Aug. 9, 1932. A. JIPP ET AL 1,870,997

PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed Jan. 4, 1930 4 Sheets-Sheet 1

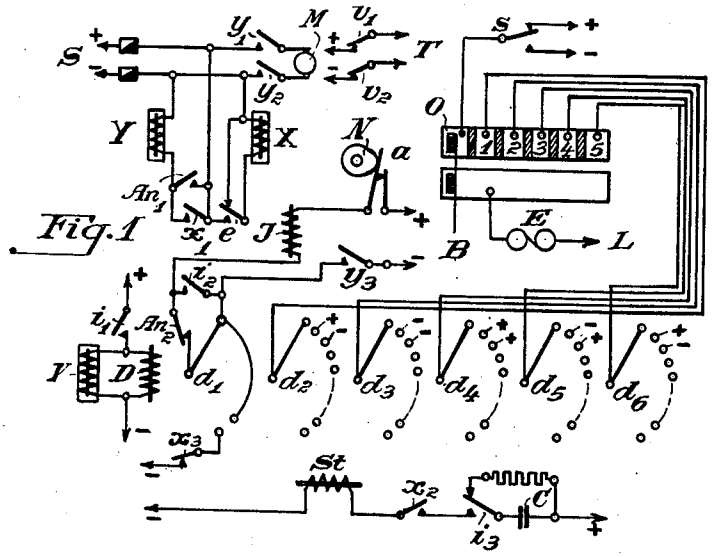

Fig. 1

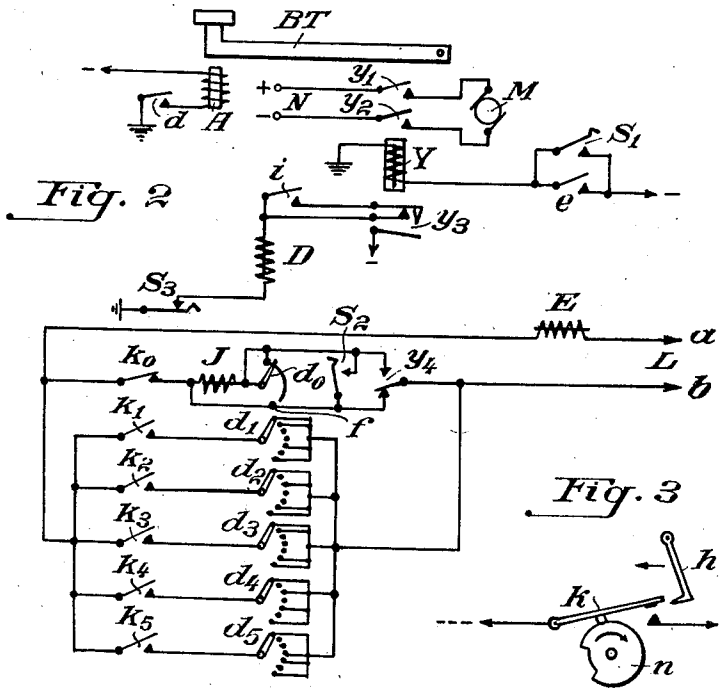

Fig. 2

Fig. 3

Inventors:
August Jipp
Ehrhard Rossberg
Franz Simon
Alfred Scheunert
Willy Skawran
by Lotka & Kehlenbeck
Attorneys.

Aug. 9, 1932. A. JIPP ET AL 1,870,997

PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed Jan. 4, 1930 4 Sheets-Sheet 2

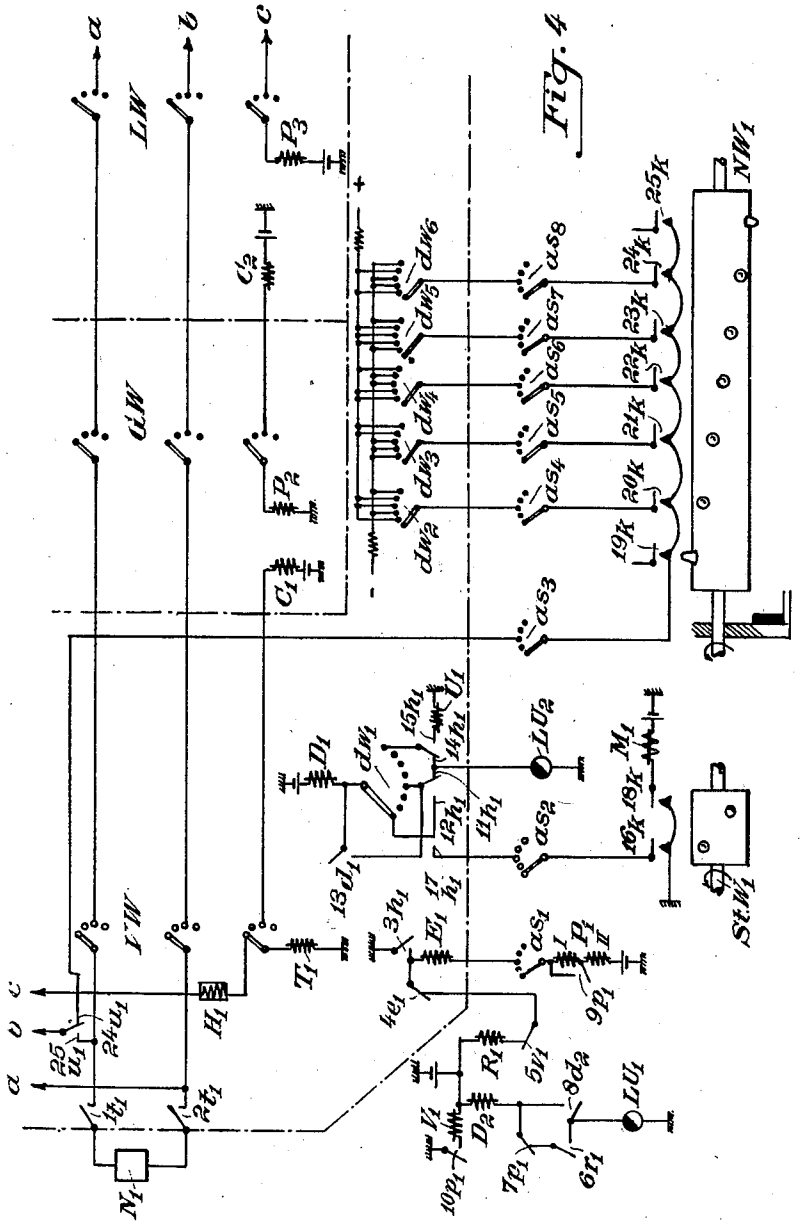

Fig. 4

Inventors:
August Jipp
Ehrhard Rossberg
Franz Simon
Alfred Scheunert
Willy Skawran
by Lorenz & Kellenbeck
Attorneys.

Aug. 9, 1932. A. JIPP ET AL 1,870,997

PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed Jan. 4, 1930 4 Sheets-Sheet 3

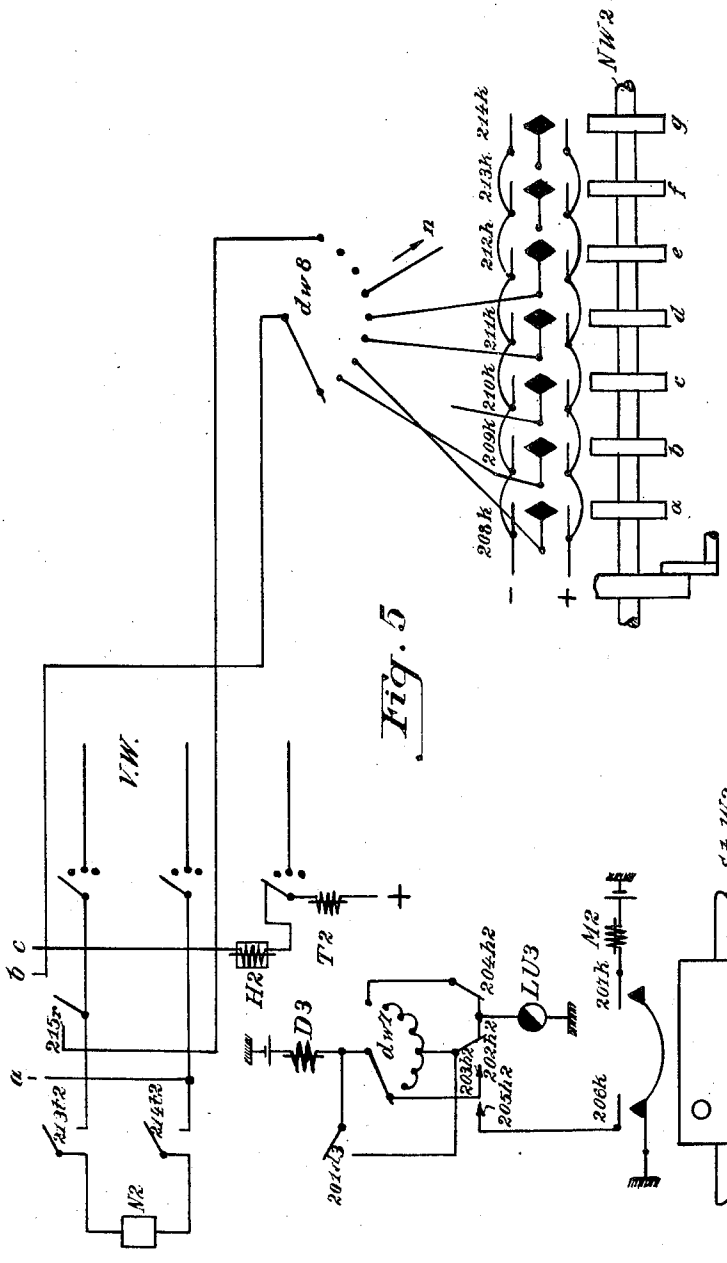

Fig. 5

Inventors:
August Jipp
Ehrhard Rossberg
Franz Simon
Alfred Scheunert
Willy Skawran
by
Pohle & Kehlenbeck
Attorneys

Aug. 9, 1932. A. JIPP ET AL 1,870,997

PRINTING TELEGRAPH EXCHANGE SYSTEM

Filed Jan. 4, 1930 4 Sheets-Sheet 4

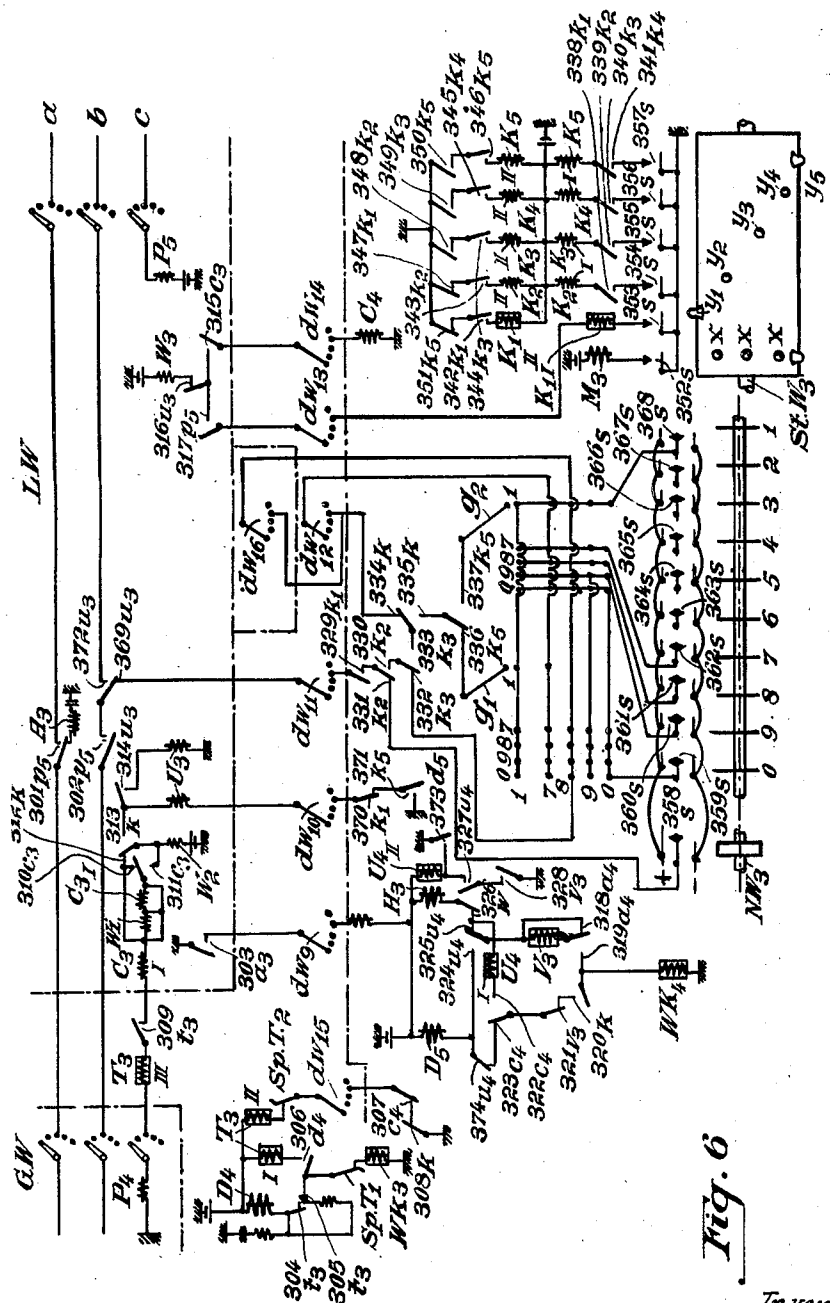

Fig. 6

Inventors:
August Jipp
Ehrhard Rossberg
Franz Simon
Alfred Scheunert
Willy Skawran
by Lotka & Kellenbeck
Attorneys.

Patented Aug. 9, 1932 1,870,997

UNITED STATES PATENT OFFICE

AUGUST JIPP, OF BERLIN-SPANDAU; EHRHARD ROSSBERG, OF BERLIN-SIEMENSSTADT; FRANZ SIMON AND ALFRED SCHEUNERT, OF BERLIN-CHARLOTTENBURG, AND WILLY SKAWRAN, OF BERLIN-NIEDERSCHONHAUSEN, GERMANY, ASSIGNORS TO SIEMENS & HALSKE, AKTIENGESELLSCHAFT, OF SIEMENSSTADT, NEAR BERLIN, GERMANY, A CORPORATION OF GERMANY

PRINTING TELEGRAPH EXCHANGE SYSTEM

Application filed January 4, 1930, Serial No. 418,460, and in Germany December 28, 1928.

Our invention relates to improvements in systems of communication, and more particularly tele-printers, tele-writers and the like.

It is well known in the art to design communication systems for tele-printers, tele-writers and the like in such a manner that the apparatus is always ready to receive a message and the transmitted signs are automatically printed or recorded by the receiving apparatus. Neither for switching the receiving apparatus on or off nor during the transmission of the messages is any attendant required at the receiving end.

It is, however, a drawback that in particular in extensive systems and such for automatic connection the calling subscriber has no means at his disposal of ascertaining at once whether the correct connection has been made and that the receiving apparatus is really ready to receive the message. This uncertainty is particularly disagreeable if a message is to be kept secret or is of great importance.

The object of our invention is to provide an automatically operating return signaling device or indicator which becomes operative when a call is received and transmits a signal to the calling subscriber. This may in the simplest case consist of a signal indicating readiness, but preferably a special signal identifying the called up subscriber will be transmitted, for instance, his name. The return signaling device is in its mode of operation preferably adapted to the tele-printer so that the return signal can be written down by the receiving apparatus of the calling subscriber.

An impulse transmitter of suitable construction is therefore employed, such as a transmitter for standard perforated paper tapes, or a step-by-step mechanism of the nature of dial selectors, or a contact mechanism with cam control.

Preferably the return signaling device is connected with a contact of the receiving relay in such a manner that said device is released by the relay as soon as the calling impulse arrives. The receiving relay is preferably connected in such a way that its armature is operated once by the calling impulse. This new position is then maintained during the operation of the system during all intervals between signals, but when the entire equipment is inactive or at rest, i. e. prior to the call, the armature is in the other position which corresponds to the operative position.

If now, for instance, in a tele-printer system a subscriber desires to transmit a message to another subscriber, he first puts himself in known manner in communication with the subscriber he wishes to call up and then depresses a calling key whereupon at the called station the armature of the receiving relay is reversed and the return signaling device or recorder rendered operative. It will be understood that instead of the key other means may be provided which start the return calling device automatically after the through connection has been effected.

The return report is now written down by the receiving apparatus of the calling subscriber so that this subscriber knows that he is correctly connected and that the station called up is ready to receive his message. The return signaling device is then automatically rendered inoperative again and switches in the receiving apparatus at the called station if this should not already have been done by the calling impulse. No attendants whatever are thus needed at the called station.

During the transmission of messages which then begins the return signaling device remains inoperative and is made ready for service again only when the connection is interrupted. On the other hand it might be desired that the return signaling device should not start at all when a message is sent out, i. e. at the calling station. Switching means are therefore provided which are indirectly or directly rendered operative by the subscriber prior to or when switching in the transmitter and which interrupt one of the circuits of the impulse transmitters at a suitable point.

Apparatus of the character indicated above may be used for most of the customary designs of tele-writers and tele-printers. Certain difficulties arise, however, in me-

chanically operating apparatus working without revolving distributor brushes, as for instance the mechanical apparatus operating on the start-stop principle. In this apparatus the combination of current impulses (as a rule five impulses) corresponding to the signal or symbol to be transmitted at the time is set in such a manner that contact springs which are controlled by a controller shaft and which can be closed consecutively during each revolution of the control shaft, are partly locked in a mechanical manner by key-operated levers.

In one embodiment of our invention these contacts are electrically connected with the signal transmitter serving for return signaling. The arrangement is preferably such that during the return signaling the run of the control shaft depends upon the operation of the signal transmitter in such a manner that the signal transmitter controls the mechanism which releases the control shaft for one revolution at a time.

In the circuits of the contacts controlled by the controller shaft are included the contacts of the signal transmitter, for instance the contact arms and contacts of a dial selector of known design, the bank of contacts of which is wired in accordance with the return symbol or signal. Instead of a dial selector a perforated paper tape transmitter or a contact mechanism controlled by tappets or cams may be used. In any event, the contacts of the signal transmitter are connected in series with the contacts controlled by the control shaft of the transmitter if closing contacts are employed.

A tele-printer system equipped with this return signaling device or indicator operates, for instance, in such a manner that the receiving relay of the called subscriber is first reversed by the calling impulse. After switching in the motor the signal transmitter provided for the return report performs its first step and releases the control shaft of the main transmitter for its first revolution by, for instance, a tripping magnet acting on the blank letter key being energized across a contact controlled by the signal transmitter. After the revolution of the control shaft a contact controlled by this shaft causes the signal transmitter to advance by a further step for the purpose of transmitting the next signal. In this way the signal transmitter and the control shaft of the main transmitter cooperate alternately by controlling each other alternately.

It is easily possible to combine the return signaling device or indicator with the tele-printer or tele-writer in a self-contained unit and, if desired, to use different switchgear in common. In many cases it is, however, preferable to use the return signaling device as a separate appliance which may be readily connected with standard apparatus and thus form a valuable supplement to existing systems.

A further considerable simplification may be brought about by providing at the exchange station one or a plurality of return signaling devices for one group or all the lines combined and by using automatic switchgear to effect the connection of a return indicator disengaged at the time.

After a connection has been made by dispatching series of current impulses in a well known manner the return signaling device is automatically switched in and transmits the return signal, which may consist of the name of the town and the name or the number of the called subscriber, to the receiver of the calling subscriber and then again renders itself automatically inoperative by disconnecting itself from the called up line. Simultaneously the line to the called subscriber is connected through and is now ready for transmitting messages. The return signaling device returns to the initial position of rest only after the two subscribers have been disconnected.

The starting of the return signaling device in the case of outgoing traffic is, however, impossible since the switchgear which initiates the operation of the name transmitter is so arranged that it can be rendered operative by arriving current impulses only.

The drawings affixed to our specification illustrate various embodiments of our invention.

In the drawings:

Fig. 1 is a return signaling device connected with the distributor ring of an electrically operating tele-writer according to the start-stop principle,

Fig. 2 shows a special construction for a mechanically operating start-stop apparatus the contacts of which are controlled by cams or tappets,

Fig. 3 is a detail of the apparatus shown in Fig. 2, and

Figs. 4, 5 and 6 illustrate various systems of connection for the application of a return signaling device in tele-printer systems with selector operation. In particular various systems of the interlinking of the return signaling device with connecting apparatus, such as selectors of exchanges, are shown in these figures.

Referring to Fig. 1 of the drawings it will be seen that a dial selector is utilized as a return signaling device, the arms of which are indicated by the reference letters d_1 to d_6. E is the receiving relay the armature e of which is reversed as soon as a calling impulse arrives. This causes the relay X to respond which by means of the contact x_1 connects in circuit the relay Y. Y now responds and by means of the contacts y_1 and y_2 connects the source of current S to the apparatus so that its driving motor M starts. Simultaneously the J-relay

is energized in the following circuit: battery, rest contact a, relay J, key An_2, selector arm d_1, reversed contact y_3, battery. The contact i_1 connects the stepping magnet D in circuit so that the selector performs its first step. Simultaneously there is energized the time lag relay V which by means of the contacts v_1 and v_2 disconnects the keyboard contacts (T) of the apparatus. During the step-by-step motion of the selector the contact i_2 is closed so that the circuit for the relay J remains closed even when a break takes place during the passage of the arm d_1 from one contact to the other.

The arms d_2 to d_6 are now according to the signal to be transmitted connected partly to +, partly to − of the battery so that a corresponding series of impulses (for instance + − + − + as shown) is sent into the line when the brush B sweeps across the transmitter disk O.

The brush in known manner, is released, for a complete revolution at each time, by the control magnet St which is energized by the charging current of the condenser C across the contact i_3 when the J-relay responds.

During the revolution the contact a is open and is closed only after the revolution is completed. In this way the relay J is connected in circuit anew so that the magnet D is energized again and the selector makes another step forward. Through the transmitter disk the sequence of impulses corresponding with the second selector step, for instance − − + + −, is now sent into the line. The cycle described is repeated until the d_1 − arm of the selector engages the last contact. Here it stops since the contact x_3 is still open.

During the return signaling the time lag relays X, Y and V are permanently energized. As soon as the selector has reached the last contact the relay V drops open and by the contacts v_1 and v_2 which were open during the return signaling, connects the keyboard contacts (T) again to the battery or the network.

The return signaling is now finished and the ordinary traffic may commence.

During the traffic the relays X and Y continue to remain energized. Only after the traffic is finished the armature e of the receiving relay is reversed into the inoperative position shown. X and Y are then deenergized so that x_3 is closed again. Through x_3 the relay J is made to respond once more, D receives a fresh impulse and advances the selector into the zero position. The control magnet St is then no longer energized because x_2 is already open.

The system is now ready for another call.

In the case of outgoing traffic the switch An, for instance a key, is reversed either prior to or simultaneously with the switching in of the main transmitter. The Y-relay is then energized across the switch An_1, so that the contacts y_1 and y_2 are closed. Simultaneously An_2 is, however, opened so that the J-relay does not respond and the return signaling device does not become operative.

Fig. 2 illustrates a return signaling device operating in a similar manner in conjunction with a tele-printer the contacts of which are controlled by a bank of cams and thus render necessary a special connection of the return signaling device.

The first calling impulse arriving over the line L energizes the receiving relay E across the following circuit: line battery (not shown), line a, relay E, closed contact k_0, line b, line battery. The relay E by closing the switch or contact e causes the relay Y to respond. The relay Y reverses its contacts y_1 to y_4. Through the contacts y_1 and y_2 the driving motor M is connected to the supply N and thus the main transmitter started. Through contact y_3 there is energized the stepping magnet D which moves the signal transmitter, designed as a dial selector, forward by one step. y_3 is designed as a follower contact and in the attracted state of y_3 D would have been deenergized again if the relay J had not been simultaneously energized through contact y_4 and had not closed the contact i. The relay Y has a time lag and remains permanently attracted during the return signaling as well as during the entire traffic since it cannot be made to drop off by the short interruptions of the contact e.

When the stepping magnet D is attracted the contact d is closed and the tripping magnet A made to respond. The blank letter key BT, for instance, is thus pulled down and the control shaft released for one revolution. During the revolution the contact k_0 is open so that D is deenergized and the contacts k_1 to k_5 close in succession. One group of current impulses is then sent into the line, in correspondence with the combination set up at the contacts of the dial selector. As soon as the revolution is completed the contact k_0 closes so that the relay J is energized anew and causes the stepping magnet D to respond again. The stepping magnet D advances the contact arms d_0−d_5 by a further step and causes the control shaft to revolve as before, for instance by operating the blank letter key BT. In this way the current impulse combination corresponding with the signs to be returned are sent into the line until the dial selector has attained its last step in front of the starting position. In this position the contact arm d_0 short circuits the relay J across the contact f so that i remains open and the stepping magnet receives no further current impulses. The return signaling is now finished and the ordinary traffic can commence.

When the transmission is finished the relay Y is made to drop off if the line of the

relay Y is permanently interrupted since the contact e of the receiving relay E remains open. The contacts y_1 and y_2 are opened again and the motor switched off. The follower contact y_3 is closed for a short time so that the stepping magnet receives a last impulse and advances its contact arms d_0-d_5 into the starting position.

In case of outgoing traffic the switch S is reversed either automatically or by hand. The relay Y is then energized across S_1 and thus the driving motor M switched on. The contacts y_3 and y_4 which serve for connecting up the return signaling device remain, however, inoperative since the relay J is shortcircuited across the contact S_2 of the reversed switch and the circuit for D was also interrupted by the contact S_3.

Fig. 3 of the drawings illustrates a construction of the contacts k_1 to k_5. The contact spring k is during a certain part of the revolution of the control shaft moved into the closed position by a cam n mounted upon the shaft. This movement can, however, take place then only when the locking lever h is located in the release position shown in the drawings. If, for instance, said lever is moved towards the left when the transmitter keyboard is operated, it locks the contact k and prevents it from moving. The locking levers h, one of which is provided for each of the contacts k_1 to k_5, are reversed by keys in definite combinations during ordinary traffic. When the blank letter key is depressed, on the other hand, all the levers are in the release position. Since the correct working of the return signaling device demands this position of the levers, the blank letter key BT must either be moved by a release magnet A, as shown in Fig. 2, or the reversal of the locking lever into the release position must be brought about by other means, for instance by a special rail, bar or lever which forces all locking levers back simultaneously and is adapted to be operated by a magnet.

Fig. 4 of the drawings illustrates the system of connection of an exchange for teleprinter systems with dial selector operation in conjunction with a return signaling device by which the name of the town and the name of the called up subscriber is adapted to be indicated at the transmitter station. The transmitter consists of a controller shaft which revolves continuously and a cam shaft which is operated electro-magnetically. To each transmitter is apportioned a dial selector which sets itself automatically on the line called. The sequence of the current impulses for the individual letters is controlled by a dial selector coordinated to each pre-selector. The number of the transmitters can be chosen according to the size of the office.

It may now be assumed that a calling subscriber has established a connection in the usual manner through pre-selector VW, group-selector OW and line selector LW. After the line selector has set itself on the called subscriber the following circuit for the H1-relay and T1-relay is established in the pre-selector of the called subscriber: ground, battery, P_3-relay at the line selector, c-arm of the line selector, c-wire, H1-relay, c-arm of the pre-selector at the called subscriber's station, T1-relay, ground. The T1-relay connects the two lines through to the called subscriber with its contacts 1 $t1$ and 2 $t1$. The R1-relay of the call line finder responds in the following circuit: ground, contact 3 $h1$, contact 4 $e1$, contact 5 $v1$, winding of the R1-relay, battery, ground. Contact 6 $r1$ closes and establishes a circuit for the stepping magnet D2 of the call finder: ground, delayed action circuit-breaker LU1, contact 6 $r1$, contact 7 $p1$, winding D2 of the stepping magnet, battery, ground. The retarded or delayed-action circuit breaker LU1 energizes the stepping magnet repeatedly until the arm $as1$ of the call finder encounters the dial selector of the called subscriber. The following circuit is then established for the relays P1 and E1: ground, battery, windings I and II of the P1-relay, arm $as1$ of the call finder, winding of the E1-relay, contact $3h1$, ground. The contact $4e1$ interrupts the circuit for the R1-relay, the contacts $7p1$ and the contact $6r$ disconnect the stepping magnet D2 from the time lag circuit breaker LU1; the contact $8d2$ which responds every time the stepping magnet responds prevents a premature de-energizing of the stepping magnet when the test relay is energized. The contact $9p1$ shortcircuits the high-resistance winding I of the P1-relay and thus blocks the call finder against a further engagement.

After the remaining arms $as2$ to $as8$ of the call finder have set themselves on the contacts to which is connected the dial selector coordinated to the called subscriber, in the example illustrated the third contacts, a circuit is prepared for the stepping magnet D1 through the arm or wiper $as2$ and the contacts $17h1$ and $12h1$. The control shaft $StW1$ which revolves continuously, now operates the contact $16k$ by means of a cam whereby a circuit is completed for the stepping magnet D1, viz.: ground, contact $16k$, wiper $as2$, contact $17h1$, wiper $dw1$, magnet winding D1, battery, ground. The dial selector performs one step and remains on the contact reached next since the control shaft $StW1$ has meanwhile continued its rotation and has broken the contact $16k$.

The control shaft then operates the contact $18k$ by a second cam. A circuit for the magnet M1 is then established, viz.: ground, battery, winding of the magnet M1, contact $18k$, ground. This circuit operates by the aid of a clutch, not illustrated, the cam shaft

NW1 which performs one revolution. The camshaft NW1 closes in succession the contacts 19*k* to 25*k*. The contact bank of the dial selector D1 the contacts of which are directly connected to the negative or positive pole of a battery is wired in correspondence with the name and the town of the called subscriber. One letter consists of 5 different current impulses which are sent to the calling subscriber through the wipers *dw*2 to *dw*6 of the dial selector D1 standing on the second contact, the wipers of the call finder *as*4 to *as*8 standing on the third contact, contact 24*u*1 and *b*-wire. The first letter consists in the example illustrated of the current impulses: +−+−+. Apart from this a current impulse is sent both at the beginning and at the end of each letter, which impulse passes over the contacts 19*k* and 25*k*. After the cam shaft NW1 has completed one revolution the slowly rotating control shaft S*t*W1 closes the contact 16*k* and thus completes the circuit for the stepping magnet D1 afresh, the magnet D1 performs another step and again remains on the contact reached after the control shaft has continued its rotation and opened the contact 16*k*. The sending of the impulse for the second letter takes place in the same manner as described before.

When the last letter has been dispatched the U1-relay responds across the last contact of the dial selector D1 in the following circuit: ground, winding of the U1-relay, contact 15*h*1, wiper or contact arm *dw*1, winding of the stepping magnet D1, battery, ground. The stepping magnet does not respond in this case owing to the high-resistance of the winding of the U1-relay. By means of the contact 24*u*1 the call finder is disconnected from the called line and by the contact 25*u*1 the *b*-line to the called subscriber is connected through to the called subscriber so that the line becomes free for the transmission of the telegraphing impulses. Until the next connection is made, the call finder remains in the position attained; the dial selector D1 is turned back into its starting position by interrupting the circuit for the U1-relay, after the calling subscriber has hung up and has thus caused the connecting gear to effect the release. The stepping magnet D1 is made to respond again through the following circuit: ground, time lag circuit breaker LU2, contact 14*h*1, wiper *dw*1, winding of the magnet D1, battery, ground, and performs a further step so that the initial position is attained again.

In the system illustrated in Fig. 5 of the drawings by which town and name of the called subscriber may likewise be given, the transmitter equipment at the exchange station (as in Fig. 4) consists of a control shaft continuously rotated, and a camshaft which is operated electromagnetically. The camshaft is, however, designed in such a manner that to each letter is apportioned a disk provided with corresponding cams, the disk being able to connect the positive or the negative pole of a battery to the transmitting device. To each pre-selector VW is apportioned a dial selector, as in the embodiment described above, the control of which takes place across its own contact arm or wiper while the connection to the called line is effected across its second wiper. By a corresponding connection of the individual contacts of the second bank of contacts of the dial selector to the contacts operated by the camshaft the correct sequence of letters is obtained for each subscriber.

If a calling subscriber has established a connection the H2- and T2-relay in the pre-selector VW of the called subscriber responds, as in the arrangement according to Fig. 4 of the drawings. Simultaneously a relay not shown in the drawings is energized which closes its contact 215*r*. By means of a cam, the control shaft S*t*W2 operates contact 206*k* and completes the following circuit for the stepping magnet D3 of the dial selector: ground, contact 206*k*, contact 205*h*2, wiper *dw*7, winding D3 of the stepping magnet, battery, ground. The magnet moves a step forward and remains stationary on the contact reached since the control shaft has continued its revolution and has again opened the contact 206*k*.

The control shaft then operates the contact 207*k* by means of a second cam and completes the following circuit for the magnet M2: ground, battery, winding M2, contact 207*k*, ground. The magnet M2 throws in a suitable clutch and thereby causes the camshaft NW2 to perform a revolution. Across the plus or minus pole, contact 209*k*, which is closed by the cam of the letter *b*, wiper *dw*8, which in the example assumed would stand on the second contact, *b*-line, the series of current impulses of the first letter is sent over the wire to the calling subscriber. The sending of the further letters takes place in the above described manner after the contact 206*k* has been closed again by the control shaft. After the last letter has been dispatched the dial selector performs a further step and remains stationary on the last contact since the opened contact 204*h*2 has interrupted the circuit to the time lag circuit breaker LU3. Across the wiper *dw*8 of the dial selector, the last contact of the dial selector, contact 215*r*, contact 213*t*2, subscriber N2, contact 214*t*2, the line is connected through to the called subscriber and is thus ready for the transmission of the telegraphic impulse.

After the completion of the transmission the connecting gear, such as pre-selector, group selector, line selector are tripped in the usual manner by the calling subscriber hang-

ing up his instrument whereby the circuit for the H2-relay in the pre-selector of the called subscriber is broken. The H2-relay drops off and connects with its contact 204*h*2 the time lag breaker LU3 to the stepping magnet D3 which makes another step forward and thus returns into the starting position.

In Fig. 6 a further modification of the system is illustrated in which town and number of the called subscriber is reported back to the caller. The central transmitting equipment consists again of a control shaft and a camshaft, the latter with 11 cams, apportioned respectively to the name, the town and the figures 0–9. The connection to the called line as well as the correct sequence of the figures is obtained by a lift rotary selector in conjunction with a relay chain. The number of the lift rotary selectors depends upon the traffic which the exchange has to handle, but for each group of 1000 subscribers at least one lift rotary selector is necessary. The selection of an idle lift rotary selector is effected by dial selectors with pre-adjustment apportioned specially to each line.

It may now again be assumed that a calling subscriber sends current impulses in the usual manner across pre-selectors and group selectors for setting the line selector to a desired subscriber line. In the line selector the A3-relay is thus energized by current impulses.

The rotary selector with pre-adjustment which in a fairly large exchange may, for instance, be located in the 7th hundred of the 8th thousands group, is already set to connect with an idle lift rotary selector since its turning magnet is permanently energized across earth, battery, winding D4, contact 304*t*3, contact 305*t*3, locking key S*p*T1, relay WK3, ground. During each response of the stepping magnet the contact 306*d*4 completes a circuit for the relay T3, viz.: ground, battery, winding I of the T3-relay, contact 306*d*4; locking key S*p*T1, WK3 relay, ground. The T3-relay interrupts with its contacts 304*t*3 and 305*t*3 the circuit for the stepping magnet D4 whereby contact 306*d*4 is opened and the T3-relay caused to open again. The contacts 304*t*3 and 305*t*3 close the circuit for the stepping magnet D4 afresh. The magnet responds and takes a step forward. This cycle is repeated until the wiper *dw*15 of the rotary selector encounters an idle lift rotary selector and completes the following circuit: ground, battery, winding II of the T3-relay, locking key S*p*T2, wiper *dw*15, contact 307*c*4, head contact 308*k*, ground. The T3-relay is energized and finally arrests the stepping magnet by opening the contacts 304*t*3 and 305*t*3. By closing the contact 309*t*3 the *c*-wire is connected through between the group selector and the line selector.

If a call arrives on this line a holding circuit is established for the T3-relay through ground, P4-relay in the particular group selector, *c*-arm or wiper of the group selector GW, winding III of the T3-relay, contact 309*t*3, winding I of the C3-relay, contact 310*c*3, head contact 312*k*, resistance *w*2, battery and ground, in order to prevent a response of the stepping magnet D4. This is necessary since in the above circuit the C3-relay in the line selector also responds and energizes the C4-relay of the lift rotary selector across the following circuit: ground, winding of the C4-relay, wiper *dw*14, contact 315*c*3, contact 316*u*3, resistance W3, battery, ground, which relay opens its contact 307*c*4. The winding II of the T3-relay would then become dead and due to the dropping of the contacts 304*t*3 and 305*t*3 complete anew a circuit for the stepping magnet D4. The relay C3 connects itself with its contact 511*c*3 in the following holding circuit: ground, P4-relay in the group selector, *c*-arm of the group selector, winding III of the T3-relay, contact 309*t*3, *c*-wire, winding I of the C3-relay, contact 311*c*3, resistance W2, battery, ground.

By the response of the A3-relay in impulses owing to the current impulses sent out by the calling subscriber there is effected the setting of the line selector on the desired subscriber line. If the subscriber line is idle the P5-relay in the line selector is energized and with its contacts 301*p*5 and 302*p*5 connects through the two connecting lines; by closing the contact 317*p*5 a circuit is prepared for the K1-relay.

By the response of the A3-relay in the line selector the A4-relay coordinated to the lift rotary selector is likewise energized in impulses across: ground, contact 303*a*3, wiper *dw*9, winding of the A4-relay, battery, ground. In this way the lift rotary selector is adjusted in the same manner as the line selector on the contact corresponding with the number of the called subscriber. The circuit for the lift magnet of the lift rotary selector is then as follows: ground, battery, winding H3 of the lift magnet, contact 326*w*, contact 325*u*4, winding of the V3-relay, contact 319*a*4, winding of the relay WK4, ground. The V-3 relay being a time lag relay remains energized during the sending of impulses and prevents a premature response of the stepping magnet D5 by opening its contact 321*v*3. After transmission of the first series of impulses the V3-relay is shortcircuited by the contact 318*a*4, it drops off and completes a circuit for the U4-relay, viz.: ground, winding of the WK4-relay, head contact 320*k*, which has closed during the first lift step of the lift rotary selector, contact 321*v*3, contact 322*c*4, winding I of the U4-relay, contact 326*w*, winding H3 of the lift magnet, battery, ground. The lift magnet does not respond in this circuit owing to

the high-resistance of the winding of the U4-relay. The relay U4 prepares a holding circuit across its contact 327*u*4. When sending out a second series of impulses the following circuit for the stepping magnet D5 is completed: ground, winding of the relay WK4, contact 319*a*4, winding of the V3-relay, contact 324*u*4, winding D5 of the stepping magnet, battery, ground.

The V3-relay again remains energized during the transmission of the impulses and closes a holding circuit for the U4-relay across ground contact 328*v*3, contact 327*u*4, winding II of the U4-relay, battery, and ground so that the U4-relay is likewise unable to drop open during the sending of impulses.

After the transmission of the impulses and the testing of the line selector for an idle subscriber line is finished, a circuit for the relay K1 is prepared by the contact 317*p*5, as already mentioned; the control shaft S*t*W3 which is continuously rotated closes by the aid of its cam *y*1 this circuit across: ground, contact 353*s*, winding I of the K1-relay, wiper *dw*13, contact 317*p*5, contact 316*u*3, resistance W3, battery, ground.

The relay K1 connects itself across ground, contact 351*k*5, contact 342*k*1, winding II of the K1-relay, battery, ground in a holding circuit so that it remains energized during the entire duration of the call answer after it has once responded, like the remaining relays of the chain of relays. The control shaft S*t*W3 now continues to revolve and establishes by means of a cam *x*, which closes the contact 352*s*, the following circuit for the magnet M3: ground, battery, winding of the magnet M3, contact 352*s* and ground. This magnet causes the camshaft NW3 to perform a complete revolution by means of a clutch not shown in the drawings.

By means of the cam which corresponds with the name of the town of the called subscriber and which connects the positive or negative pole of a battery to a change-over contact 358*s*, the current impulses indicating the name of the town are thus sent out along the following circuit: positive or negative pole of the battery, contact 358*s*, contact 331*k*2, contact 329*k*1, contact arm *dw*11, contact 369*u*3, contact 302*p*5, *b*-wire to the receiver of the calling subscriber. After the camshaft NW3 has completed a revolution the cam *y*2 of the control shaft S*t*W3 closes the contact 354*s* and thus the following circuit for the relay K2: ground, contact 354*s*, contact 338*k*1, winding I of the relay K2, battery, and ground. The relay K2 connects itself across ground, contact 347*k*1, contact 343*k*2, winding II of the K2-relay, battery, ground, in a holding circuit. The control shaft S*t*W3, continues to revolve and again closes by means of a further cam *x* the above described circuit for the release magnet M3, which brings about a second revolution of the camshaft NW3. Let us assume that the subscriber called has the number 8719. Since the lift rotary selector, as assumed is situated in the group of the 8th thousand, the 8th contact bank designating the figure 8 of the one contact set, the contacts of which are connected with one another, can be firmly connected to the contact 332*k*3. During the second revolution of the camshaft NW3 the cam coordinated to the figure 8 closes the following circuit for sending out the current impulse corresponding to this number, viz.: positive or negative pole of the battery, contact 329*k*1, contact arm *dw*11, contact 369*u*3, contact 302*p*5, *b*-wire to the receiver of the calling subscriber.

The contact series corresponding to the number 7 cannot be connected to a definite contact like the thousands number because in this case a special lift rotary selector would be necessary for each hundreds group. This series of contacts is for this reason connected by the rotary selector arm 12 with the respective hundred to which the rotary selector is coordinated. The contact arm *dw*16 belongs to a rotary selector, not shown, in the 8th hundreds group; as shown in the example the contact series designating the figure 8 is connected to this contact arm. The transmission of the hundreds number 7 in the example illustrated takes place in a similar manner to that of the thousands number. The control shaft S*t*W3 closes by the cam *y*3 a circuit for the relay K3, through ground, contact 355*s*, contact 339*k*2, winding I of the relay K3, battery, and ground. Relay K3 connects itself into a holding circuit across ground, contact 348*k*2, contact 344*k*3, winding II of the relay K3, battery, ground. The cam *x* of the control shaft S*t*W3 controls the release magnet M3 and again causes a revolution of the camshaft NW3. The circuit for current impulses corresponding with the number 7 which the corresponding cam of the camshaft NW3 connects to the change-over contact is as follows: positive or negative pole of the battery, contact 333*k*3, contact 330*k*2, contact 329*k*1, contact arm *dw*11, contact 369*u*3, contact 302*p*5, *b*-wire to the receiver of the calling subscriber. The issue of the tens and units of the number of the called subscriber is obtained by a coordinate-like wiring of the contacts of the lift rotary selector.

In the contact set designating the tens the contacts are wired in horizontal rows, in the second contact set, on the other hand, which designates the units, in vertical rows. To each of the wired contact rows is coordinated a number from 0 to 9 respectively and connected to the respective change-over contacts 359*s* to 368*s* operated by the cams of the camshaft NW3.

Since the arms of the lift rotary selector

already stand on the contact corresponding to the number of the called subscriber, in the example assumed on the 9th contact of the first decade, the following circuit is established for the issue of the tens number after the control shaft StW3 has energized by its cams y 4 and x the relay K4 and the release magnet M3, respectively, viz.: positive or negative pole of the battery, change-over contact 368s, vertical row of contacts 1, horizontal row of contacts 1, contact 9, contact arm g1 of the lift rotary selector, contact 336k5, contact 335k4, contact 333k3, contact 330k2, contact 329k1, contact arm dw11, contact 369u3, contact 302p5, b-wire, to the receiver of the calling subscriber. For the release of the unit number, after the control shaft StW3 has again energized the relay K5 and the magnet M3 by the cams y5 and x, respectively, the circuit is as follows: positive or negative pole of the battery, contacts 360s, vertical row of contacts 9, contact arm g2 of the lift rotary selector, contact 337k5, contact 335k4, contact 333k3, contact 330k2, contact 329k1, contact arm dw11, contact 369u3, contact 302p5, b-wire to the receiver of the calling subscriber. This completes the call return or answering of the name of the town and the number of the called subscriber.

When the relay K5 responds the holding circuit for the relay K1 is broken by the contact 351k5. The relay K1 drops off with time lag so that the last figure is still issued with certainty. By the release of the relay K1 there is initiated the stepwise drop of the relay chain K1 to K5 by the contact 342k1 opening the holding circuit for the relay K1; relay K1 drops off and opens through contact 347k1 the holding circuit for the relay K2, the latter drops off and opens the holding circuit for relay K3 and so on until relay K5 drops off and the chain of relays is thus deenergized again. When the relay K5 responds the relay K1, being a time lag relay, does not drop off at once; in this way the following circuit is completed for the relay U3 in the line selector LW: ground, contact 371k5, contact 370k1, contact arm dw10, winding I of the relay U3, head contact 313k, resistance W2, battery, ground. The relay U3 responds and on the one hand switches the b-line through to the called subscriber by closing its contact 373u3 and on the other hand disconnects the rotary selector from the connecting line. The line is now ready for the transmission of the telegraphic impulses. For the relay U3 the following holding circuit is completed: ground, winding II of the relay U3, contact 314u3, head contact 313k, resistance W2, battery, and ground. The contact 316u3 has opened the circuit of the relay C4, relay C4 drops open and closes the contact 307c4. The stepping magnet D5 of the lift rotary selector is again energized by the dropping of the contact 323c4 along the following circuit: ground, winding of the relay WK4, head contact 320k, contact 321v3, contact 323c4, contact 374u, winding D5 of the stepping magnet, battery, and ground.

The contact 373d5 is closed in consequence of the attraction of the stepping magnet D5 and establishes a circuit for the relay U4, viz.: ground, contact 373d5, winding II of the U4-relay, battery, ground. Contact 374u4 then opens again and interrupts the circuit for the stepping magnet. The stepping magnet D5 drops off and interrupts the circuit for the relay U4, whereupon the said magnet D5 is again energized across the dropped off contact 374u4, and the lift rotary selector performs a further step forward. This cycle of operations continues until the rotary selector has returned into its position of rest whereupon the head contact 320k opens and stops the selector finally. By the dropping off of the second head contact 308k the lift rotary selector is made ready for the connection of further rotary selectors with pre-adjustment.

We claim as our invention:

1. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means operating on extending a connection to a desired station for sending back to the calling station signals which characterize the desired station, said automatic means being arranged to operate said receiving mechanism at the calling station.

2. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means operating on extending a connection to a desired station for sending back to the calling station signals which characterize the desired station, said automatic means consisting of a stepping mechanism adapted to produce groups of impulses for operating said receiving mechanism at the calling station.

3. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means operating on extending a connection to a desired station for sending back to the calling station groups of impulses which characterize the desired station, said automatic means consisting of a selector-like stepping switch whose bank con-

tacts are wired according to said groups of impulses.

4. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which upon the extension of a connection to a desired station will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, said automatic means comprising a selector-like stepping switch whose contact bank is wired according to said groups of impulses, and a printing telegraph transmitting mechanism whose contacts are connected with the wipers of said stepping switch.

5. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which upon the extension of a connection to a desired station will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, said automatic means comprising a selector-like stepping switch whose contact bank is wired according to said groups of impulses, and a printing telegraph transmitting mechanism whose contacts are connected in series with the corresponding wipers of said stepping switch.

6. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means comprising a stepping mechanism and a printing telegraph transmitting mechanism whose contacts are connected with each other, which means, upon the extension of a connection to a desired station, will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, the stepping-on of said stepping mechanism and the rotation of said transmitting mechanism being dependent upon each other.

7. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means comprising a stepping mechanism and a printing telegraph transmitting mechanism whose contacts are connected with each other, to produce, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, the stepping-on of said stepping mechanism being effected by a contact which is controlled by said transmitting mechanism.

8 In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means comprising a stepping mechanism and a printing telegraph transmitting mechanism whose contacts are connected with each other, to produce, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, said transmitting mechanism consisting of a plurality of contacts and a common cam spindle controlling them.

9. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means comprising a stepping mechanism and a printing telegraph transmitting mechanism whose contacts are connected with each other, to produce, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, contacts, a common cam spindle controlling said contacts, and a continuously revolving control shaft for rotating said spindle when engaging said automatic means.

10. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which, upon the extension of a connection to a desired station, will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, the operation of said automatic means being effected when engaging the desired station.

11. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which, upon the extension of a connection to a desired station, will produce groups of impulses char-

acterizing the desired station for operating said receiving mechanism at the calling station, the operation of said automatic means being effected by means of a relay becoming operative when engaging the desired station.

12. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which, upon the extension of a connection to a desired station, will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, said automatic means being arranged at said central office.

13. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means which, upon the extension of a connection to a desired station, will produce groups of impulses characterizing the desired station for operating said receiving mechanism at the calling station, said automatic means being arranged at said central office and assigned to a plurality of subscribers' stations.

14. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, automatic means at said office for producing, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station to operate said receiving mechanism at the calling station, and automatic contact devices for cutting through said connection to the desired station after the answer back is finished.

15. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, a plurality of automatic devices at said office for producing, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station to operate said receiving mechanism at the calling station, and selector switches for automatically switching on to said connection an idle one of said automatic devices.

16. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, a plurality of automatic devices at said office for producing, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station to operate said receiving mechanism at the calling station, and selector switches for automatically switching on to said connection an idle one of said automatic devices, the operation of said selector switches being effected by a relay becoming operative when engaging the desired subscribers' line.

17. In a printing telegraph exchange system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office, means at said office for establishing connections between said subscribers' stations as desired, and automatic means at said office for producing, upon the extension of a connection to a desired station, groups of impulses characterizing the desired station to operate said receiving mechanism at the calling station, said automatic means comprising a plurality of stepping switches each of which is assigned to, and has its contact wired in accordance with, one of the subscribers' stations, a plurality of transmitting mechanisms adapted to generate groups of impulses for operating the printing telegraph receiving mechanisms at the subscribers' stations, and a plurality of selector switches each of which upon the extension of said desired connection, automatically connects an idle one of said transmitting mechanisms with that of said stepping switches which is assigned to the desired station.

18. In a printing telegraph system, a plurality of subscribers' stations, printing telegraph transmitting and receiving mechanisms at each of the stations, a central office for establishing connections between said subscribers' stations as desired, and automatic transmitting means operating on extending a connection to a desired station for sending out to a calling subscriber's station a predetermined series of impulse combinations characterizing a called station, said automatic transmitting means consisting of signal producing means representing a series of impulse combinations in a fixed form, and of distributing means for sending out said impulse combinations in identical manner corresponding to the transmission of the message impulse combinations.

19. In a printing telegraph system, a plurality of subscribers' stations, printing telegraph transmitting and reciving mechanisms at each of the stations, a central office for establishing connections between said subscribers' stations as desired, and automatic transmitting means at the central office for sending out to a calling subscriber's station a

predetermined series of impulse combinations characterizing a called station upon connection thereto, said automatic transmitting means consisting of signal producing means representing a series of impulse combinations in a fixed form, and of distributing means for sending out said impulse combinations in identical manner corresponding to the transmission of the message impulse combinations.

In testimony whereof we affix our signatures.

AUGUST JIPP.
EHRHARD ROSSBERG.
FRANZ SIMON.
ALFRED SCHEUNERT.
WILLY SKAWRAN.