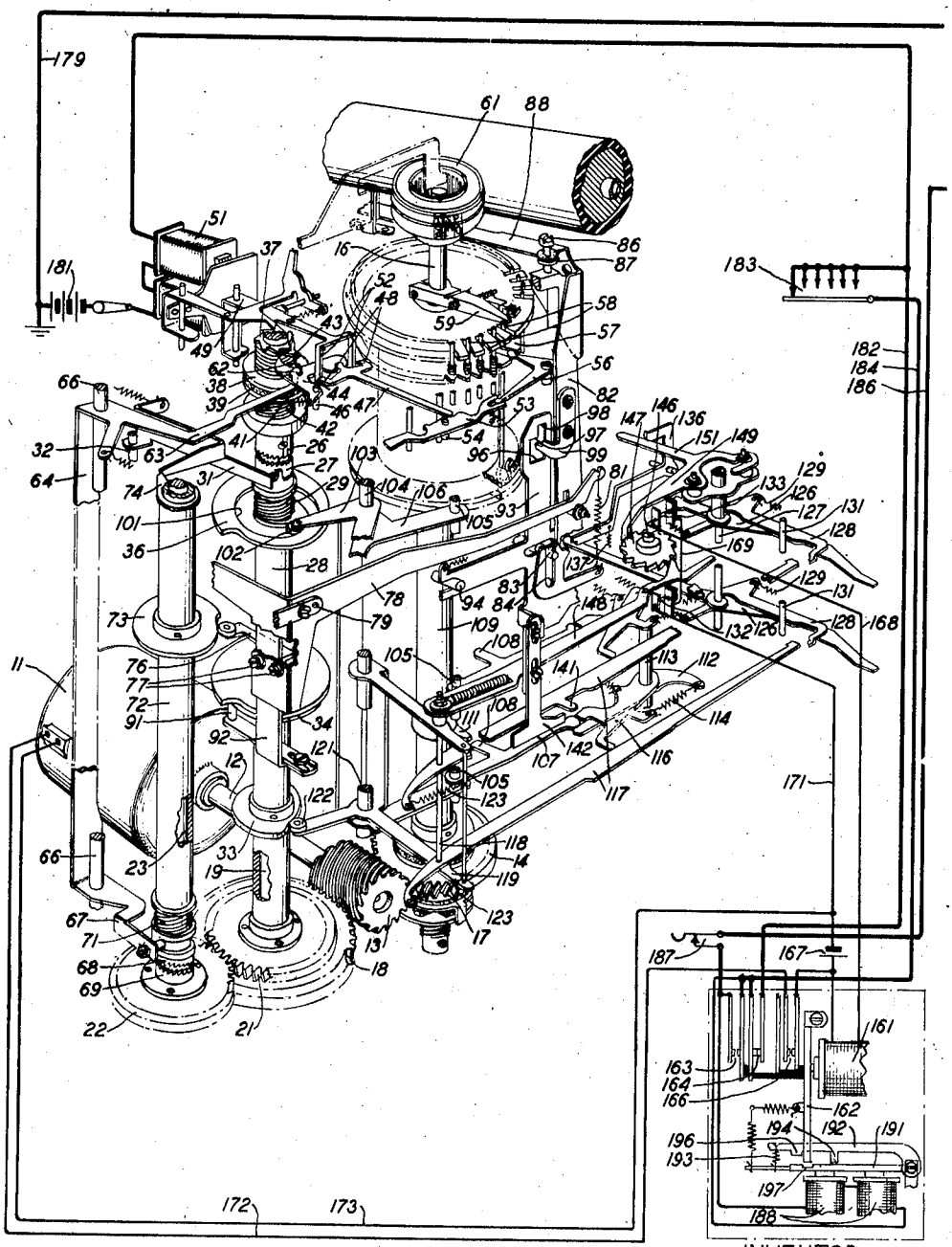
March 21, 1944. B. S. SWEZEY 2,344,792

MOTOR CONTROL MECHANISM FOR PRINTING TELEGRAPH APPARATUS

Filed Nov. 27, 1941 2 Sheets-Sheet 1

FIG. 1




INVENTOR
B. S. SWEZEY
BY J. W. Schmied
ATTORNEY

March 21, 1944. B. S. SWEZEY 2,344,792

MOTOR CONTROL MECHANISM FOR PRINTING TELEGRAPH APPARATUS

Filed Nov. 27, 1941 2 Sheets-Sheet 2

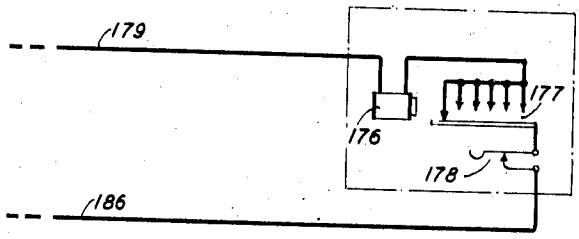
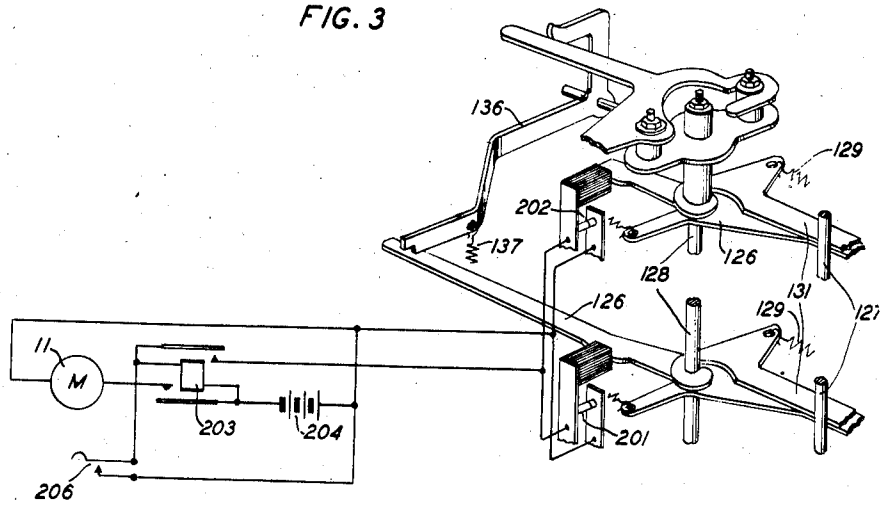



FIG. 2

FIG. 3




INVENTOR
B. S. SWEZEY
BY
J. W. Schmied
ATTORNEY

Patented Mar. 21, 1944 2,344,792

# UNITED STATES PATENT OFFICE

2,344,792

## MOTOR CONTROL MECHANISM FOR PRINTING TELEGRAPH APPARATUS

Burdette S. Swezey, Floral Park, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 27, 1941, Serial No. 420,608

22 Claims. (Cl. 178—23)

This invention relates to printing telegraph apparatus and particularly to signal responsive control mechanism for the driving motors of telegraph signal receiving printers.

An object of the invention is to improve the reliability of operation and to guard against the accidental or unintentional operation of remote motor-stop control mechanism.

A feature of the invention is that the reception of three signaling code combinations, none of which involves operation of the spacing mechanism of the receiving printer is required to effect the operation of the motor-stop control mechanism, and if any signal involving the operation of the spacing mechanism is received prior to reception of the third code combination, the motor-stop circuit control mechanism is disabled.

According to a preferred embodiment of the invention, a telegraph signal receiving printer has a driving motor, the power supply circuit of which includes a pair of circuit controlling contacts. The power supply circuit for the operating motor is complete when the contacts are in closed condition and the opening of the contacts to stop the motor is effected by an electromagnet, the energizing circuit of which includes two pairs of normally opened contacts. The magnet controlling contacts are closable by individual function levers of the receiving printer, which are operated in response to individual received signals. One of the two function levers is operable in response to its assigned signal, only when the receiving printer is in the upper case or figures shift condition so that two signals are required to effect the operation of that function lever, namely the figures shift signal, preceding the specific function lever signal. The closure of the contacts controlled by that function lever is only momentary.

The other function lever is directly responsive to its assigned signal irrespective of the case shift condition of the receiving printer and a latch is provided for holding the contacts closed.

The character spacing mechanism of the receiving printer includes a rotatable spacing shaft which is operated in step-by-step manner for character spacing and which has secured thereto a ratchet with which a check pawl cooperates. As is the case in all ratchet and check pawl structures, the ratchet, upon being rotated in step-by-step manner, cams the check pawl outwardly from the axis of the ratchet as the apex of a ratchet tooth moves along the pawl and escapes from its checking edge, and upon the escape of the tooth apex, the pawl drops into the next notch of the ratchet. The present invention takes advantage of this rocking of the check pawl by the ratchet in that a release or trip element for the latching mechanism associated with the latchable contact operating function lever is associated with the check pawl and upon any rocking of the check pawl by the ratchet following the latching of the contact operating function lever, the latch is tripped or released and the function lever is permitted to return to normal position, thus permitting the contacts controlled by it to reopen.

With the foregoing arrangement, the motor-stop control magnet can become energized only upon the reception of three code combinations, namely, the code to which the latchable function lever responds, the figures shift code and the code to which the momentarily operable function lever responds. In the event that an operator, having placed a receiving printer in the figures shift condition by the transmission of the figures shift signal, accidentally transmits the motor-stop function signal, which is the signal to which the momentarily operable function lever responds, the operating motor of the receiving printer will not be stopped because the contacts controlled by the latchable function lever have not been closed and it is extremely unlikely that the signal for operating the latchable function lever will have been accidentally or unintentionally transmitted in combination with the figures shift signal and the motor stop signal, so that the latchable function lever would not ordinarily be latched in the operated condition preceding the operation of the momentarily operable function lever, except by express intention. With the character spacing mechanism being arranged to release the latchable function lever, any signal which effects the operation of the character spacing mechanism received when the latchable function lever is in latched condition, will cause that function lever to be unlatched and the contacts which it controls will accordingly be opened. Thus if the signal which controls the latchable function lever is transmitted either intentionally or unintentionally, and thereafter a signal involving character spacing is transmitted, the latchable function lever will be unlatched incident to the operation of machine as result of reception of the signal which involves character spacing. The latchable function lever does not become unlatched upon the reception of the figures shift code because that code does not produce a character spacing operation.

A magnet controlled latch is provided for holding the armature of the motor-stop control mag-

net in the operated condition, so that the motor-stop control contacts will remain opened after the motor-stop control magnet has become deenergized, since its circuit is closed only momentarily due to the fact that the motor-stop function lever is a momentarily operable lever. The latching magnet remains energized until a motor start signal is received and the effect of this signal is to release the latching magnet which in turn unlatches the armature of the motor-stop control magnet and permits the motor-stop contact to be reclosed.

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 in which:

Fig. 1 is a diagrammatic perspective view of a telegraph signal receiving printer having motor-stop contact control mechanism according to the present invention, together with a schematic electrical circuit view showing the motor-stop and motor-start magnet circuits and associated motor power supply circuit;

Fig. 2 is a diagrammatic view of a remote signal transmitting station; and,

Fig. 3 is a combined fragmentary diagrammatic perspective view and schematic electrical circuit view of an alternative embodiment of motor-stop control system.

Referring now to the drawings and particularly to Fig. 1, there is shown in that figure the principal elements of a telegraph signal receiving printer of the type shown in Patent 2,247,408, granted July 1, 1941, to A. H. Reiber. The disclosure of this patent is incorporated herein by reference as part of the present specification. The printer shown in Fig. 1 has a driving motor 11, the shaft 12 of which carries a pinion gear 13. Pinion 13 meshes with a gear 14 sleeved on a type-wheel shaft 16 and interconnected with the shaft 16 through a friction clutch assembly 17. Pinion 13 also meshes with a gear 18 which is secured to a shaft 19 to which continuous rotation is imparted by gear 18 from motor 11. A gear 21 is secured to gear 18 and there is meshed with the gear 21, a gear 22 which is secured to a shaft 23. The shafts 16, 19 and 23 perform all of the mechanical operations in the receiving printer.

Shaft 19 has secured thereto the driving portion 26 of a positive clutch with which a driven portion 27 slidable on shaft 19 is engageable. Driven clutch portion 27 is slidably keyed to a cam assembly sleeve 28, is urged to move into engagement with driven portion 26 by compression spring 29 and is normally restrained from engagement with driven portion 26 by a clutch throw-out lever 31 pivoted at 32. Cam assembly sleeve 28 has secured thereto a function bail cam 33, a type-wheel elevating control cam 34 and a combined printing and operating bail cam 36.

At its upper end the shaft 19 has sleeved thereon a selector cam assembly 37 which is driven by shaft 19 through a friction clutch assembly including flanges 38 secured to cam assembly 37, friction discs 39 and discs 41 secured to shaft 19. A compression spring 42 compresses the friction discs 39 between the discs 41 carried by shaft 19 and the flanges 38 of cam assembly 37 and develops a gripping force tending to cause the cam assembly 37 to rotate with shaft 19.

The cam assembly 37 has a plurality of spirally arranged cam projections 43 which serially impart counter-clockwise rocking movement to individual sword-lever bell cranks 44 pivoted at 46. Each of the sword-lever bell cranks 44 has articulated thereto a selector sword-lever 47 which has spaced abutment arms 48. A selector lever 49 which is controlled by a selector magnet 51 is provided with depending arms 52, the distance between which is less than the distance between the abutment arms 48 of sword lever 47, so that when selector lever 49 is in extreme counter-clockwise position, its right-hand depending arm 52 will be in alignment with the right-hand abutment arms 48 of all of the sword levers 47 and its left-hand depending arm 52 will be out of alignment with the left-hand arms of all of the sword levers 47. When selector lever 49 moves into extreme clockwise position, its left-hand depending arm 52 comes into alignment with the left-hand abutments 48 of all of the sword levers 47 and its right-hand depending arm 52 moves out of alignment with the right-hand abutment 48. When selector lever 49 is in extreme counter-clockwise position and a sword-lever bell crank 44 is operated, its associated sword lever 47 will be retracted leftwardly as viewed in Fig. 1 and the sword lever 47 will be moved into extreme clockwise position, whereas if the selector lever 49 is in extreme clockwise position, the sword lever 47 will be moved into extreme counter-clockwise position, which is the position shown in Fig. 1.

Each of the sword levers 47 cooperates at its foremost or free end with a transfer lever 53 which is pivoted at 54 and is rocked into extreme clockwise position when its associated sword lever 47 is restored to normal position after having been retracted by bell crank 44 and rocked into extreme counter-clockwise position by selector lever 49. Conversely a transfer lever 53 is rocked into extreme counter-clockwise position when its associated sword lever 47 is returned to normal position after having been rocked into extreme clockwise positions by selector lever 49. Each of the transfer levers 53 is articulated to one arm of a code disc bell crank lever 56, the other arm of which is articulated to a code disc 57.

There are as many of the code discs 57 as there are significant impulses in the code combinations to be received by the printer, which in well-known types of printing telegraph apparatus is five or six code impulses, and code discs are arranged in a stack coaxially of the type-wheel shaft 16, the shaft 16 extending through the assembly of code discs. The code discs 57 are notched permutationally around their edges to control the selection of a plurality of selectable pins 58. When an alignment of notches in the code discs 57 is presented to one of the pins 58, the upper end of the pin is permitted to move inwardly radially of the code discs into the path of a type-wheel stop arm 59 carried by and secured to type-wheel shaft 16. Rotation is imparted to type-wheel shaft 16 through the friction clutch assembly 17 from gear 14 and when stop arm 59 encounters a selected pin 58, the arm is arrested, thus arresting shaft 16. Type-wheel shaft 16 has slidably keyed near the upper end thereof a type wheel 61. The orientation of type wheel 61 with respect to stop arm 59 is such that when arm 59 is arrested in position to effect the selection of a particular character for printing, that character on the periphery of the type wheel is presented in printing position.

In addition to the cam projections 43, the selector cam assembly also has a cam projection 62 for rocking in clockwise direction an arm 63 carried by a clutch throw-out lever 64 pivoted at

66. Lever 64 has at its lower end a clutch throw-out arm 67 which cooperates with the driven portion 68 of a positive clutch mechanism carried by the shaft 23. The driving portion 69 of the clutch mechanism is positively connected to gear 22. Driven portion 68 of the clutch is slidable axially of shaft 23 under the influence of a compression spring 71 for engagement with driving portion 69, is normally restrained from engagement with the driving portion by clutch throw-out arm 67 and is slidably keyed to a cam sleeve 72 carried by shaft 23.

Cam sleeve 72 has secured thereto a type-wheel elevating cam 73 and a cam 74 for rocking clutch throw-out lever 31 in clockwise direction to permit the engagement of driven clutch element 27 with driving clutch element 26 carried by main shaft 19. The orientation of cam 74 on sleeve 72 is such that the cam operates clutch throw-out lever 31 near the end of a revolution of sleeve 72. It should be noted that the orientation of cam projection 62 on selector cam assembly 37 is such that it rocks clutch throw-out lever 64 near the end of a revolution of the selector cam assembly 37 and therefore about the time that the last of the sword levers 47 has been set in selective position under the control of selector lever 49.

Type-wheel elevating cam 73 is engaged by a follower arm 76 secured by means of screws 77 to a lever 78 pivoted at 79. At its free end the lever 78 is connected by a tension spring 81 to a type-wheel supporting frame 82 which is movable vertically and is guided by pin 83 disposed in slot 84 and by stud 86 extending through boss 87. The type-wheel supporting frame 82 has at the top thereof a horizontally disposed platform 88 which engages the hub of type-wheel 61 and moves the type-wheel upwardly and downwardly on shaft 16 as frame 82 is lifted and lowered.

When sleeve 72 is rotating after having been released for rotation by clutch throw-out lever 64, the cam 73 operates upon follower arm 76 to rock lever 78 in counter-clockwise direction, thus tending to distend tension spring 81. The spring 81 acts upon type-wheel supporting frame 82 to lift the type-wheel 61 to bring the type elements carried on its periphery into printing position.

At the time that cam 73 has rocked lever 78 into extreme clockwise position, cam 74 operates clutch throw-out lever 31 to permit engagement of driven clutch portion 27 on main shaft 19 with driving portion 26 whereby rotation is imparted to main cam assembly sleeve 28. Cam 34 carried by sleeve 28 has in its under surface a channel which is entered by a cam follower 91 carried by a cam follower lever 92 which is also secured to lever 78. In the rest position of cam 73, the apex thereof has moved out of engagement with follower arm 76 so that lever 78 seeks to return to extreme clockwise position. However, the time of initiation of rotation of cam sleeve 28 is such with respect to the rotation of cam sleeve 72 that before cam 73 comes to rest, the channel in cam 34 assumes control over lever 78 and holds the lever in extreme counter-clockwise position. Lever 78 is held in this position until printing from type-wheel 61 has been accomplished under the control of printing cam 36, as is fully disclosed in the hereinbefore identified patent, whereupon the channel in cam 34 permits lever 78 to return to extreme clockwise position and controls the return of the lever to this position so that such return is not violent.

Since the type-wheel 61 has two rows of type faces around the periphery thereof, it is necessary to stop the upward movement of type-wheel 61 when the type-wheel has reached either of two elevational positions to present the proper row of type faces in printing position. This is controlled by a slide 93 which is slidably mounted on pins 83 and 94. Slide 93 is provided with a stepped aperture 96 which affords two arrestment surfaces 97 and 98 for an arm 99 secured to type-wheel supporting frame 82 and extending into aperture 96. The movement of slide 93 from one to the other of its two positions to bring stop surface 97 or 98 into the path of arm 9, is controlled by the shift and unshift mechanism of the printer, as is fully disclosed in the Reiber patent. When the upward movement of type-wheel supporting frame 82 is arrested by stop surface 97, the type-wheel will be arrested in its vertical movement with the upper row of type faces presented in printing position and this is the so-called unshift or letters position. When frame 82 is arrested by stop surface 98, the type-wheel is arrested in position to present the lower row of type faces in the printing position and this is the shift or figures position. The movement imparted to lever 78 by cam 73 is somewhat more than enough to lift the type-wheel to its upper position of arrestment and spring 81 yields when the type-wheel is arrested in either of its two elevational positions.

The printing cam 36 has in the upper surface thereof a channel 101 in which is disposed a cam follower 102 carried by a lever 103 pivoted on a rod 104. Lever 103 has associated therewith an arm 106 which carries a pivot rod 105 which supports a plurality of vertically spaced floating levers 107. Each of the floating levers 107 has an arm 108 extending toward type-wheel shaft 16 and a sleeve 109 carried by and secured to the type-wheel shaft 16 has a plurality of abutment pins 111 in various angular positions corresponding to selective stop positions of the type-wheel at which functions are to be selected. In a selective position of the type-wheel corresponding to the selection of a function, one of the abutment pins 111 is aligned with the arm 108 of one of the floating levers 107.

The free end of each of the floating levers 107 is disposed at the left side of one arm of a lever 112 which is pivoted at 113 and is connected by a tension spring 114 to a lever 116 also pivoted at 113. Each of the levers 116 has its free end in abutment with a function bar 117 and all of the function bars 117 are pivotally supported by a rod 118 carried by the right-hand arm of a bell crank 119 pivoted at 121. The left-hand arm of bell crank 119 has at its free end a cam follower roller 122 which engages function cam 33. The function bars 117 are biased by tension springs 123 into engagement with the free ends of levers 116.

Mounted at the rear or free ends of function bars 117 is an assembly of function levers 126 pivoted on rod 127. In close proximity to each of the function levers 126 is a latch lever 128 also pivoted on rod 127 and having its right-hand end curved forwardly to extend toward the free end of the associated function bar 117 at the right-hand side thereof. Each of the latch levers 128 is biased in clockwise direction by a spring 129 and a stop pin 131 determines the idle or rest position of the latch lever 128.

For the purposes of the present invention, the

lower function lever 126 is arranged to close a pair of normally open contacts 132 and the upper function lever 126 is arranged to close a pair of normally open contacts 133.

For the purpose of illustrating the operation of the function mechanism, let it be assumed that a code combination has been received which will cause the selection of a type-wheel stop pin 58 to arrest the type-wheel in position to effect the selection of the lower function bar 117. Near the end of the rotation of selector cam assembly 37 clutch throughout lever 64 will be operated to permit the engagement of the positive clutch which comprises clutch elements 68 and 69 on the front shaft of the printer. Rotation will be imparted to cam sleeve 72 and cam 73 will rock lever 78 in counter-clockwise direction to effect the elevation of type-wheel 61 to printing position. Since the selection of a function is ordinarily not accompanied by the printing of a character, the type-wheel will have a blank or non-printing element presented to the printing mechanism, when the rotation of the type-wheel is arrested by the particular pin 58 selected.

By the time the front cam sleeve 72 has completed its cycle of rotation and cam 74 has operated clutch throw-out lever 31, type-wheel 61 will have rotated to the new selected position and will have been arrested. Upon the operation of clutch throw-out lever 31, the positive clutch comprising clutch elements 26 and 27 on the main shaft will become engaged and rotation will be imparted to the main cam assembly sleeve 28. Printing is controlled by a cam follower (not shown) which engages the periphery of printing cam 36 but since a blank portion of the type-wheel 61 is presented to the printing mechanism, no character will be printed. About the time that the printing operation occurs, cam groove 101 in cam 36 rocks bell crank 103 sharply in counter-clockwise direction and then restores it to extreme clockwise position. Since the floating levers 107 are carried by the free end of arm 106 of bell crank 103, the foremost or left-hand ends of the floating levers 107 will be moved through an arc in counter-clockwise direction. Those which find no type-wheel shaft abutment pins 111 aligned with their arms 108 will rock idly about the point of engagement of the free ends with their associated levers 112 and will not impart movement to those levers. With an abutment pin aligned with the arm 108 of the lowermost of the floating levers 107 as shown in Fig. 1, the arm 108 will be brought into engagement with the abutment pin 111 which will serve as a fulcrum for that particular floating lever 107 and as the counter-clockwise movement of the foremost or left-hand end of the lever 107 continues, the lever will be rocked in clockwise direction upon the end of the abutment pin 111 as a fulcrum and the free end will be moved to the right as viewed in Fig. 1, thus rocking the associated lever in counter-clockwise direction. Due to the interconnection of levers 112 and 116 by tension spring 114, the lever 116 will also be rocked in counter-clockwise direction and will rock the associated function bar 117 in clockwise direction if the function lever 117 is not then blocked against clockwise rotation under circumstances which will be described later. It should be noted that if the function bar is blocked at this time the associated lever 116 will also be blocked and spring 114 will yield and take up the motion of lever 112.

Assuming that the lowermost function bar 117 is not blocked at this time, its free end will more rightwardly. About the time that floating levers 107 are operated, which operation is momentary, cam 33 starts to rock bell crank 119 counter-clockwise to move function bars 117 endwise rearwardly (rightwardly as viewed in Fig. 1). Just as the floating levers become fully operated the free ends of function bars 117 move past the ends of the forwardly curved portions of latches 128. The selected one of the bars 117, in the present description the lowermost, has its free end to the right of the end of the latch, while the unselected bars have their free ends to the left of their latches. The selected bar is now blocked out of normal position by its latch 128, and cam groove 106 restores the floating levers 107 to normal. If the timing of the operation of floating levers 107 and of the reciprocation of bars 117 should be so close that the free end of a bar 117 which is being selected should strike the end of its latch, this will not prevent the latching of the bar 117, because the free end of the latch is cut on a diagonal, and the bar 117 will continue to be moved reciprocably and clockwise, camming latch 128 in counterclockwise direction sufficiently for the free end of bar 117 to clear the forwardly extending portion of the free end of latch lever 128. As soon as the free end of function bar 117 has moved to the right of the forwardly extending free end of latch 128, the latch will be restored by spring 129 to normal position in engagement with stop pin 131 with its forwardly extending end to the left of the free end of function bar 117 and blocking the return of that bar to normal position. The operation of floating levers 107 need be only of sufficient duration to insure that a function bar 117 associated with a floating lever 107 which finds an abutment pin 111 presented to it will become latched by its associated latch 128.

As cam sleeve 28 rotates, cams 34 and 33 also rotate. The cam 34 which has assumed control of the type-wheel elevating lever 78 by means of the follower 91 holds the type-wheel in elevated position until after the printing mechanism has been operated under the control of cam 36 and thereafter permits lever 78 to return to normal position in a smooth steady motion spread over a considerable portion of the cycle of rotation of cam 34. Cam 33 has a gentle rise and a sharp drop-off near the end of its cycle of rotation and during the major portion of the cycle of rotation of cam 33, it rocks bell crank 119 in a smooth gentle motion in counter-clockwise direction thus reciprocating the function bars 117 endwise toward their function levers 126. The function levers 126 have an offset immediately to the left of the free ends of the latches 128 so that function bars 117 which have not been selected and latched will impart no movement to their associated function levers 126. A selected function bar, which has been assumed to be the lowermost bar 117 shown in Fig. 1, upon being moved endwise encounters and rocks its associated function lever 126 in counter-clockwise direction whereby the left-hand end of the lowermost lever 126 will close contacts 132.

In accordance with the present embodiment of the invention, the left-hand arm of the lower function lever 126 extends beyond the contacts 132 and near its free end the undercut end of a latching bell crank 136 rests upon the lower function lever 126. Latching bell crank 136 is biased in counter-clockwise direction by tension spring 137 and when the function lever 126 is rocked

in counter-clockwise direction by its function bar 117, the undercut portion of latching bell crank 136 drops into blocking relation to the left-hand arm of the lower function lever 126 thus latching the function lever in operated or extreme counter-clockwise position and maintaining contacts 132 closed.

The upper function lever 126 which is selectable in similar manner by an abutment pin 111 in a different angular position on the type-wheel sleeve 109, is not provided with a latch and accordingly the contacts 133 are closed only momentarily for the reason that when cam follower roller 122 drops off the apex of function cam 33, bell crank 119 returns to normal position and retracts the function bars 117 to their normal or unoperated position.

The upper function bar 117 is provided with a laterally projecting finger 141 adjacent to which is disposed in a plane just clear of the end of finger 141 when the function bar is in normal position, a blocking plate 142 carried by an arm extending downwardly from the shift and unshift controlling slide 93. When the printer is in the shift condition with the shift controlling slide 93 in extreme left-hand or forward position to present the upper stop surface 98 in the path of stop arm 99 carried by type-wheel supporting frame 82, function blocking plate 142 is disposed to the left of the end of finger 141 of the upper function bar 117 out of blocking relation thereto. However, when the printer is in the unshift condition with the shift controlling slide 93 in its right-hand or rearward position, so that the lower stop surface 97 is in the path of stop arm 99, plate 142 will have moved into the path of arcuate movement of finger 141 of the upper function bar 117 so that the function bar will be blocked and cannot be rocked clockwise by its floating lever 107 and latched by its latching lever 128. It follows from this that when the printer is in the unshift condition, the upper function bar 117 which controls the operation of the non-locking contact 133 cannot be selected and operated and that a figures shift signal must have been received and have placed the printer in the shift condition in order for the contacts 133 to be operated.

The character spacing mechanism of the receiving printer shown in Fig. 1 includes a pinion shaft 146 which, as is fully disclosed in the Reiber patent, steps the platen carriage by means of a pinion carried by shaft 146 meshing with a rack carried by the platen carriage, a spacing ratchet 147 carried by the pinion shaft 146, and a spacing pawl 148 for operating ratchet 147, pivotally supported by the rod 118 which supports function bars 117 so as to be reciprocable by bell crank 119 operated by function cam 33. A holding or check pawl 149 engages ratchet 147 and prevents reverse rotation of the ratchet when pawl 148, having advanced the ratchet one step, is retracted to pick up the next tooth on the ratchet 147 in preparation for the next character spacing operation. Check pawl 149 holds ratchet 147 by entering the space between two teeth of the ratchet.

It will be apparent that when ratchet 147 is advanced one step by spacing pawl 148, the check pawl 149 is cammed through a small angular distance in clockwise direction as the tooth next to the space in which the free end of pawl 149 is disposed passes the free end of the pawl, whereupon pawl 149 returns to extreme counter-clockwise position with its free end disposed in the next space. Advantage is taken of this slight rocking of check pawl 149 to release latch 136 for the lower function lever 126, by the attachment to the check pawl 149 of a latch tripping lever arm 151. When latch 136 is not in blocking relation to the lower function lever 126, its upwardly extending arm is held out of engagement with tripping lever 151 and arm 151 engages it only near the end of the stroke of check pawl 149 and lifts latch 136 clear of the lower function lever 126, which at this time is an idle operation. The latching of the lower function lever 126 is accompanied by a slight counter-clockwise movement of latch 136, which brings the end of its upwardly extending arm substantially into engagement with arm 151 carried by check pawl 149. After the lower function lever 126 has become latched, the next operation of the receiving printer which involves character spacing, will cause the check pawl 149 to rock latch 136 free of the lower function lever 126, permitting the function lever to return to normal position and permitting contacts 132 to open. A character spacing operation takes place incident to the printing of any character and also in response to the word spacing signal combination. It ordinarily does not take place incident to functions such as shift, unshift, carriage return, line feed, motor stop, signal bell operation, and break, and as is fully disclosed in the Reiber patent, means is provided for moving the spacing pawl 148 clear of the spacing ratchet 147 incident to the selection of any function so that spacing will be suppressed when the function cam 33 operates bell crank 119, it being understood that spacing pawl 148 is reciprocated, each time that bell crank 119 is operated.

Contacts 132 and 133 are associated with motor control mechanism which may be of the type shown in Patent 1,964,268 granted June 26, 1934, to O. A. Morgenstern. The disclosure of that patent is incorporated herein by reference as a part of this specification. The motor control mechanism is shown in the lower right-hand corner of Fig. 1.

Referring now to that portion of Fig. 1, an electromagnet 161 has an armature 162 which controls three pairs of contacts 163, 164 and 166. When the armature 162 of electromagnet 161 is in the released position, contacts 163 and 166 are closed and contacts 164 are opened. Conversely when the armature of electromagnet 161 is in the attracted position, which is the condition shown, contacts 163 and 166 are opened and the contacts 164 are closed. The energizing circuit for electromagnet 161 extends from the positive terminal of battery 167 through the winding of electromagnet 161, conductor 168 to one of the normally opened contacts 133. The other of these contacts is connected by conductor 169 to one of the normally opened contacts 132 and the other of the contacts 132 is connected by conductor 171 to the negative terminal of battery 167. The contacts 132 and 133 are thus observed to be in series in the energizing circuit of electromagnet 161 and both pairs of contacts must be closed in order to complete the energizing circuit for the magnet.

The contacts 166 controlled by electromagnet 161 are the motor-control contacts and the right-hand one of the contacts 166 is connected to the positive terminal of battery 167 while the left-hand one of those contacts is connected through conductor 172, driving motor 11 and conductor 173 to the negative terminal of battery 167.

Let it be assumed that armature 162 of electro-

magnet 161 is in the released position so that contacts 166 are closed, and power is being applied to motor 11, through conductors 172 and 173 and that it is desired to stop motor 11 by the transmission of appropriate signals to selector magnet 51 of the receiving printer. The stopping of motor 11 is accomplished by the opening of contacts 166 through the energization of electromagnet 161, which necessitates the closure of contacts 132 and 133 in such manner that both pairs of contacts shall be closed at least for an instant sufficient to effect the energization of the electromagnet. It will be apparent that contacts 132 must be closed before the contacts 133 since the latter are non-locking and close only momentarily. The closure of contacts 132 necessitates the selection and operation of the lower function bar 117 and since the selection of this function bar is not restricted by the shift and unshift mechanism, it is always responsive to the reception of its assigned signal irrespective of the shift or unshift condition of the printer. According to one embodiment of the invention it has been proposed to make the lower function bar 117 responsive to the blank or all spacing signal. The blank signal function is ordinarily not restricted as to the shift or unshift condition of the printer but it could be restricted if desired for any reason so as to be selectable only in the shift condition or only in the unshift condition of the printer. Responsive to the blank or all spacing signals, the lower function bar 117 becomes selected and operated and contacts 132 become closed and are retained in this condition by latch 136.

In order to select the upper function bar 117, it is first necessary to place the shift control slide 93 in the shift or extreme left-hand position in order to unblock the finger 141 of the upper function bar. This is accomplished by the reception of the shift signal. After the upper function bar 117 has been unblocked, the motor stop signal will effect the selection of that function bar which upon being operated will close contacts 133 momentarily to complete the energizing circuit for electromagnet 161 which will attract its armature to open its contacts 166, thus opening the energizing circuit for motor 11. The apparatus shown in Fig. 2 includes a latch for holding the armature 162 of electromagnet 161 in the attracted position as will presently be described, whereby only momentary closure of contacts 133 with contacts 132 latched in the closed condition is necessary to effect the interruption of the motor circuit.

From the foregoing it will be observed that stopping of the motor 11 may be accomplished by the transmission to the receiving printer of three signal combinations which have been identified herein as blank, shift and motor stop. Since the blank function bar is operable independently of the shift or unshift condition of the printer, it will be apparent that stopping of the motor will be accomplished by the transmission of these signals in the order blank, shift and motor stop or in the order, shift, blank and motor stop. If the printer disclosed herein did not include the latchable contacts 132 but only the momentarily operable contacts 133, unintentional operation of the motor-stop mechanism could result from accidental striking of the motor-stop signal key in a keyboard transmitter after a figures shift signal had been transmitted for preparing the printer to print figures or punctuation marks. With the contacts 132 included in the system, it is extremely unlikely that an operator would transmit the blank or preparatory signal combination before or after a shift signal intended to place the printer in condition to print figures or punctuation marks, whereby the accidental striking of the motor-stop signal key would result in stopping of the motor 11. The additional preparatory function in connection with the motor-stop function reduces to a minimum the likelihood of unintentional stopping of the motor 11.

The release of the latch for the lower function lever 126 by operation of the spacing mechanism of the printer provides for restoration of the contacts 132 to normal or open condition by remote control and without the necessity of attention locally by an attendant. Since the contacts 133 close only momentarily, the contacts 132 may remain closed without having any further effect on electromagnet 161. Furthermore, the transmission of the blank signal combination or of a break signal for a purpose other than preparation for a motor-stop signal will effect the closure and latching of contacts 132 but this will have no effect on electromagnet 161 unless the shift and motor-stop signals are transmitted while contacts 132 remain closed. The transmission of any signal combination which involves character spacing after contact 132 has been latched in closed condition will release the latch and restore the contacts to normal open condition.

A distant telegraph station for transmitting signals to the printer shown in Fig. 1 is shown diagrammatically in Fig. 2. At the remote station the selector magnet 176, transmitting contacts 177 and break key 178 are connected in series and a circuit may be traced from one end of this series circuit through line conductor 179, signaling battery 181, local selector magnet 51, transmitting contacts 183, conductor 184, winding of magnet 188, break key 187 and line conductor 186 to the other end of the series circuit at the remote station. The left-hand one of the contacts 164 and the right-hand one of the contacts 163 are connected to the conductor 184. The right-hand one of the contacts 164 is connected by conductor 182 to the opposite terminal of transmitting contacts 183 from that to which conductor 184 is connected, so that when contacts 164 are closed, a shunt circuit will bridge the transmitting contacts 183 and those contacts will be ineffective to impress signals on the communication circuit. The left-hand one of the contacts 163 is connected to the opposite terminal of magnet 188 from that to which conductor 184 included in the communication circuit is connected, so that when contacts 163 are closed magnet 188 will be shunted out of the communication circuit and accordingly will be deenergized.

When the armature 162 of electromagnet 161 is in the released position, contacts 166 are closed so that motor 11 is in operation, contacts 164 are opened and contacts 163 are closed. A signaling circuit may then be traced from the transmitting contacts of the station in Fig. 2 through selector magnet 176 at that station, line conductor 179, battery 181, selector magnet 51 at the station in Fig. 1, transmitting contacts 183, conductor 184, closed contacts 163, break key 187 and line conductor 186 to the other end of the series circuit at the station in Fig. 2. The winding of electromagnet 188 is connected across the contacts 163, as previously stated, so that with

those contacts closed, the winding of electromagnet 188 is short-circuited. Since contacts 164 are now open, transmitting contacts 183 are not shunted, and they may be operated to transmit signals. When the combination of signals which will effect a motor-stop operation is transmitted from the station in Fig. 2 and is received by the selector magnet 51 in Fig. 1, electromagnet 161 becomes energized and attracts its armature. Thereupon contacts 166 become opened to interrupt the operating circuit of motor 11, contacts 164 become closed and contacts 163 become opened. Contacts 164 reestablish the shunt across the transmitting contacts 183 and contacts 163 remove the short circuit across the winding of magnet 188 which, being now included in the communication circuit, becomes energized by the current which flows during the rest condition of the system.

As is fully disclosed in the Morgenstern patent, the armature 191 of magnet 188 has associated with it a lever 192 supported on the same pivot as the armature 191, biased by spring 193 to follow armature 191 in counter-clockwise direction and held in spaced relation to the armature by finger 194. Lever 192 extends through an aperture in the armature 162 of electromagnet 161 and is provided with a lug 196 for retaining armature 162 in the attracted position when armature 191 is held attracted by electromagnet 188. The lug 196 serves as a primary latch for the armature 162. Armature 191 of magnet 188 is provided with a notch 197, the left-hand edge of which is slightly to the left of the right-hand edge of lug 196. The notch 197 serves as a secondary latch for armature 162 when armature 191 is released.

In order to restart the motor 11 either the break key 178 or the break key 187 may be opened to interrupt the communication circuit. Electromagnet 188 becomes deenergized and releases its armature 191, thus lifting lug 196 out of blocking relation to armature 162, but before the armature is unblocked by lug 196, it becomes blocked by notch 197 in armature 191 so that armature 162 merely escapes from lug 196 but is not fully released as long as the line circuit remains opened. Upon the reclosure of either of the break keys which had been opened, armature 191 is again attracted and releases the armature 161 which closes contacts 166 to restart motor 11 and close contacts 163 to short circuit the winding of electromagnet 188 but armature 162 of magnet 161 holds the armature 191 in the attracted position mechanically. By this operation of opening and reclosing the communication circuit, the station of Fig. 1 is fully restored to condition for intercommunication with the station of Fig. 2.

In Patent 1,965,383, granted July 3, 1934, to C. C. Lane, there is shown a motor control circuit different from that disclosed in the Morgenstern patent with which the present invention is adapted to cooperate and the disclosure of the Lane patent is incorporated herein by reference as part of the present specification. The Lane patent shows a relay operable to close the motor circuit and the relay has a holding circuit including normally closed contacts which upon being opened will interrupt the holding circuit for the relay which will release and open the motor circuit.

Fig. 3 shows the adaptation of the present invention to cooperate with the motor control circuit shown by Lane. Like reference characters have been employed to designate elements in Fig. 3 corresponding to elements in Fig. 1 but whereas in Fig. 1 the contact pairs 132 and 133 controlled by the function levers 126 are normally open, in Fig. 3 the contact pairs 201 and 202 are normally closed and the function levers 126 are operable to open the contacts, the contacts 201 being held open by latch 136 and the contacts 202 being opened momentarily. A relay 203 has one end of its winding connected to one terminal of battery 204 and the other terminal connected to one spring of a normally open, non-locking start key 206 the other spring of which is connected to the other terminal of battery 204. One terminal of motor 11 is connected to the lower front contact of relay 203, the cooperating armature of which is connected to one terminal of battery 204 and the other terminal of motor 11 is connected to the other terminal of battery 204. A holding circuit for the relay 203 becomes closed upon the operation of relay 203 from one terminal of battery 204 through the winding of relay 203, upper armature and front contact of that relay, normally closed contacts 201 and 202 in parallel to the other terminal of battery 204.

The motor 11 is started by momentary closure of start key 206 which completes the energizing circuit for relay 203 which operates to close the motor circuit through its lower armature and front contact and to close its holding circuit through the upper armature and front contact and through the normally closed contacts 201 and 202. In order to stop the motor 11 the lower function lever 126 in Fig. 3 which corresponds to the lower function lever 126 of Fig. 1 is operated in the manner hereinbefore described and the function lever opens the contacts 201 and becomes latched by the latch 136. The holding circuit for relay 203 is not thereby interrupted as it remains closed through the contacts 202. After the lower function lever 126 has become latched the upper function lever 126 which corresponds to the upper function lever shown in Fig. 1 is momentarily operated in the manner heretofore described to open momentarily the contacts 202. The opening of contacts 202 with the contacts 201 latched open interrupts the holding circuit for relay 203 which releases, and interrupts the circuit of motor 11 at the lower armature and front contact of the relay. Motor 11 may be restarted by momentarily closing the start key 196 or, alternatively, by signal responsive remote control as is fully disclosed in the Lane patent.

Although a specific embodiment of the invention has been shown in the drawings and described in the foregoing specification, it is to be understood that the invention is not limited to such specific embodiment 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 printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said energizing circuit, means including two sets of normally open contacts in series for actuating said motor circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for closing one of said sets of contacts, means for retaining said one set of contacts closed, means responsive to another predetermined received signal for closing the other of said sets of contacts, and means op-

erated by said spacing mechanism for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit.

2. In a printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said energizing circuit, means including two sets of normally open contacts in series for actuating said motor circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for closing one of said sets of contacts, means for retaining said one set of contacts closed, means responsive to another predetermined received signal for closing the other of said sets of contacts, and means operated by said spacing mechanism when an operation thereof intervenes the operation of said two signal responsive means for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit in response to the closure of said other set of contacts.

3. In a printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening said motor energizing circuit, means including an electrical circuit normally open at two points for operating said motor energizing circuit opening means, means responsive to a predetermined received signal for closing said normally open circuit at one of said points, means for retaining said circuit closed at said point, means responsive to another predetermined received signal for closing said normally open circuit at the other point, and means operated by said spacing mechanism intervening the operation of said two circuit closing means for releasing said retaining means to disqualify said motor energizing circuit opening means against operation in response to the operation of the circuit closing means at said second point.

4. In a printing telegraph apparatus including a character spacing mechanism, electrical circuit controlling means, means responsive to a predetermined signal for operating said circuit controlling means, means for retaining said circuit controlling means in operated condition, and means operated by said spacing mechanism for releasing said retaining means.

5. In a printing telegraph apparatus including a character spacing mechanism, electrical circuit controlling means, means responsive to a predetermined signal for operating said electrical circuit controlling means, means for latching said operating means in operated condition, and means operated by said spacing mechanism for releasing said latching means to restore said electrical circuit controlling means to initial condition.

6. In a printing telegraph apparatus, a character spacing mechanism including a spacing ratchet, an operating pawl therefor and a check pawl therefor, means for operating said operating pawl cyclically, electrical circuit controlling means, means responsive to a predetermined signal for operating said electrical circuit controlling means, means for latching said operating means in operative condition to retain said electrical circuit controlling means operated, and means associated with said check pawl and operable thereby upon operation of said ratchet by said operating pawl for releasing said latching means to disable said operating means and said electrical circuit controlling means.

7. In a printing telegraph apparatus, a character spacing mechanism including a spacing ratchet, an operating pawl for said ratchet and a check pawl for said ratchet, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening said energizing circuit, means including two sets of normally open contacts in series for actuating said motor circuit opening means, means responsive to a predetermined received signal for closing one of said sets of contacts, means for retaining said one set of contacts closed, means responsive to another predetermined received signal for momentarily closing the other of said sets of contacts to operate said motor circuit opening means, and means associated with and operable by said check pawl upon rotation of said spacing ratchet by said operating pawl for disabling said retaining means.

8. In a printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening said energizing circuit, means including two sets of normally open contacts in series for actuating said motor circuit opening means, means responsive to a predetermined received signal for closing one of said sets of contacts, means for retaining said one set of contacts closed, means for closing the other of said sets of contacts, means responsive to another predetermined signal for conditioning the second-mentioned contact closing means to be operated, means responsive to a third predetermined received signal for operating the second-mentioned circuit closing means, and means operated by said spacing mechanism for releasing said retaining means to disable said actuating means.

9. In a printing telegraph apparatus including a character spacing mechanism, a driving motor having an energizing circuit, means for opening said energizing circuit, means including two sets of normally open contacts in series for actuating said motor circuit opening means, means responsive to a predetermined received signal for closing one of said sets of contacts, means responsive to another predetermined signal for closing the other of said sets of contacts, means presentable in either of two positions in response to other predetermined signals for blocking said second-mentioned contact closing means in one of said positions and for unblocking said contact closing means in the other of said positions, and means operated by said spacing mechanism for releasing said retaining means to disable said actuating means.

10. In a printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said circuit, means including two sets of contacts operable conjointly to cause said circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for operating one of said sets of contacts, means for maintaining said one set of contacts operated, means responsive to another predetermined received signal for operating the other of said sets of contacts, and means operated by said spacing mechanism for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit.

11. In a printing telegraph apparatus includ-

ing a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said circuit, means including two sets of contacts operable conjointly to cause said circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for operating one of said sets of contacts, means for maintaining said one set of contacts operated, means responsive to another predetermined received signal for operating the other of said sets of contacts momentarily, and means operated by said spacing mechanism for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit.

12. In a printing telegraph apparatus including a character spacing mechanism, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said energizing circuit, means including two sets of normally closed contacts in parallel effective when operated conjointly to cause said circuit opening and closing means to open said circuit, means responsive to a predetermined signal for opening one of said sets of contacts, means for maintaining said one set of contacts opened, means responsive to another predetermined received signal for opening the other of said sets of contacts, and means operated by said spacing mechanism for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit.

13. In a printing telegraph apparatus including a character spacing mechanism and a signal controlled case shift mechanism having two selectively effective conditions, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said circuit, means including two sets of contacts operable conjointly to cause said circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for operating one of said sets of contacts, means for maintaining said one set of contacts operated, means responsive to another predetermined received signal for operating the other of said sets of contacts, means associated with said case shift mechanism and effective when said case shift mechanism is in a particular one of its effective conditions for rendering one of said contact operating means inoperative, and means operated by said spacing mechanism for releasing said retaining means to disqualify said motor circuit opening and closing means against opening said circuit.

14. In a printing telegraph apparatus including a character spacing mechanism and a signal controlled case shift mechanism having two selectively effective conditions, a driving motor for said printing telegraph apparatus having an energizing circuit, means for opening and closing said circuit, means including two sets of contacts operable conjointly to cause said circuit opening and closing means to open said circuit, means responsive to a predetermined received signal for operating one of said sets of contacts, means for maintaining said one set of contacts operated, means responsive to another predetermined received signal for operating the other of said sets of contacts, means associated with said case shift mechanism and effective when said case shift mechanism is in a particular one of its effective conditions for preventing signal responsive operation of the last-mentioned of said contact operating means, and means operated by said spacing mechanism for releasing said retaining means to terminate retention of said one set of contacts in operated condition.

15. In a printing instrumentality, a selectively operable lever having a normal position and an operated position, a retaining latch for retaining said lever in operated position, a character spacing ratchet, an operating pawl for said ratchet, a check pawl for said ratchet, and means associated with said check pawl for releasing said retaining latch as said ratchet acts upon said check pawl incident to advancement of said ratchet by said operating pawl.

16. In a printing instrumentality, a selectively operable lever having a normal position and an operated position, a retaining latch for retaining said lever in said operated position, a character spacing ratchet feed mechanism including a ratchet, an operating pawl and a check pawl, said ratchet having interdental spaces of sufficient depth to impart appreciable movement to said check pawl upon advancement of said ratchet by said operating pawl, and means associated with said check pawl for releasing said retaining latch upon being subjected to said movement by said ratchet.

17. In a printing telegraph apparatus having an operating motor and a character spacing mechanism, an energizing circuit for said motor including circuit controlling means, selectively operable means for performing a preparatory operation upon which actuation of said circuit controlling means to open said motor energizing circuit depends, means for causing said selectively operable means to remain operated, other selectively operable means for causing said circuit controlling means to open said motor energizing circuit, and means controlled by said spacing mechanism for causing said first-mentioned selectively operable means to be restored to unoperated condition.

18. In a printing telegraph apparatus having an operating motor and a character spacing mechanism, an energizing circuit for said motor including circuit controlling means, selectively operable means for performing a preparatory operation upon which actuation of said circuit controlling means to open said motor energizing circuit depends, means for causing said selectively operable means to remain operated, other selectively operable means for causing said circuit controlling means to open said motor energizing circuit, and means controlled by said spacing mechanism for causing said first-mentioned selectively operable means to be restored to unoperated condition, said last-mentioned means when operated following operation of said first-mentioned selectively operable means and preceding operation of said other selectively operable means, being effective to nullify said preparatory operation whereby to prevent operation of said circuit controlling means.

19. In a printing telegraph apparatus having an operating motor and a character spacing mechanism, an energizing circuit for said motor including circuit controlling means, selectively operable means for performing a preparatory operation upon which actuation of said circuit controlling means to open said motor energizing circuit depends, means for causing said selectively operable means to remain operated, other selectively operable means for causing said circuit controlling means to open said motor energizing circuit, and means controlled by said

spacing mechanism upon the next ensuing operation thereof irrespective of the occurrence or non-occurrence of an operation of said other selectively operable means for causing said first-mentioned selectively operable means to be restored to unoperated condition.

20. In a printing telegraph apparatus, an electrical instrumentality to be operated selectively, means including an electrical circuit normally open at two points for operating said instrumentality, means responsive to a predetermined received signal for closing said circuit at one of said points, means for retaining said circuit closed at said point, means responsive to another predetermined received signal for closing said circuit at the other point, and means operably effective in response to reception of any one of a plurality of other signals intervening said two predetermined signals for disabling said retaining means to disqualify said instrumentality against operation in response to the operation of the circuit closing means at said second point.

21. In a printing telegraph apparatus, an electrical instrumentality to be operated selectively, means including an electrical circuit for operating said instrumentality, said circuit having two serially connected means normally obstructing flow of current in said circuit, means responsive to a predetermined signal for conditioning one of said serially connected means to pass current in said circuit, means for retaining said one of said serially connected means conditioned, means responsive to another predetermined received signal for conditioning the other of said serially connected means to pass current in said circuit whereby to cause said instrumentality to be operated by current through said two serially connected means, and means operably effective in response to reception of any one of a plurality of other signals intervening said two predetermined signals for disabling said retaining means to disqualify said instrumentality against operation upon conditioning of said other of said serially connected means.

22. In a printing telegraph apparatus, an electrical instrumentality to be operated selectively, means including an electrical circuit for operating said instrumentality, said circuit having two serially connected and normally deactivated circuit closing means, a signal responsive selectable element for activating each of said circuit closing means individually, means for momentarily operating said selectable elements upon selection thereof, means for retaining one of said circuit closing means activated after operation of its selectable element by said operating means, and means operably effective in response to any one of a plurality of other signals intervening those controlling selection of the selectable elements for said circuit closing means for disabling said retaining means to disqualify said instrumentality against operation upon activation of the other of said circuit closing means.

BURDETTE S. SWEZEY.