending channel, a first receiver associated with said receiving channel and responsive to all signals on said channel, switching means controlled by said first receiver, a second receiver associated with said receiving channel, means controlled by said switching means for conditioning said second receiver to respond to signals on said receiving channel, means controlled by said switching means for starting said transmitter, other means also controlled by said switching means for stopping said transmitter, and means controlled by said first receiver independently of said switching means for disabling said second receiver.

20. In a communication system, a sending channel, a receiving channel, a transmitter associated with said sending channel, a first receiver associated with said receiving channel and responsive to all signals on said channel, switching means controlled by said first receiver, a second receiver associated with said receiving channel, means controlled by said switching means for conditioning said second receiver to respond to signals on said receiving channel, means also controlled by said switching means for controlling said transmitter, means controlled by said first receiver for preliminarily conditioning said switching means to control said transmitter, means controlled by said conditioning means for momentarily suspending response of said second receiver to signals on said receiving channel, and means controlled by said first receiver independently of said switching means and said conditioning means for terminating response of said second receiver to signals on said channel.

21. In a communication system, a sending channel and a receiving channel, a transmitter associated with said sending channel, a receiver associated with said receiving channel, signal controlled switching means for selectively activating said receiver and said transmitter, signal responsive means for preliminarily conditioning said switching means to control said transmitter, and means controlled by said conditioning means for depriving said switching means of activating capability with respect to said receiver whereby said switching mechanism may selectively activate said receiver or said transmitter in response to the same signal.

22. In a communication system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said sending channel, a normally deactivated receiver associated with said receiving channel, signal controlled switching means associated with said receiving channel, means normally selectively controllable directly by said switching means for activating said receiver, means normally selectively controllable indirectly by said switching means for activating said transmitter, means for conditioning said transmitter activating means to be directly controllable by said switching means, and means controlled by said conditioning means for depriving said switching means of control over said receiver activating means whereby said switching mechanism may selectively control said receiver activating means or said transmitter activating means in response to the same signal.

23. In a communication system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said send-

ing channel, a normally deactivated receiver and a normally activated signal responsive selector mechanism associated with said receiving channel, means controlled by said selector mechanism for selectively completing and activating any of a plurality of conductive paths, means normally directly associated with one of said paths for activating said receiver, means associable with said one path for activating said transmitter, means for associating said transmitter activating means with said path, and means controlled by said associating means for disassociating said receiver activating means from said path whereby either said transmitter activating means or said receiver activating means may be controlled over said one path.

24. In a communication system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said sending channel, a normally activated signal responsive selector mechanism associated with said receiving channel, means controlled by said selector mechanism for selectively completing and activating any of a plurality of conductive paths, means associable with one of said paths for activating said transmitter, means for associating said transmitter activating means with said path, and means controlled by said transmitter activating means upon operation thereof for deactivating said associating means.

25. In a communicatiton system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said sending channel, a normally deactivated receiver and a normally activated signal responsive selector mechanism associated with said receiving channel, means controlled by said selector mechanism for selectively completing and activating any of a plurality of conductive paths arranged in fan circuit formation, means normally directly associated with one of said paths for activating said receiver, means associable with said one path for activating said transmitter, means controlled by said signal responsive selector mechanism independently of said fan circuit paths for associating said transmitter activating means with said one of said fan circuit paths, and means controlled by said associating means for disassociating said receiver activating means from said one of said fan circuit paths whereby either said transmitter activating means or said receiver activating means may be controlled over said one of said fan circuit paths.

26. In a communication system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said sending channel, a normally deactivated receiver associated with said receiving channel, signal controlled switching means associated with said receiving channel, means selectively operable by said switching means for activating said receiver, means normally disassociated from said switching means for activating said transmitter, means for associating said transmitter activating means with said switching means, means controlled by said associating means for disabling said receiver, and means operable by said transmitter activating means for deactivating said associating means whereby said receiver is reactivated.

27. In a communication system, a sending channel and a receiving channel, a repeating relay associated with said receiving channel, said relay being normally biased to be unresponsive to signals on said channel, a receiver controlled by said repeating relay, a normally deactivated transmitter associated with said sending channel, signal controlled switching means associated with said receiving channel, means selectively operable by said switching means for reversing the bias on said relay whereby to render said relay responsive to signals on said receiving channel, means normally disassociated from said switching means for activating said transmitter, means for associating said transmitter activating means with said switching means, and means controlled by said associating means for restoring to said relay a bias rendering it unresponsive to signals on said receiving channel.

28. In a telegraph system, a communication channel, a transmitter associated with said channel, a plurality of telegraph receivers controllable over said channel by said transmitter having a plurality of selector elements, a plurality of pairs of normally open switching contacts to be controlled by said selector elements of at least one of said receivers, means for closing said contacts in accordance with the setting of said selector elements, a cyclically operable bail for operating said contact closing means, means for holding said contact closing means out of cooperative relation to said bail, means for disengaging said holding means from said contact closing means to establish cooperative relation of said contact closing means with said bail, means controlled by said contacts for causing others of said receivers to be rendered responsive to signals transmitted by said transmitter, and means associated with said contact closing means for cooperating with said holding means upon restoration of the holding means to effective position to effect restoration of said contact closing means to non-cooperative relation to said bail.

29. In a printing telegraph system, a communication channel, a transmitter associated with said channel, a plurality of telegraph receivers controllable over said channel by said transmitter having a plurality of selector elements, a plurality of pairs of normally open switching contacts to be controlled by said selector elements of at least one of said receivers, means for closing said contacts in accordance with the setting of said selector elements, a cyclically operable bail for operating said contact closing means, a lever operable from one to the other of two positions, means associated with said lever and effective when said lever is in one of said positions for holding said contact closing means out of cooperative relation to said bail, means for operating said lever to the other position to retract said holding means from holding relation to said contact closing means whereby to establish cooperative relation of said contact closing means to said bail, means controlled by said contacts for causing others of said receivers to be rendered responsive to signals transmitted by said transmitter, means for restoring said lever to said one position, means associated with said contact closing means for cooperating with said lever in said restored position to modify the movement imparted by said bail to said contact closing means whereby said contact closing means is restored to non-cooperative relation to said bail, and means for restoring said holding means to holding relation to said contact closing means.

30. In a telegraph system, a communication channel, a transmitter associated with said channel, a plurality of telegraph receivers controllable over said channel by said transmitter having a plurality of selector elements, a plu-

rality of pairs of normally open switching contacts to be controlled by said selector elements of at least one of said receivers, means for closing said contacts in accordance with the setting of said selector elements, a cyclically operable bail for operating said contact closing means, a lever operable from one to the other of two positions, yieldably mounted means carried by said lever and effective when said lever is in one of said positions for holding said contact closing means out of cooperative relation to said bail, means for operating said lever to the other position to retract said yieldably mounted holding means from holding relation to said contact closing means whereby to establish cooperative relation of said contact closing means to said bail, means controlled by said contacts for causing others of said receivers to be rendered responsive to signals transmitted by said transmitter, means for restoring said lever to said one position, said holding means engaging said contact closing means in non-holding relation and yielding to accommodate said restoration of said lever, and a cam member carried by said contact closing means, said cam member having a sloping cam surface for engaging said lever in said restored position to modify the movement imparted by said bail to said contact closing means whereby said contact closing means is restored to non-cooperative relation to said bail and said yieldably mounted holding means is thrust into holding relation to said contact closing means.

31. In a printing telegraph system, a communication channel, a transmitter associated with said channel, a plurality of telegraph receivers controllable over said channel by said transmitter having a plurality of selector elements, a plurality of printing elements individually selectable by said selector elements, cyclically operable means for actuating said printing elements upon selection, means associated with at least one of said receivers for withholding operation of said printing element actuating means, a plurality of pairs of normally open switching contacts to be controlled by said selector elements of said receiver having said withholding means, means for closing said contacts in accordance with the setting of said selector elements, cyclically operable means for operating said contact closing means, means for holding said contact closing means out of cooperative relation with said second-mentioned cyclically operable means, means for disengaging said holding means from said contact closing means to establish cooperate relation of said contact closing means to said second-mentioned cyclically operable means and for operating said withholding means for said printing element actuating means, means controlled by said contacts for causing others of said receivers to be rendered responsive to signals transmitted by said transmitter, and means associated with said contact closing means for cooperating with the holding means therefor upon deactivation of said disengaging means for effecting restoration of said contact closing means to non-cooperative relation to said second-mentioned cyclically operable means.

32. In a telegraph system, a communication channel, a transmitter associated with said channel, a plurality of telegraph receivers controllable over said channel by said transmitter having a plurality of selector elements, a plurality of pairs of normally open switching contacts to be controlled by said selector elements of at least one of said receivers, means for closing said contacts in accordance with the setting of said selector elements, cyclically operable means for operating said contact closing means, means for holding said contact closing means out of cooperative relation with said cyclically operable means, means for disengaging said holding means from said contact closing means to establish cooperative relation of said contact closing means to said cyclically operable means, means controlled by said contacts for causing others of said receivers to be rendered responsive to signals transmitted by said transmitter, and means associated with said contact closing means for cooperating with the holding means therefor upon deactivation of said disengaging means for effecting restoration of said contact closing means to non-cooperative relation to said cyclically operable means.

33. In a communication system, a sending channel and a receiving channel, a normally deactivated storage type transmitter associated with said sending channel, a signal responsive selector mechanism associated with said receiving channel, switching mechanism controlled by said selector mechanism, means selectively operable by said switching mechanism for activating said transmitter, and means associated with said transmitter for deactivating said transmitter activating means upon completion of transmission of the signals stored in said transmitter.

34. In a communication system, a sending channel and a receiving channel, a normally deactivated storage type transmitter associated with said sending channel, a signal responsive selector mechanism associated with said receiving channel, switching mechanism controlled by said selector mechanism, means selectively operable by said switching mechanism for activating said transmitter, means associated with said transmitter for deactivating said transmitter activating means upon completion of transmission of the signals stored therein, and means selectively operable by said switching mechanism for deactivating said transmitter activating means independently of the deactivating means associated with said transmitter.

35. In a communication system, a sending channel and a receiving channel, a normally deactivated transmitter associated with said sending channel for transmitting signals from a perforated signal storage tape, means for perforating signals in said tape preparatory to transmission of said signals, a signal responsive selector mechanism associated with said receiving channel, switching mechanism controlled by said selector mechanism, means selectively operable by said switching mechanism for activating said transmitter, means associated with said transmitter for deactivating said transmitter activating means upon completion of transmission of the signals stored in a tape severed from said perforating means whereby to stop said transmitter, and means associated with said transmitter for stopping said transmitter without deactivating said transmitter activating means upon exhausting the slack in a tape unsevered from said perforating means.

36. In a communication system, a sending channel and a receiving channel, one or more normally deactivated transmitters associated with said sending channel, one or more normally deactivated receivers associated with said receiving channel, a normally activated receiving selec-

tor mechanism also associated with said receiving channel, means controlled by said selector mechanism for selectively completing and activating a plurality of conductive paths, means operable over individual ones of said paths for controlling said one or more receivers individually, means for controlling said one or more transmitters individually, means controlled by said selector mechanism for preparing said transmitter controlling means to be operated over others of said paths, means for restoring said preparing means to unoperated condition, and means operable by said preparing means for associating said restoring means with all unassigned ones of said paths and all assigned ones of said paths exclusive of those over which said transmitter controlling means are operable but including those over which said receiver controlling means are operable whereby to effect restoration of said preparing means upon completion and activation of any of said paths exclusive of those over which said transmitter controlling means are operable.

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