April 4, 1939. H. J. NICHOLS 2,153,203

COMMUNICATION SYSTEM

Original Filed Jan. 29, 1934 3 Sheets-Sheet 1

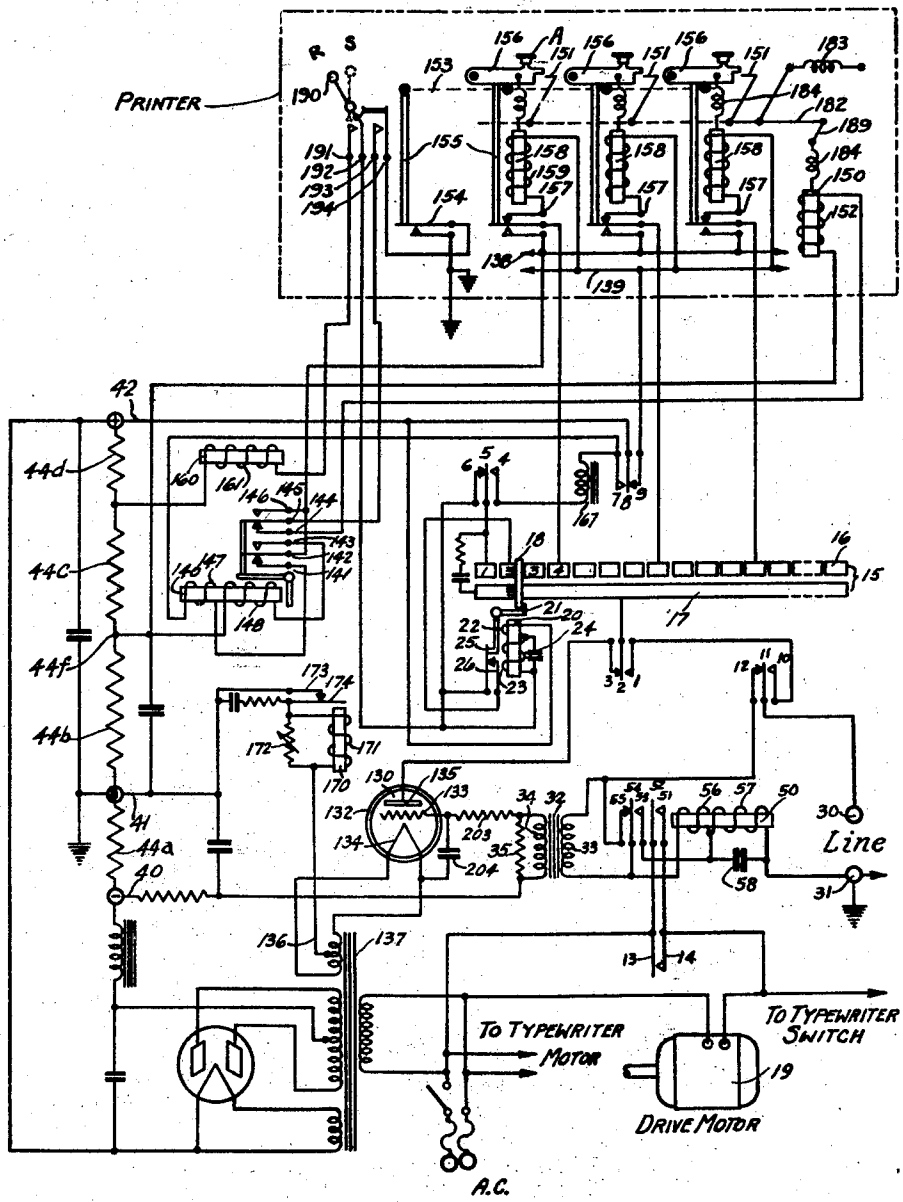

Fig. 1.

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COMMUNICATION SYSTEM

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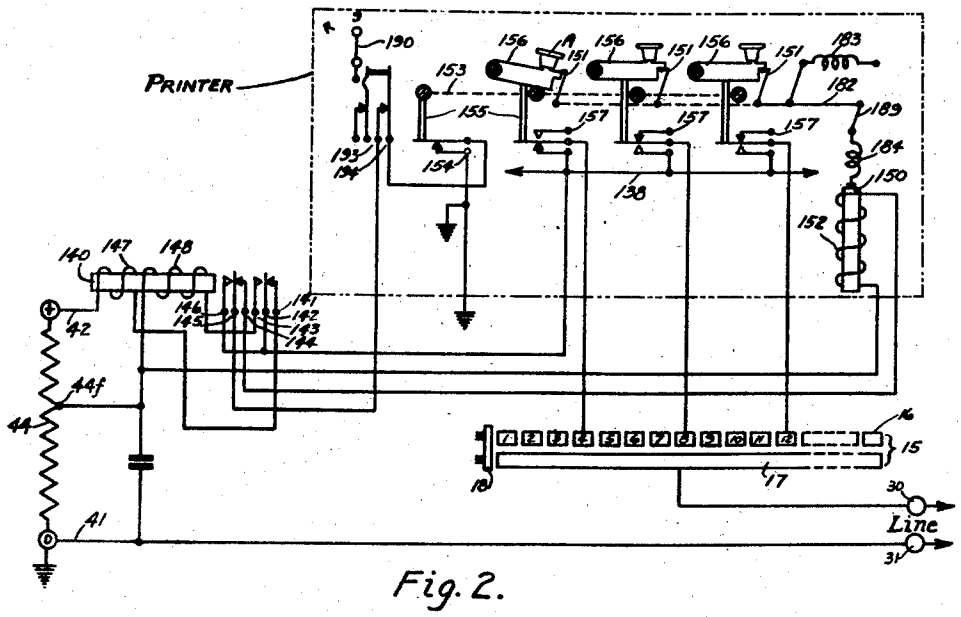

Fig. 2.

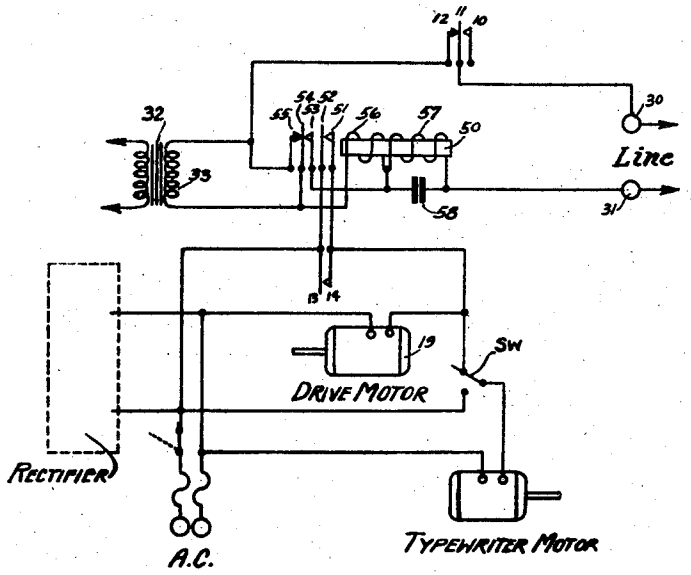

Fig. 3.

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COMMUNICATION SYSTEM

Original Filed Jan. 29, 1934 3 Sheets-Sheet 3

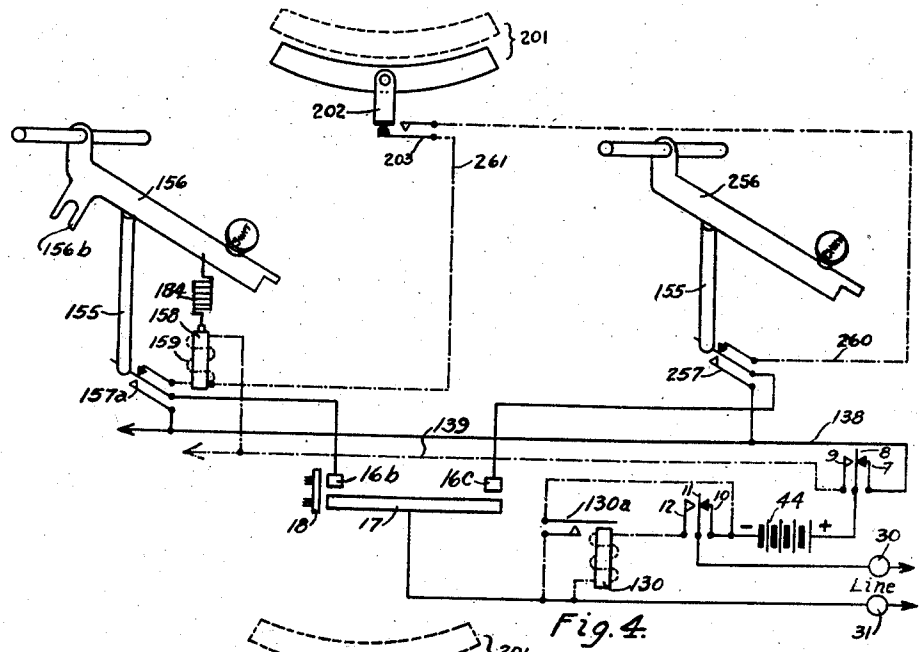

Fig. 4.

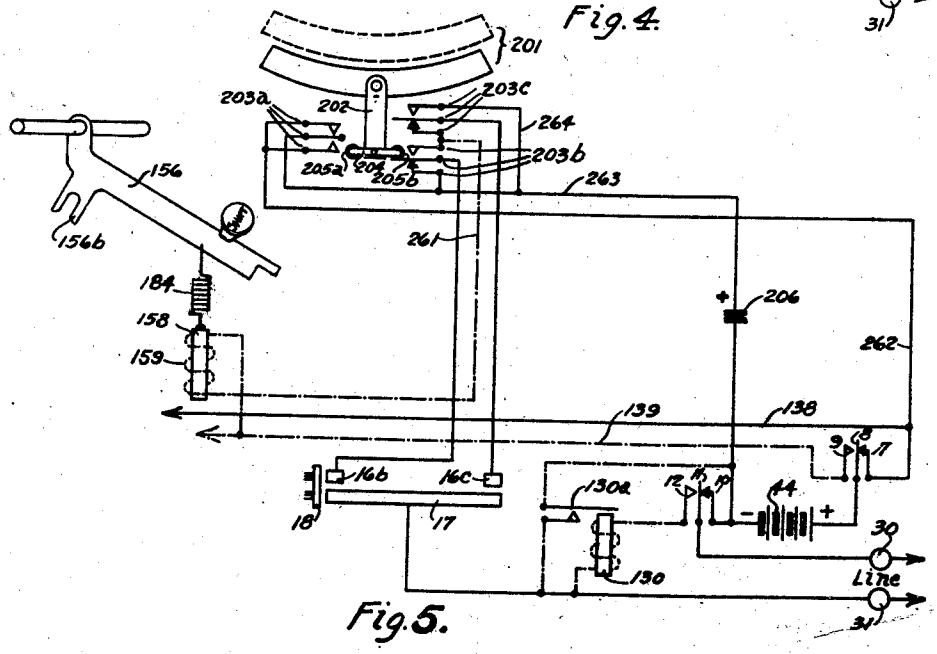

Fig. 5.

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Patented Apr. 4, 1939 2,153,203

UNITED STATES PATENT OFFICE

2,153,203

COMMUNICATION SYSTEM

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Original application January 29, 1934, Serial No. 708,767, now Patent No. 2,104,571, dated January 4, 1938. Divided and this application May 12, 1937, Serial No. 142,092

16 Claims. (Cl. 178—25)

This invention relates to synchronous communication systems, one particularly to single impulse printing telegraph systems. The present application is a divisional case of the copending application Serial No. 708,767, filed January 29, 1934, patented January 4, 1938, No. 2,104,571.

The present application relates solely to the shift control mechanisms and case shift check features and has for an object the provision of means whereby the operation of the sending machine can control the shift operating mechanism at the receiving machine and in addition thereto be assured that the receiving machine is typing in proper case.

These objects are attained by employing a system whereby single impulses, the characteristics of which are the same, are employed to control the receiving units in a distinctive manner upon the reception of successive electrical impulses. The control means such as a solenoid associated with the shift keybar is energized successively by the impulses, operating the keybar successively to control the positioning of the type basket, or operating instrumentality in a different manner. That is, normally the type basket may be in the lower case position, upon reception of a shift impulse the shift keybar is operated to operate the associated shift mechanism and type basket, effecting positioning of the type basket in upper case position. Upon reception at a later timed interval of another shift signal the said keybar and associated mechanism is operated to return the type basket to the lower case position. Therefore, it is seen that the combination of an operating instrumentality is provided and a key lever control means therefor adapted to cause operation of the instrumentality and further control means adapted to control the operation of the key lever whereby the said instrumentality is controlled in a different manner upon successive operation or energization of the control means. The specific shift mechanism is not shown interconnecting the keybar and type basket and not deemed necessary since such mechanism is well known in the art, for example, one form of mechanism is shown in U. S. Patent No. 2,049,468.

Further provision is made, and also forms an object of the present invention, whereby positive checking means are provided so that one station or both stations can check upon the relative case positions of the typewriter type baskets at both stations. Therefore it is assured to the operator that both machines are typing in the same cases. In one modification separate shift check means is provided to provide for checking the type basket position and another modification is shown whereby the shift mechanism and checking features of the type basket position are all controlled by a single keybar whereby any station can effect operation of the shift mechanism and also check the type basket position so as to be positioned in the same case position at the stations.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings, and the invention also constitutes certain new and novel features of the construction and combination of parts hereinafter set forth and claimed.

In the drawings,

Fig. 1 shows in diagrammatic form the circuits and apparatus which, together with the typewriter or printer typing mechanism, comprise a complete communication unit. The circuits are shown in the receiving condition, or more precisely, in readiness to receive.

Fig. 2 shows in diagrammatic form the particular parts of the circuit and apparatus used to control the key board and to prevent the transmission of false signals.

Fig. 3 is a diagram showing the arrangement of circuits, apparatus, and switches whereby automatic starting of the receiving machine is accomplished.

Fig. 4 shows in diagrammatic form a simplified arrangement for both sending and receiving shift and shift check signals, and for utilizing same for the remote control of the shift action of the receiving machine.

Fig. 5 is a similar diagram showing a simplified shift arrangement in which the shift and shift check functions are automatically combined.

In the several figures, like characters represent like parts.

General description

For purposes of description and as illustrative of a preferred embodiment of the invention, a complete communication unit is hereinafter described as comprising a typewriter, a typewriter control unit, and a distributor unit. The typewriter control unit is preferably mounted underneath and inside the typewriter frame. The distributor unit is preferably housed in a case located near the typewriter. The two units are conveniently connected electrically by a multiple conductor cable.

The complete communication units may be used

in pairs, one unit sending while the other receives, and vice versa, or they may be connected in such a manner that the sending unit controls a group of receiving units. Units may be connected for communication purposes by means of general communication systems, such as a telegraph, telephone, or radio system, or simply by a pair of wires, or one wire and ground.

In Fig. 1, the apparatus comprising the typewriter control unit is included within the dot-dash rectangle; all other apparatus is included in the distributor unit.

The apparatus shown in Fig. 1 performs the functions of transmitting and receiving synchronizing and printing signals, and utilizing these signals, and responsive local impulses, for various starting, synchronizing, selecting, and control purposes. The local impulses are distributed to their proper circuits by the rotary distributor.

Referring now to Fig. 1 in detail, the rotary distributor 15 consists of a series of insulated metallic segments 16 and a solid metallic ring 17 mounted on a suitable disc of insulating material (not shown). A rotary contactor 18 is frictionally driven by drive motor 19 and contacts each segment once during each revolution in a well understood manner. The drive motor 19 must be of exactly uniform speed, or suitable governing means must be employed to obtain a highly uniform speed.

The rotary contactor 18 is shown in the rest position on number 2 segment. A release magnet 20, functioning as a start-stop means, is provided to stop and release rotary contactor 18 in accordance with the invention, and for illustrative purposes is shown with its armature 21 in engagement with contactor 18. Armature 21 also operates spring contacts 25 and 26 which function in connection with starting operations. Release magnet 20 is provided with a low impedance winding 22 and a high impedance winding 23 connected in series aiding relation. Across the terminals of winding 23 is connected storing condenser 24. Release magnet 20 is of the quick acting, slow release type which responds quickly to a short current pulse, but holds for a protracted period, hence if supplied with properly timed impulses, continues to hold in the operated position so long as such pulses are regularly received, but drops out shortly after the pulses cease, or in case the pulses are too greatly diminished. An improved relay or magnet of this type, which may be termed a pulse sustained relay, is described in detail in my copending patent application, Serial No. 672,161, filed May 22, 1933 patented Jan. 4, 1938, No. 2,104,570.

The power for transmission purposes and for the operation of the various relays and magnets is obtained from any suitable direct current source, preferably from a rectifier assembly as shown.

The output of the rectifier is applied to the terminals of a four section voltage divider 44, as shown. The positive bus 42 is connected to the positive terminal of voltage divider 44, and the negative bus 40 to the negative terminal. The zero bus 41 is connected to the zero or ground terminal between sections 44*a* and 44*b* of voltage divider 44, section 44*a* thus furnishing in a well understood manner negative bias for the grid 133 of electronic relay 130.

The elements of electronic relay 130, which is of the grid controlled, gaseous discharge type are the grid 133, the cathode 134, and the anode or plate 135, all contained in an envelope 132 containing gas or vapor at low pressure, as is well understood.

In series with the anode-cathode circuit of relay 130 is the cut-off relay 170, connected as shown, with winding 171 shunted by variable resistor 172 and provided with spring contacts 173 and 174. As is well known, the grid of a grid controlled gaseous discharge tube is normally unable to stop the discharge through the anode circuit when once started, and in general, either the plate current must be cut off, or else the plate must be rendered negative in respect to the cathode. It is preferred to cut off the plate current after a properly timed interval by utilizing cut-off relay 170 to open contacts 173—174. The variable resistor 172 permits of very exact timing of the cut-off interval, and the location of the relay in the circuit as shown is found to give quick and reliable de-ionization of electronic relay 130. A spark suppressor arrangement may be connected across contacts 173—174 as shown to reduce sparking to a negligible degree.

The non-repeat relay 140 is connected in circuit only while sending, and has for its principal function the prevention of the transmission of false signals. It will be explained in detail hereafter in connection with Fig. 2.

The multiple switch relay 160, controlled by send-receive switch 190, provides the automatic switching operations required to change from sending conditions to receiving conditions and vice versa. It is provided with a single winding 161 and five sets of contact springs number 1–14 inclusive. In order to simplify the diagram, these contacts are shown in their natural locations in the circuit. The winding of relay 160 is connected in series with the windings of release magnet 20 across section 44*d* of the voltage divider reducing the voltage across these windings and economizing on holding current.

The start relay 50 is connected across the line on receiving so as to respond to received signals. It is of the pulse sustained type and performs various switching operations to start the receiving machine automatically. It will be more fully described hereinafter in connection with Fig. 3.

The input transformer 32 is connected to the line on receiving by start relay 50. It applies the signal pulses to the grid of electronic relay 130.

Included in the typewriter control unit is the key solenoid assembly suitably mounted, consisting of a bank of solenoids 158, one for each operating key 156 of the typewriter or printer. The plunger of each solenoid is connected to its associated key lever by means of a spring link 184. This construction provides smooth operation of the printer actuating levers, and improves the pull characteristics of the solenoids.

Each key lever 156 has associated with it an individual key switch 157, of break-make type, actuated by an individual insulated push rod 155. The armature spring of each key switch is connected to an individual segment, the make springs being connected to the common key-switch bus 138 as shown, while the break springs are connected to the individual solenoids. A universal bail 153 is positioned below and transversely across the row of key levers, being held in light contact therewith by a retractile spring (not shown). When any key is depressed, bail 153 closes auxiliary switch 154 by means of push rod 155. Auxiliary switch 154 forms a part of the key-latch and non-repeat arrangement.

The key latch 151 consists of a pivoted, universal latch bar extending across the ends of

all the key levers, the ends of which are provided with a square projection as shown. A retractile spring 183 attached to latch 151 so as to obtain proper leverage normally holds the latch out of engagement with the key levers. The key latch magnet 150 actuates the key latch, as will be more fully explained in connection with Fig. 2. The send-receive switch 190 is a two-position switch which switches certain circuits from sending to receiving conditions, as required.

Sending circuits and operations

Referring to Fig. 1, the transmission of synchronizing signal impulses is accomplished as follows:

Assume that drive motor 19 is operating and tending to rotate rotary contactor 18 by a friction drive but that the contactor is held in the rest position on segment 2 by armature 21 of release magnet 20. To start sending synchronizing signals, send-receive switch 190 is thrown to the S or send position. This completes a circuit from positive bus 42 through winding 22 and condenser 24 of release magnet 20 via contacts 192—191 of send-receive switch 190, through winding 161 of relay 160 to the voltage divider between sections 44c and 44d. A current pulse through this circuit operates relay 160, breaking contacts 2—3, 5—6, 8—9, 11—12, and making contacts 1—2, 4—5, 7—8, 10—11, 13—14. Release magnet 20 is also energized, attracting armature 21 which releases rotary contactor 18. As condenser 24 becomes charged a small steady current limited mainly by the resistance of windings 23 and 161 flows through these windings providing sufficient holding current to hold relay 160 and magnet 20 in the operated condition. A strong operating pulse followed by low holding current is thus provided.

On being released by armature 21, contactor 18 is set in rotation by the friction drive and takes up the uniform speed of the motor drive shaft. When contactor 18 reaches segment 1, a circuit is completed from positive bus via contacts 8—7 thru inductance 167, via contacts 4—5 to segment 1; thence via contactor 18 to ring 17 and via contacts 2—1 and 10—11 thru line and return to zero bus via ground. For the duration of contact with segment 1, current flows thru the circuit just traced, and a signal impulse is sent to the line. This periodic signal impulse, which is repeated for each revolution of contactor 18, constitutes the synchronizing signal.

Inductance 167, which is included in the circuit transmitting the synchronizing signal is designed to match the inductance of winding 147 of non-repeat relay 140 which is included in the circuit transmitting printing signals, hence the amplitude and wave form of the synchronizing signals and printing signals are substantially identical.

To commence sending printing signals, send-receive switch 190 is thrown to the S position, and synchronizing signals are sent to the line for a few seconds to permit the receiving machine to come to synchronism as hereinafter described. Printing signals may then be sent by depressing the typing keys of the typewriter as for ordinary typing.

Referring to Fig. 2, and assuming that key A is struck, a printing signal is transmitted as follows: As the key is depressed, the middle and lower contacts of its own particular key switch are closed, thus connecting sending bus 138 to a particular segment, in this case to segment 4. When rotary contact 18 arrives at segment 4, a circuit is completed from positive bus 42 through winding 147 of non-repeat relay 140 via contacts 141—142 of same, to send bus 138, via contacts of closed key switch 157 to segment 4, via contactor 18 to ring, thence via contacts 2—1 and 10—11 to line and return to zero bus via ground. A current pulse flows through this circuit including the line, its duration being determined by the time of contact of contactor 18 with the connected segment. Such aperiodic signal impulses, distinguished in respect to the time interval from the preceding synchronizing signal, constitute the printing signals.

Concurrently, as the key lever nears the bottom of its stroke, the printing mechanism (not shown) of the typewriter is tripped, and the typewriter immediately types the proper character to furnish a local copy of the message.

Key latch and non-repeat arrangement

Instantly upon the depression of a printing key, the key latch arrangement is operated as follows: Each time a key is depressed, universal bail 153 closes the contacts of auxiliary switch 154 by means of push rod 155. The lower spring of the auxiliary switch is connected to ground and the upper spring is connected via contacts 194—193 to contact 145 of non-repeat relay 140. Upon the closing of the auxiliary switch contacts, a circuit is completed from ground via contacts of auxiliary switch 154 and contacts 194—193 and 145—144 through winding 152 of latch magnet 150 to tap 44f of voltage divider 44. A current pulse through the circuit just traced operates latch magnet 150 which by means of spring link 184 and crank arm 189 quickly hooks the pivoted latch member 151 over the end of the depressed key lever, latching it down. This is done so quickly that the finger can be removed from the struck key with great rapidity without danger of premature release of the key lever.

As illustrated in Fig. 2, the latch member 151 not only serves to hold down the depressed key, but also serves as an interlock to hold all other keys against being depressed, thus guarding against depressing a second key before the printing signal from the connected segment is sent to the line. This arrangement has the advantages of not requiring additional interlocking means to obtain this feature, and also in that the interlocking feature only comes into play during sending, the key board being entirely free when receiving. As a consequence, less actuating force for the key levers is required permitting smaller key solenoids to be employed.

The printing impulse previously described, in addition to sending a printing signal to the line, also performs an important function in the key-release and non-repeat operations. The printing impulse flowing through winding 147 energizes non-repeat relay 140, which operates, opening contacts 141—142 and 144—145, and closing contacts 142—143 and 145—146. Opening contacts 141—142 disconnects winding 147 which is too low in resistance to place directly across the line. Opening contacts 144—145 cuts holding current off winding 152 of latch magnet 150 which releases, thus permitting retractile spring 183 to draw latch 151 away from the key levers, thus releasing all keys insofar as the latch arrangement is concerned. It is possible, however, that a key may be inadvertently held down by the finger after being released by the latch, and in

this event, it is necessary to prevent false repeat signals from being sent to the line. Therefore, when contacts 145—146 are closed, send bus 138 is connected via these contacts to ground, hence any connected segment, except the synchronizing segment, is placed at zero potential, and no more printing signals can be sent to the line so long as contacts 145—146 remain closed. Closing contacts 142—143 supplies holding current for winding 148 through a circuit from voltage divider tap 44f through winding 148 via contacts 143—142, 146—145, 193—194 and auxiliary switch 154 to ground. When the depressed key is released, auxiliary switch 154 is opened, taking holding current off the non-repeat relay, which releases and opens contacts 143—142 and 146—145. This completes the cycle, and leaves all sending circuits in normal condition.

It will be noted that the key latch 151 serves as a key board lock during the brief but variable interval from the instant a key is depressed until the signal impulse is transmitted by rotary contactor 18, whereupon the non-repeat relay cuts off the current from the latch magnet. Simultaneously, the non-repeat relay grounds the send bus and hence any connected segment, preventing further signals being sent to the line until all keys are released. The result is that only one signal can be sent for each cycle of operation of a key lever. This constitutes the non-repeat feature. In case continued repeat signals from a key are desired, it is only necessary to connect the key latch switch of that particular key to positive bus instead of to the send bus, which exempts that particular key from the non-repeat feature.

In normal operation, the keys are depressed and released quickly, and the keyboard is released for further writing practically instantly when the signal is sent to the line.

Starting circuits and operations

Referring to Figs. 1 and 3, and more particularly to Fig. 3, the apparatus primarily involved in receiving both synchronizing and printing signals comprises start relay 50, the primary winding 33 of input transformer 32, and their associated circuits and switches. Start relay 50, preferably of the pulse sustained type previously described, is preferably provided with a low impedance operating winding 56 and a high impedance holding winding 57 wound on the same core and connected in series aiding relation. Across winding 57 is connected storing condenser 58. The impedance of the windings and condenser in combination should preferably match the impedance of the transmission line or connecting transmission circuits. As compared to release magnet 20, start relay 50 need not be as powerful, since it is required only to operate its own contact springs, and need not respond to the first pulse received. Likewise, it is not essential that start relay 50 have separate operating and holding windings, although there is in some cases an advantage in having a separate operating winding, both in respect to a more prompt response and in compensating for primary winding 33, as more fully explained hereinafter. Relay 50 is provided with a pair of make contacts 51—52, and a set of break-make contacts numbered 53–55 inclusive. In parallel with make contacts 51—52 are connected make contacts 13—14 which may be actuated either by multiple switch relay 160 as indicated above, or manually by send-receive switch 190, as may be preferred. Contacts 13—14 function in the starting of drive motor 19 when initiating sending conditions.

The operation of the automatic start arrangement is as follows: The incoming signals, assumed to be the synchronizing signals, are received at the line terminals 30, 31 and traverse the circuit from terminal 30 via contacts 11—12 via contacts 55—54 through winding 56 and condenser 58 to terminal 31. The pulses through this circuit build up the charge on condenser 58 faster than the charge leaks off through winding 57, thus energizing relay 50 which pulls in its armature on a signal pulse, opening contacts 55—54, and closing contacts 54—53, and 52—51. Opening contacts 55—54 removes the short circuit on primary 33, which thus becomes capable of functioning. Closing contacts 54—53 short circuits winding 56, whose impedance is thus removed from the signalling circuit to compensate for the addition of the impedance of winding 33. Closing contacts 52—51 connects power to drive motor 19 and, if required, to the typewriter motor in instances where electric driven typing machines are employed. It is to be noted (Fig. 3) that a two-way manual switch SW is provided for the typewriter motor, so that this motor may be started automatically if not already running.

So long as signals are regularly received, relay 50 remains operated; if signalling is discontinued, or interrupted, the charge on condenser 58 is not replenished, and relay 50 releases, restoring all circuits to initial conditions. This completes the cycle of operations of the automatic start arrangement, which provides means for starting up the receiving machine in the absence of attendants, after which messages may be received in the usual manner. It also provides for shutting down the receiving machine during idle periods.

It is to be noted that the arrangement illustrated assumes that power is already turned on the rectifier apparatus and also on the cathode of the electronic relay 130. This is the preferred arrangement where messages are being sent back and forth frequently, since there is no need to wait until the rectifier and electronic relay tubes are warmed up before starting transmission. Where messages are sent infrequently, or the warm up period is negligible, or the saving by not having the tubes lighted is a consideration, start relay 50 can be utilized to turn current on the rectifier, or electronic relay, or both, as desired. Such variations in switching arrangements to meet various operating conditions will be evident to those skilled in the art and are clearly within the scope of the invention.

Synchronization

The operations connected with the sending of the periodic synchronizing signals have already been described. Referring again to Fig. 1, the operations connected with receiving and utilizing these signals are as follows: The first step is that of establishing synchronism of rotary contactor 18 of the receiving machine with the received synchronizing signals. Since the periodic synchronizing signals are sent from a particular segment, termed the synchronizing segment, of the sending machine, it follows that for complete synchronization, the rotary contactor at the receiving machine must arrive at the leading edge of the synchronizing segment each time a synchronizing signal arrives from the sending machine.

At the receiving station, the synchronizing

signals are received at the line terminals 30 and 31, and upon the operation of start relay 50 are applied to the primary 33 of input transformer 32. Concurrently, the drive motor is started up, as previously described. The synchronizing signals through primary 33 induce a voltage across secondary 34 and shunt resistor 35, and with proper polarity, alter the bias voltage on grid 133 and trigger off electronic relay 130, which becomes ionized and conducting, thus permitting a strong current flow in its plate circuit. The contactor 18 being held at rest on segment 2, a circuit is completed from zero bus via contacts 173—174, through relay winding 171 via center tap 136 of power transformer 137 to cathode of relay 130 thence to plate 135, via contacts 3—2 to ring, via contactor 18 to segment 2, via contacts 26—25 through condenser 24 and winding 22 to positive bus. A strong current pulse flows through this circuit, operating release magnet 20 and thereafter cut-off relay 170, which opens contacts 173—174, terminating the pulse. The armature 21 is quickly pulled in, releasing contactor 18 and opening contacts 25—26. The pulse of current through condenser 24 charges that condenser, providing holding current for relay 20, and preventing the release of armature 21.

Upon release, contactor 18 is set quickly in motion by its friction drive, and is thereafter rotated at uniform speed by drive motor 19. Contactor 18, having been released from segment 2 in response to a pulse occurring concurrently with the passage of the contactor across segment 1 at the sending station would arrive at segment 1 before the arrival of the next synchronizing signal, were it not for a slight delay in the operation of relay 20 and a slight amount of slip of the friction drive. Because of these delays, the lead provides by starting contactor 18 from segment 2 enables the contactor to arrive at the leading edge of segment 1 as the next synchronizing signal is received. This synchronizing signal energizes electronic relay 130 as before, but this time the local circuit is completed via segment 1, the circuit of segment 2 having been opened at contacts 25—26 by the operation of release magnet 20. The current pulse through the completed circuit replenishes the charge on condenser 24, maintaining release magnet 20 in the operated position, hence armature 21 does not interfere with contactor 18 which continues in rotation so long as it arrives on segment 1 in unison with the synchronizing signal. Means are provided for adjustment of the starting position of contactor 18, and also of the frictional driving force, thus enabling exact timing of the starting revolution to be made. In practice, it is found that with proper adjustments, synchronism is accurately established on the first revolution. Thereafter, the maintenance of synchronism depends on the preservation of precisely uniform speed of the drive motors at the sending and receiving machines. Should, for any reason, unison within approximately one-half segment width be departed from, or the incoming synchronizing signals be interrupted beyond a predetermined interval, contactor 18 is stopped on the rest segment by reason of release magnet 20 dropping out through lack of sufficient holding current. The synchronizing procedure is then repeated when the next synchronizing pulse is received. Thus synchronism, if lost, is automatically reestablished.

The system of synchronizing herein described is particularly adapted to communication systems to be operated in regions having a common power system of accurately controlled frequency, in which circumstances good results are obtained from synchronous drive motors supplied with power from the common system. As is well understood, the employment of synchronous motors in such installations assures virtually perfect isochronism, and if the receiving machine is established in the proper phase relation, synchronism with the sending machine will continue practically indefinitely. For installations where suitable synchronous power is not available, the synchronizing system disclosed in my copending application Serial No. 672,161, filed May 22, 1933 may be preferred.

Receiving circuits and operations

Synchronism having been established as previously described and the rotary contactors at the receiving and sending stations being in unison, printing signals may be sent to the receiving station as described in connection with sending operations.

Referring to Fig. 1, the printing signals when received are applied to primary 33 as previously described, and potential variations from secondary 34 trigger off electronic relay 130 which becomes conducting. A circuit is thus completed from zero bus via contacts 173—174, through relay winding 171 via center tap 136 of power transformer 137 to cathode of relay 130, thence to plate 135, via contacts 3—2 to ring as before described, and thence via contactor 18 to the segment with which it is in contact. The response of electronic relay 130 to signals being practically instantaneous, and contactor 18 being in unison with the corresponding member at the sending station, it is evident that the contacted receiving segment will correspond to the sending segment. From this segment, of which segment 4 may be considered an example, the circuit continues via the middle and upper contacts of key switch 157 through winding 159 of key magnet 158 to key magnet bus 139 via contacts 9—8 to positive bus. The pulse through this circuit energizes key magnet 158 whose plunger is attracted, stretching spring link 184 which pulls down the key lever to which it is attached. The key lever trips the typewriter or printer mechanism (not shown) printing the selected character. As the key lever nears the end of its downward travel, push rod 155 opens the key switch contacts. Owing, however, to inertia of the key lever and other retarding effects, the circuit is actually broken by the opening of contacts 173—174 by cut-off relay 170 which is preferably adjusted to cut off the current just short of the termination of the line signal. With perfect unison, the circuit is broken before contactor 18 leaves the connected segment.

Shift and shift-check arrangement

Referring to Figs. 4 and 5, which illustrate a method and apparatus for controlling and checking the shift function of the receiving typewriter or printer, in order to simplfy the description of this feature and to facilitate the tracing of circuits, the diagrams are shown schematically with some parts of the circuits in abbreviated form. The manner in which this feature is incorporated with other apparatus shown in Fig. 1 will be clear by the circuits and apparatus shown in the diagrams considered in connection with Fig. 1. In general, circuits used in sending operations are shown in full lines while those used in receiving

only are shown by dash lines. The switch contacts are shown in position for sending.

Referring to Fig. 4 in particular, the diagram illustrates an embodiment of the invention in which the shift and shift-check functions are distinct. The shift key lever is similar to the printing key levers **156**, and is similarly provided with its individual key switch **157** and key magnet **158**. The fork member **156***b* indicates the function of the key lever in actuating the shift mechanism (not shown). A shift mechanism suitable for use with this invention is shown in my copending application Serial No. 701,644 dated December 9, 1933.

In connection with the present description, it is to be understood that the shift mechanism alternately shifts to the upper case and lower case characters on successive operations of the shift key. Otherwise stated, each time the shift key is depressed, the shift mechanism shifts case, and remains locked in that case until the succeeding depression of the shift key. This mode of operation dispenses with the need for holding the shift key depressed manually while upper case characters are being typed. The receiving machine is controlled to perform the shift and other printing movement operations by printing signals as previously described. The particular point to be noted in connection with the present description is that if the receiving machine is left in the wrong case position, or due to some cause is erroneously shifted, upon starting up the receiving machine by remote control, the proper keys of the receiving machine would be actuated by the sending machine, but the characters would be typed in the wrong case, with consequent confusion in the message. Hence assurance of conformity in the typing case at the receiving machine is highly desirable and means are provided for securing such conformity.

Conveniently located on the key board is another key **256** designated as the check key, which is provided with its individual key switch **257**, but does not actuate any mechanism of the typewriter and is used only for transmitting signals. Attached to some part of the typing mechanism which moves into predetermined positions related to the shift case, as for example, type basket **201**, is an actuating finger **202** adapted to actuate shift switch **203**, as indicated. The upper case position of type basket **201** is indicated in broken lines. When the type basket is in the lower case position, the contacts of shift switch **203** are open; when the type basket is in the upper position they are closed. The remaining parts or their equivalents have been described in connection with Fig. 1.

The operation is as follows: The sending machine is placed in a predetermined case position, such as the lower case position, and to check the shift position of the receiving machine, and correct same if not in conformity with the sending machine, check key **256** is depressed. A circuit is thus closed from positive battery via contacts **8**—**7** via send bus **138**, lower and middle contacts of key switch **257** to segment **16***c*. When rotary contactor **18** arrives at segment **16***c*, the circuit is completed to ring **17** thence to line and return via contacts **11**—**10** to negative battery. A current pulse in this circuit during the duration of contact with segment **16***c* sends a printing signal to the receiving machine, which is assumed to be synchronized, with its rotary contactor **18** likewise in contact with segment **16***c*. At the receiving machine the operation is as follows: The printing signal passes from line terminal **30** via contacts **11**—**12** through relay **130** to line terminal **31**. Relay **130** is thus energized, completing a local circuit from negative battery via contacts **130***a*, via ring and rotary contactor **18** to segment **16***c*, via middle and upper contacts of key switch **257**, via conductor **260**, contacts of shift switch **203** (assumed to be closed) and conductor **261** through key magnet winding **159** to receiving bus **139** via contacts **9**—**8** to positive battery.

It having been assumed that the contacts of shift switch **203** are closed, that is that the receiving machine is in the upper case (non-corresponding) position, key magnet **158** is energized, operating key lever **156** which trips the shift mechanism and brings the receiving machine into the lower case position and hence into conformity with the sending machine. Should, however, the receiving machine already be in lower case, the circuit would be incomplete at the contacts of shift switch **203** and the receiving machine would not be shifted. Thereafter, operation of the shift key lever **156** will cause corresponding shift of case at both sending and receiving stations through segment **16***b*, in the same manner as described above for the printing key levers.

It is to be understood that variations in the location and arrangement of the shift switch and other details may be found convenient in adapting the invention to various typing mechanisms, and such variations will be readily perceived by those skilled in the art and are within the scope of the invention. Likewise, the method and apparatus disclosed are readily adapted to other machines than that shown in Fig. 1, and to groups of machines under the remote control of a sending station.

In the embodiment of the invention just described, shift checking may be accomplished from one shift position of the sending machine, but not both. In the embodiment now to be described, shift checking can be accomplished from either shift position, the check key is eliminated, and checking is accomplished automatically upon the operation of the shift key. Referring to Fig. 5 in detail, shift key **156** is provided with a key magnet **158** but no key switch, the transmission of signals being performed by the shift switch. The finger **202** carried by a convenient part of the typing mechanism as above described, is provided with a cross piece **204** carrying at each end an insulated jockey roller indicated by **205***a* and **205***b* respectively. Shift switch **203** comprises one set of alternate make contacts, designated by **203***a*, and two sets of break-make contacts designated as **203***b* and **203***c* respectively. The connections of these contacts will become apparent in tracing out the sending and receiving circuits.

In the first embodiment of the shift-check arrangement, it is to be observed that the mechanical shift action had been completed before the check signal was transmitted. To avoid confusion in transmission, because of the variable interval between the depression of the shift key and the transmission of the shift signal, it is desirable in the second embodiment to provide means to insure that the mechanical shift action is completed before the shift signal is transmitted to the receiving machine. To this end, it is provided that during the mechanical shift action, preparations are made to transmit the shift signal, but the signal is only transmitted after the completion of the mechanical shift action, irrespective of the manual operation of the shift

key. Condenser **206** is provided to store the energy to transmit the shift signal during the variable interval prior to transmission.

The operation is as follows: To shift, the shift key is depressed in the manner, and the shift mechanism (not shown) is tripped to shift the typebasket (for example). Assuming that the typebasket is moved upwards, as jockey roller **205***a* passes switch **203***a*, the middle contact is momentarily closed on the upper contact, and then the contacts open as the pocket roller slips past. During the moment that the contacts are closed a circuit is completed from positive battery via contacts **8—7** through conductor **262**, via upper and middle contacts of switch group **203***a*, through conductor **263** and condenser **206** to negative battery. Condenser **206** is thus charged to the potential of battery **44**. As the typebasket completes its upward travel, jockey roller **205***b* closes the middle and upper contacts of switch group **203***c*.

When rotary contactor **18** reaches segment **16***c*, a circuit is completed from the positively charged side of condenser **206** through conductor **263**, via upper and middle contacts of switch group **203***c* to segment **16***c*, via contactor **18** to ring thence to line terminal **31**, through line and return, via contacts **11—10** to negative side of condenser **206**. Condenser **206** discharges through this circuit, sending the shift signal to the line.

At the receiving machine, the operation is as follows: The line signal energizes relay **130** as before described. Assuming that the receiving machine is in the lower case position as shown in Fig. 5, when relay **130** closes its contacts, a local circuit is completed from negative battery via contacts **130***a* to ring, via contactor **18** to segment **16***c*, thence via middle and lower contacts of group **203***c* and conductor **261** through winding **159** of key magnet **158** to receive bus **139**, via contacts **9—8** to positive battery. A current pulse through this circuit energizes key magnet **158** which pulls down the shift key and trips the shift mechanism, shifting the typebasket to the upper position. The receiving machine is thus brought to conformity with the sending machine as regards case.

Assume on the contrary that the receiving machine had been left in the upper shift position. In that event the receiving circuit would have been broken at the contacts of group **203***c*, and the key magnet **158** would not be energized, hence the receiving machine would remain in the upper shift position and would thus conform with the sending machine.

Were it assumed that the sending machine was initially in the upper shift position, the operation would be the same, except that the shift signal would have been transmitted via switch group **203***b* and segment **16***b*, and at the receiving machine the local pulse would have been applied through the corresponding circuit.

It is to be noted that with the arrangement shown, by selecting a suitable size for condenser **206**, it will be fully discharged while transmitting the shift signal to the line, hence no especial provision against repeat signals is necessary.

It will be apparent that my invention provides a communication system particularly adapted to the utilization of commercial typewriters for the sending, receiving and printing functions of a printing telegraph system. Also that various features of the invention may be readily adapted to uses other than those illustrated.

While the methods herein described, and the forms of apparatus for carrying these methods into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise methods and forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In apparatus of the character described including a sending station and a receiving station, typewriter mechanism at each of said stations movable to upper and lower case positions, an actuating member at said sending station controlling movement of said mechanism thereat from one case position to another upon successive operations, an actuable member at said receiving station for moving the mechanism thereat from one case position to another upon successive operations, transmission means for causing operation of said actuable member in response to an operation of said actuating member, and additional actuating means for causing operation of said actuable member only when said mechanism at said receiving station is in non-corresponding position with the mechanism at said sending station.

2. In apparatus for the character described, in combination, a controlling shift mechanism, a shift mechanism actuating member therefor, signal transmitting means actuated thereby, signal reeciving means, a controlled shift mechanism, means for causing actuation of said controlled shift mechanism in response to the reception of a signal by said receiving means, and means operable in response to the position of said controlled shift mechanism for controlling said actuating means to maintain said controlled shift mechanism in proper case position corresponding to the case of said controlling shift mechanism.

3. In remotely controlled printing apparatus, in combination, shift mechanism, a shift mechanism controlling member, electromagnetic operating means for said controlling member and switching means actuated by said shift mechanism to control said electromagnetic operating means.

4. In apparatus of the character described a controlling mechanism and a controlled mechanism both shiftable to a plurality of positions, said controlling mechanism including a shift mechanism actuating member, a switching means actuated by said actuating member, a signal transmitting circuit associated therewith for sending a first signal indicative of a shift in position of said controlling mechanism, an auxiliary means for sending a second signal indicative of a predetermined position of said controlling mechanism, and means for effecting a shift in position of said controlled mechanism in response to said first signal, and for effecting a shift in position in response to said second signal only when the controlled mechanism is in a non-corresponding position with said controlling mechanism.

5. A system of the character described comprising, in combination, a plurality of mechanisms including shiftable type baskets and controlling means therefor, including means whereby operation of the corresponding controlling means effects positioning of the type basket to a certain case position, and means to position the type basket of one mechanism to correspond to the position of the type basket of the other mecha-

nism upon operation of any one of said controlling means and irrespective of the positions of the type baskets.

6. A system of the character described comprising, in combination, a plurality of typewriters, each including positionable shift mechanisms and an associated shift key, control means, independent of the shift key, included in one of said typewriters to control the operation of the shift mechanism of another of said typewriters, and means controlled upon operation of said control means to position the shift mechanism of the second mentioned typewriter to correspond to the position of the first mentioned typewriter, irrespective of the position of the shift mechanism of the second mentioned typewriter.

7. A system of the character described comprising, in combination, signal transmitting means including a typewriter mechanism having a positionable shift mechanism, and signal receiving means including a typewriter mechanism having a positionable shift mechanism, means including in said transmitting means to initiate a control signal, and means included in said receiving means responsive to said control signal to control the operation of the said shift mechanism thereat so as to correspond to the position of the shift mechanism of the first mentioned typewriter, irrespective of the positions of the shift mechanisms.

8. A system of the character described comprising, in combination, a plurality of typewriter mechanisms each including a positionable shift mechanism and controlling shift key therefor, means to transmit a control signal upon operation of the shift key of one of said typewriter mechanisms, and means responsive to said control signal to control the shift key and corresponding shift mechanism of another of said typewriter mechanisms so as to correspond in position to the shift mechanism of the first mentioned typewriter mechanism, irrespective of the position of the shift mechanism of the second mentioned typewriter, upon receipt of the control signal.

9. A system of the character described comprising in combination, sending and receiving typewriter means, each of which include shiftable type basket mechanism, means controlled by the sending typewriter means to transmit a control signal, and means responsive to said signal to position the type basket mechanism of the receiving typewriter means to coincide with the type basket position of the said sending typewriter means, irrespective of the position of the type basket of the receiving typewriter means.

10. A system of the character described comprising, in combination, a typewriter mechanism having shiftable type basket mechanism and a controlling keybar therefor, means to control the operation of the keybar and means controlled upon operation of the said control means to position the type basket mechanism in one position and upon a second operation of said control means is effective to position the type basket mechanism in another position.

11. A system of the character described comprising, in combination, a receiving typewriter mechanism having shiftable type basket mechanism and a controlling keybar therefor, electromagnetic means to control the operation of the keybar, and a control circuit for said electromagnetic means energized aperiodically to operate the electro-magnetic means and keybar so that upon one operation thereof the type basket mechanism is positioned in one position and upon a successive similar operation thereof the type basket is positioned in a different position.

12. A system of the character described comprising, in combination, a typewriter mechanism having shiftable type basket mechanism and a controlling keybar therefor, means controlled by the keybar to position alternately the type basket upon successive and complete operation of the keybar, and means to control automatically the operation of the said keybar.

13. A system of the character described comprising, in combination, a typewriter mechanism having shiftable type basket mechanism and a controlling keybar therefor, means to transmit successive timed shift signals, and means responsive to said timed signals to control the operation of said keybar to position the type basket alternately upon successive operations of the keybar.

14. A system of the character described comprising, in combination, a typewriter mechanism having shiftable type basket mechanism, means including signal distributing means to transmit timed shift control signals, means including signal distributing means to receive the timed control signal and means controlled by the said received signals to position the type basket mechanism in alternate positions upon receipt of the successive timed control signals.

15. In a remotely controlled recording mechanism, the combination of an operating instrumentality, a key lever including controlling means adapted to cause operation of said instrumentality, a circuit including means adapted to be energized by successive impulses, operating means controlled by the energization of the said means included in the circuit, and means cooperating with the said operating means to operate the said controlling means whereby the said instrumentality is controlled in a different manner upon the successive energization of the said means included in the circuit.

16. In a remotely controlled recording mechanism, the combination of an operating instrumentality, a key lever and control means therefor adapted to cause operation of said instrumentality, and electromagnetic means adapted to control the operation of the key lever whereby the said instrumentality is controlled in a different manner upon successive energization of said electromagnetic means.

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