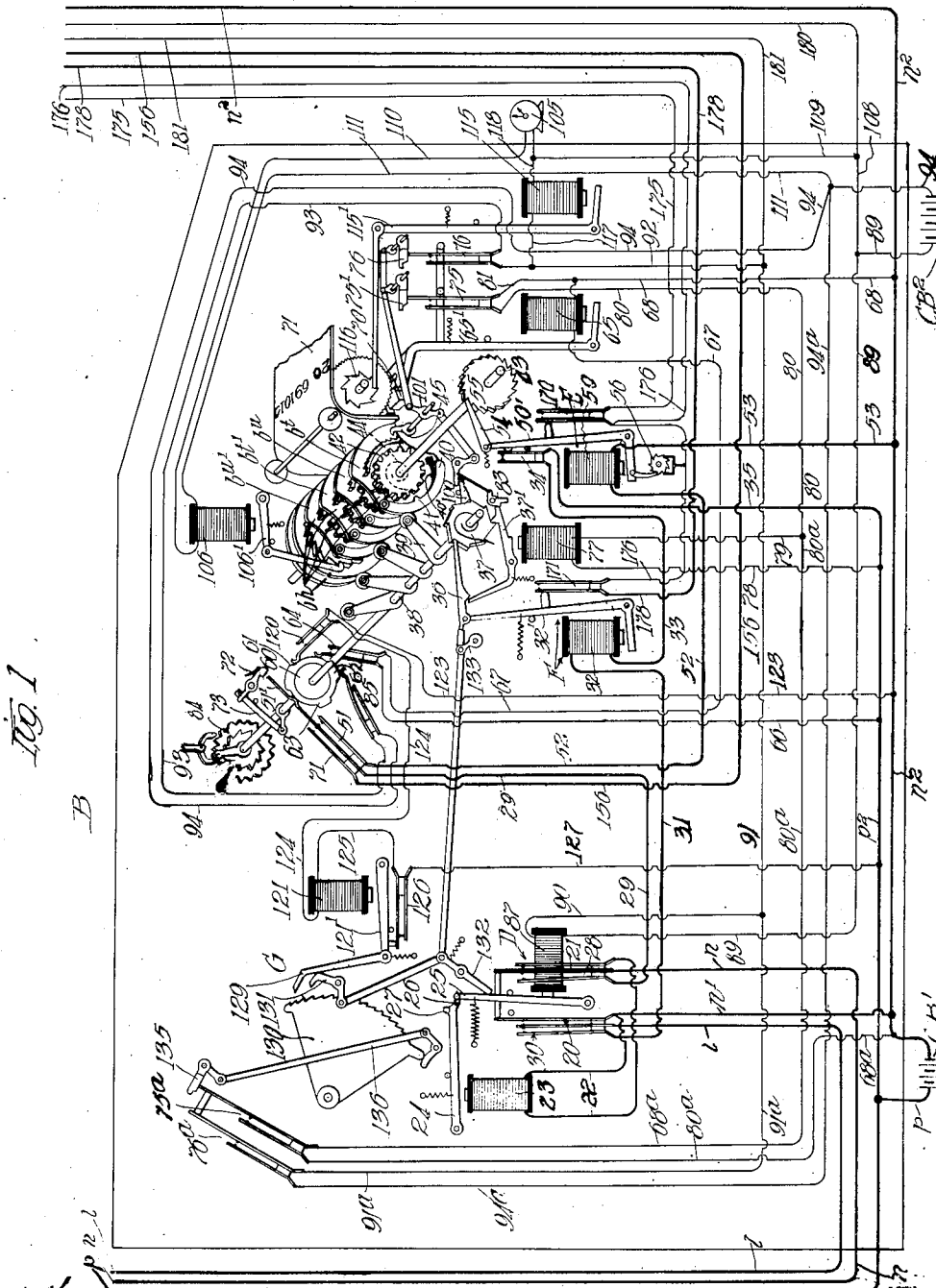


J. McFELL.
ELECTRIC SIGNAL TRANSMITTING MEANS.
APPLICATION FILED SEPT. 13, 1915.

1,308,958.

Patented July 8, 1919.
3 SHEETS—SHEET 1.



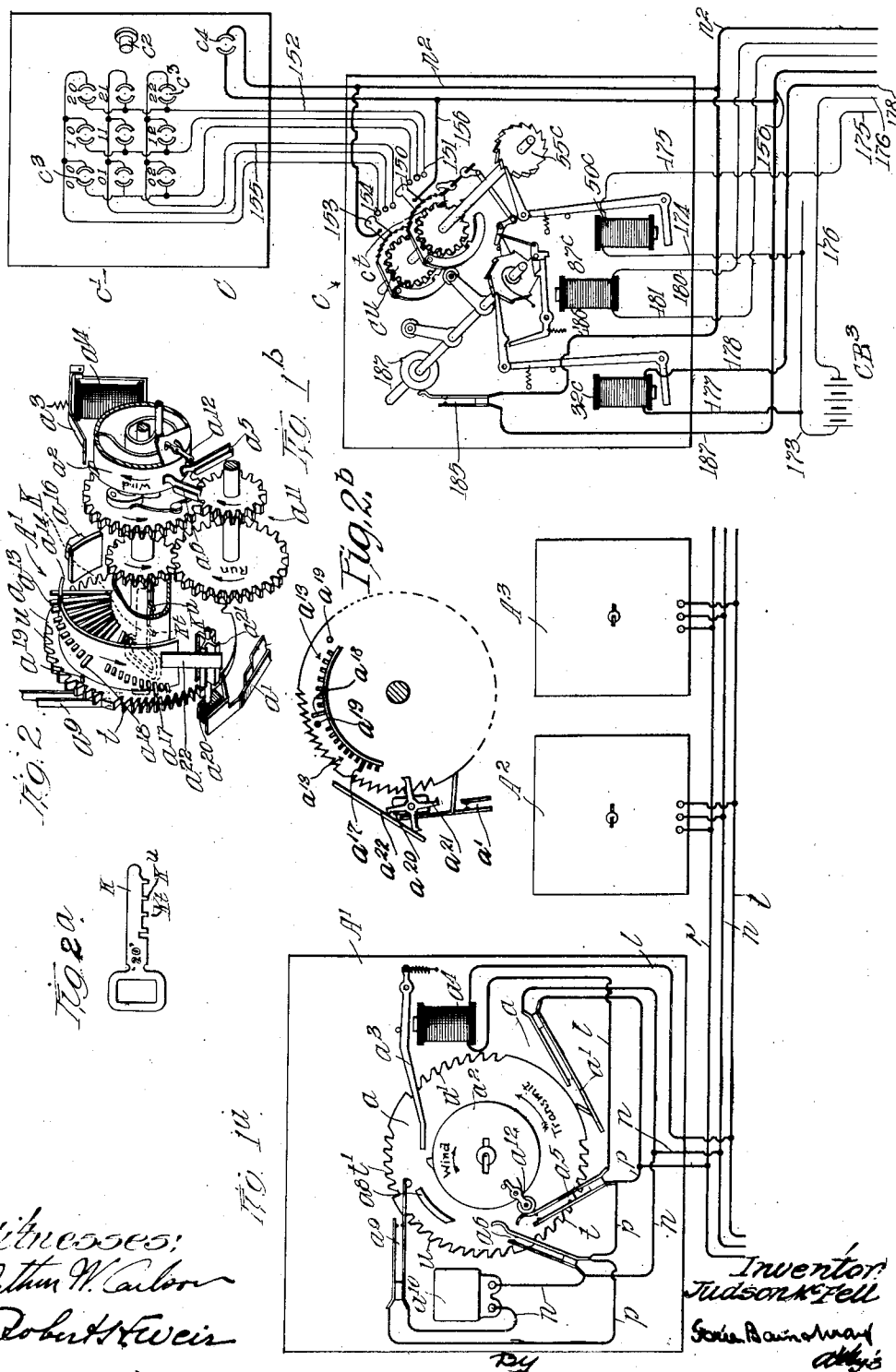
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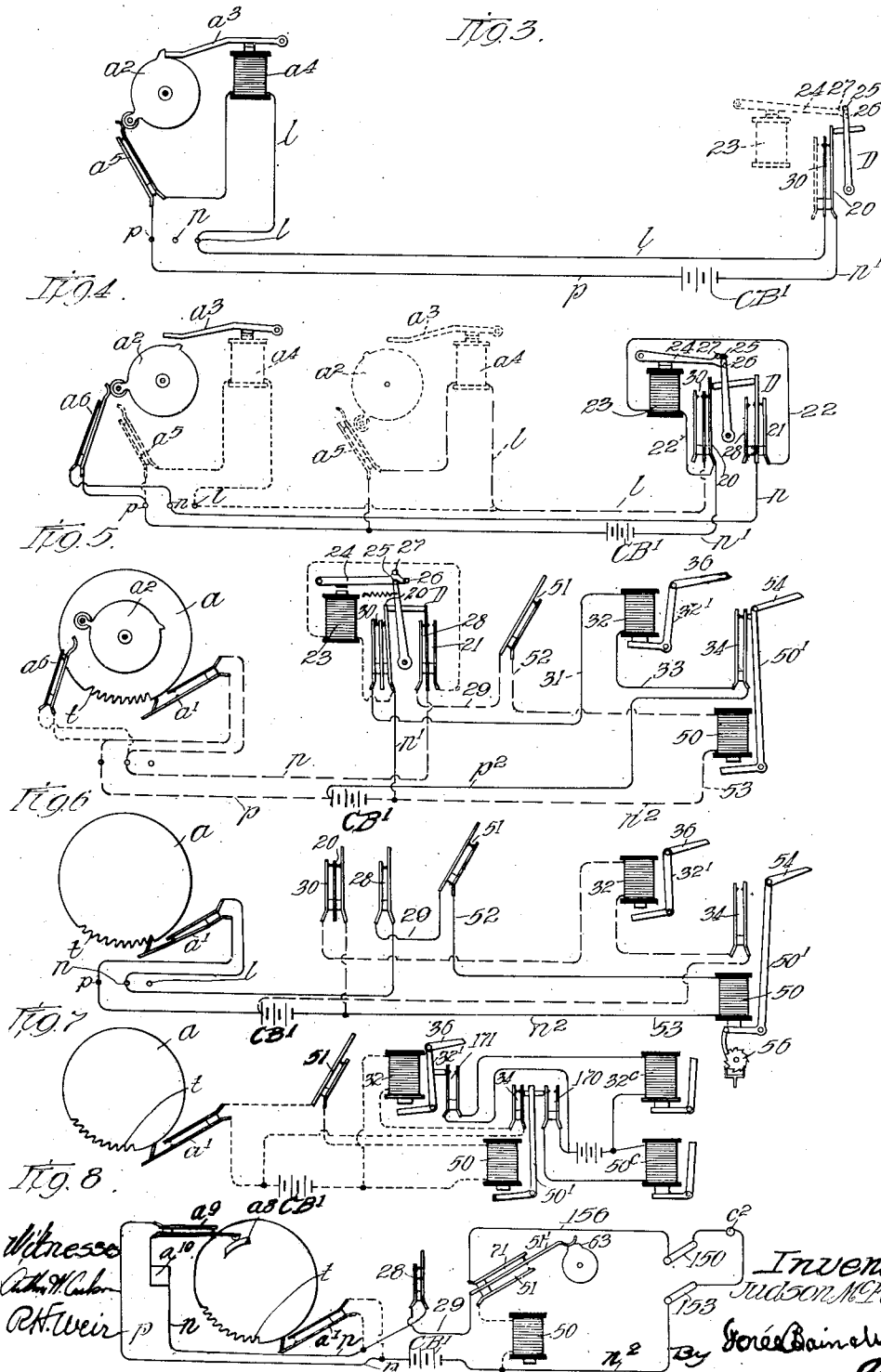


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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

JUDSON McFELL, OF CHICAGO, ILLINOIS.

ELECTRIC SIGNAL-TRANSMITTING MEANS.

1,308,958.

Specification of Letters Patent.

Patented July 8, 1919.

Application filed September 13, 1915. Serial No. 50,382.

To all whom it may concern:

Be it known that I, JUDSON McFELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Signal-Transmitting Means, of which the following is a specification.

My invention relates to electric signal transmitting means, and has for its general object to provide signaling means by which a code-signal may be transmitted telegraphically to a central station from the automatic transmitter or "box" at any one of a plurality of signal initiating stations, such automatically-transmitted signal indicating both the individuality of the user and the number of the particular station from which he is transmitting; and a further object of my invention is to provide such apparatus as will record the signals received at "central" in most convenient form.

Another object of the invention is so to construct and arrange the apparatus that the central-station authorities may cause a signal to be transmitted back to any selected user, individually, incidentally to his transmission of his individual signal to the central station, no matter from what one of the signal-initiating stations said user may be effecting his signal-transmission; that is to say, by way of illustration, I make provision whereby if central wants user 23, central may set the central apparatus so that user 23, only, will be "answered back" when he turns in his signal, whether the user transmits from box "00", box "100" or any other box.

Other objects of my invention are to provide an effective, efficient, and simple systemic arrangement and suitable advantageous, rugged, easily-operated apparatus for attaining the stated results; and generally and in detail to make provision for the economical and easy installation and maintenance of an efficiently working system to the stated ends.

Many other and further objects of my invention, more in detail, will become apparent to those skilled in the art from the following description taken in conjunction with the accompanying drawings in which—

Figures 1, 1^a and 1^b jointly constitute a diagrammatic illustration of a system embodying my invention;

Fig. 2 illustrates a transmitter structure

schematically shown in perspective; Fig. 2^a shows a key therefor, and Fig. 2^b details certain switch-control parts.

Fig. 3 illustrates a lock out circuit.

Fig 4 illustrates the first starting-operation due to a preliminary-circuit-closure at the box.

Fig. 5 shows the second starting operation, due to the circuit-break terminating the preliminary impulse.

Fig. 6 shows the signaling operation, as far as the register.

Fig. 7 shows the coördination of the register and the answer-back selector.

Fig. 8 shows the answer back circuit.

While it will be apparent to those skilled in the art that many changes may be made in the construction and arrangement of apparatus, circuit-controlling parts, and circuits, within the spirit of my invention and within the scope of the appended claims, the inevitable complexity of such a system as that here in contemplation makes difficult and tedious the illustration and description of specific modifications, and I will, therefore, confine the description closely to full disclosure of one specific form of system, embodying the invention, that I prefer to employ; but without intent to limit my invention thereto in its broader aspects.

First generally to outline the plan of operation of the installation illustrated;

A¹, A², A³ represent signaling boxes or transmitters that constitute the signaling apparatus at a plurality of signal initiating stations. According to the particular central station mechanism herein shown, 100 of these transmitters may conveniently be taken care of. And each transmitter will serve 100 users but, as will become apparent, systems of larger or smaller capacity may be made in accordance with my invention.

These transmitters are associated with a centrally-energized line equipment, shown as consisting of three wires *p*, *n*, and *l*, that I will respectively term, for convenient identification, the positive, negative and lockout wires. In a general way, two of these wires, *p* and *n*, are used in the signaling circuit; the third wire, *l*, which also has connection to the negative battery terminal is used as a return for lock-out or non-interference purposes.

Each transmitter is preferably an automatic box of the spring motor type, adapted to be wound by a key K. Each user has a

different key, and, by the preferred construction shown, the form of the key is the mechanical factor that will result in setting the transmitter to send a signal individual to the user, in addition to sending the constant box-number signal that, of course, differs for each box.

Each transmitter has a motor driven signal wheel a associated with a signaling switch a^1 , and adapted, when rotated, to work the signaling switch a^1 to transmit first an individual, key-set number-signal from the tens and units notches t and u and then a "box-number" signal, from notches t' and u' . For the box-number the signal wheel notches are permanently cut; for the individual number there are, preferably, ten notches provided in each digit group, but the turning of the key, performed in winding the box, acts to set appropriate disabling mechanism so that only a selected number of notches for the appropriate user's signal will be effective to operate the signal switch a^1 . If nine of the ten notches of each digit group are thus rendered ineffective the result will be the setting of signal "00" on the central register, and so, correspondingly, when box 69 is wound by key 20, say, the signal switch will be operated to send groups of impulses numbering, successively 3, 1, 7, 10, or when user 55 signals from the same box, his key sets the mechanism to send 6, 6, 7, 10.

The running down of the box will transmit such four-digit-group signal over the line wires p, n to be recorded at the central station by a recorder that has on its record wheels numerals from "0" to "9".

The "lock-out" feature preferably provided, prevents signal "clashes" or interference, after the following fashion: The winding of the transmitter necessitates a key impelled rotation of a suitable part, as winding plate a^2 , that may be disabled from rotation by a disabling latch a^3 controlled by a disabling magnet or lock-out-magnet a^4 . The very first movement of this winding plate a^2 closes the "busy-test" switch a^5 that is included, with the magnet a^4 in a circuit normally open at the central station when the system is idle, closed at central when the line is busy, such circuit including the third wire l . If any other transmitter be operating (or, in other words, if the central-station control switch of the lock-out circuit is closed), then closure of the switch a^5 will energize lock-out magnet a^4 , causing it to attract its latch a^3 to oppose plate a^2 so that the motor cannot be wound. Thus the system is made "non-interfering", for the person attempting to signal over a busy line cannot wind his box.

If, however, the winding plate a^2 is able to progress past the disabling point it closes a "preliminary" or "starting" switch a^6 to

send a preliminary impulse to central station for certain preparatory purposes to be described, (one of which is closure of the central station switch for the lock-out circuit).

The subsequent rotation of the signal wheel a works the signal switch a^1 as described to send the four-digit signal to which the central recorder will respond.

Further, (after the signal transmission is completed, but before the signal wheel completes its full cycle of operation), a cam a^8 on the signal wheel closes the answer-back switch a^9 , that is in circuit with an answer-back alarm device a^{10} , shown as a buzzer.

The answer back circuit is also controlled by a central station device that is settable to any user's number. If the central station supervisors have previously set a selective apparatus to indicate a certain individual number, the transmission of that number (and that only) will work the central station apparatus so as to make central closure of the answer-back-circuit, and consequently the answer-back buzzer a^{10} will fully operate to apprise the user that he is wanted at central.

At the central station I have shown two instrument sets B and C, the first being generically the signal recording apparatus and the latter being generically the answer back selective apparatus. I prefer that the recording apparatus be of the printing type and various forms may be used, but I have shown a novel recorder having number wheels in accordance with the number of digits that may be transmitted as a signal from any box, and with these supplemented by horological indicating wheels, so that, on a suitable tape, the recorder may print on a transverse reading line such an indication as "20, 69, 10:15" showing that user 20 signals from box 69 at 10.15 o'clock.

The recorder mechanism at central station is shown generally as comprising four signal-set number-wheels or segments b^1, b^2, b^3 , and b^4 corresponding with the tens and units orders of the individual or key-set signal and of the box-number signal, respectively and supplemented by the horological wheels b^5 , each number wheel peripherally having numerals 0 to 9.

In the particular apparatus shown the preliminary impulse (from transmitter switch a^6) incidental to the winding of a transmitter operates certain circuit-changing apparatus D that I may term the "starting device", so as to close (as far as the central station is concerned) the lockout circuit above mentioned, and also so as to condition the recorder mechanism B, as a whole, for its functional operations.

When the true signal-transmission from the box begins the line-impulses work a step-up device E in accordance with the digit-

groups of impulses. This step-up turns the shaft on which the number wheels of the recorder are shown as loosely mounted. Each of said number-recording wheels is shown as connectible with this shaft by clutch mechanism, and to control the throwing in or out of the clutches, thereby to bring the different wheels successively under the control of the step-up, E, I provide a "shifter" mechanism F.

This shifter mechanism is electroresponsive and is arranged to operate each time there is a dwell in the signaling sequence, that is to say, as long as regular impulses of a digit group are working the step up E, shifter F remains inert, but when a dwell occurs and step up E becomes inert, then the shifter F is energized and operates.

As the result of the preliminary operation of the starting device D this shifter mechanism connects the first recorder wheel b^1 with the shaft (because at that time the step up E is inert) and the first group of impulses transmitted from the signal-box steps the said wheel b^1 forward. Between the tens-digit group, thus recorded, and the units-digit group of signaling impulses a dwell occurs in the signaling operation; the shifter operates during this dwell; the first said recorder wheel is thereby disconnected from the recorder shaft and the second recorder wheel b^2 is clutched to the shaft; wherefore the second group of signal impulses, working the step up device E, steps forward this second wheel b^2 . And so on throughout the series of four impulse groups.

During the time that this stepping of the recorder number wheels is taking place, the two number wheels of the selector c forming part of the answer-back apparatus are being stepped up in harmony with the individual signal, just as are the first two wheels of the recorder device. These selector wheels carry movable contacts to sweep over a series of stationary contacts and such stationary contacts are connected with the plug board c' . (Only a few of the plug sockets on board c' are represented, but of course there will be as many plug sockets as there are users to be served.) If the central operator wishes to communicate with a certain user, say user 22, the first time such user transmits his individual signal for record, the central operator inserts a metallic connecting plug c^2 in plug socket 22, and when user 22 signals, the selector c is automatically stepped up so that its traveling contacts, coming to rest on fixed contacts connected with plug socket 22, are connected together through such plug. This operation effects a closure, at the central station, of connections necessary for establishing the answer-back circuit, and as a result of such closure, (and of other automatic operations

to be described,) the system is conditioned for operating the buzzer a^{10} at the box of the calling user. Consequently before the user's box has run down, closure of the answer-back switch a^9 at the user's box starts the buzzer a^{10} in operation and the user is apprised of the fact that he is wanted at central.

Since my present invention relates primarily to telegraphic signaling, I have not complicated it by illustration of telephonic auxiliaries, but it will be understood by those skilled in the electric arts that the central station and the transmitting stations may be connected by telephone, and that the line wiring may be used as part of the telephone wiring, if desired.

In the range of operation thus far outlined, the central station mechanism acts mainly in response to operations initiated at the transmitter. As far as the transmitter is concerned, it may be built simply to make its single round of operations and desist in its initial condition. The central station apparatus, however, (when of the type hereinbefore suggested involving a settable recorder and a settable selector,) must have its mechanical parts and its switches restored to initial condition upon completion of a signal cycle and this restoration may be effected by return springs under the control of automatic releasing devices that are arranged in circuits local to the central station. In the specific instance herein shown I prefer that the releasing devices be of two kinds, namely, normal releasing devices that are thrown into operation when the central recorder has otherwise completed its cycle of functions and has printed the signal-record; and, second, (as a refinement) a retarded "emergency" releaser G that will work to throw all parts back to normal if, for any reason, the central recording apparatus is worked part way through a cycle and then stops for a certain length of time. Explanatorily of this last-mentioned feature, it is quite possible, for instance, that a repair man working on the line, (or any other cause of intermittent connecting of the line wires) might cause such temporary circuit-closures as would partly work the recording apparatus after the fashion of a signal, and if matters were left in this condition the central recording apparatus would be "out of step." With the retarded releasing apparatus shown, however, the retarded releaser G would work under such conditions, after a certain length of time, operating the release devices so as to throw the recording apparatus back to normal condition, putting it back in step.

As to the regular releasing devices, it suffices here to suggest that, conveniently, (since the recorder apparatus is first set and then automatically prints after the main

signal-transmitting functions have been performed,) the printing mechanism may be used as a means to set the releasing devices in operation, and the automatic restoration of mechanical parts of the recorder may occur during the time when the answer back (if set) will be working; so that, automatically, all mechanical and electrical parts of the recorder B get back to normal condition substantially synchronously with the cessation of activity of transmitter motor, thus conditioning the entire system for transmission of another signal.

Now more specifically to describe the construction and arrangement of the devices shown for embodying the invention above outlined:

The line.

Two wires p and n , running from the multiplied boxes to the central battery CB' serve all of the signaling purposes. At each box the preliminary switch a^6 , the signaling switch a' , and the answer-back switch a^9 are bridged across these wires. But of course the circuit through these two wires is only intermittently closed in the box-operation. Hence, for lock-out purposes, a third wire l is employed in conjunction with wire p , is made connectible with the battery as soon as any transmitter starts in operation so that there may be a constantly-potentiated circuit for the lock-out devices during all of the time that any transmitter is operating.

The transmitter.

The transmitter mechanism, that acts, first, to "busy test" the line; second, to send a preliminary impulse; third, to transmit a key-selected, individual user's-number-signal followed by a predetermined box-number; and, fourth, to close the answer-back connections, all in the course of its single "round" or cycle of operations, may be variously constructed in detail. Indeed, theoretically, hand-operated switches such as telegraph keys might be so deftly manipulated as to close the circuits in proper sequence and at proper intervals in lieu of the various motor-actuated switches, but for practical work this hand-operation is not feasible. It will be appreciated that speed and regularity of spacing in impulse-transmission are very important to the proper operation of the system, so that some form of mechanical transmitter is a practical necessity, and obviously a mechanical structure that makes such provision that the mere insertion and turning of a key may condition the device for full performance of a whole sequence of functions is highly desirable, to speed up the operation of the system, to relieve the user of all needless work, and to avoid error.

In the present drawing I have shown in Fig. 2 a diagrammatic representation of a transmitter sufficient to indicate the performance of all its important functions and to outline feasible mechanical construction.

Key K, when inserted, turned and withdrawn, winds the transmitter motor by rotating plate a^2 that is part of the motor-spring box and sets the transmitter in operation. The unwinding of the spring returns the plate a^2 and, through gearing a^{11} , drives the signal wheel a in rotation. In the wiring diagrams, Figs. 1, 3, etc., mechanical relationships and directions of movement have been transposed in parts for simple illustrations. The plate a^2 carries a knuckle-jointed stud a^{12} to close switches a^5 and a^6 on its winding movement but not on its return. The cam a^3 for closing the answer-back switch may be directly on signal wheel a .

Key K has points k^t and k^u that set the transmitter to send its selective user's signal. When the key turns in winding the box, its points k^t and k^u act upon, and radially extend or project, appropriate pins a^{13} of the two groups of ten pins that are carried by a suitable frame a^{14} on wheel a and that correspond in peripheral succession with the notch-spacing of the signal wheel. As shown in Fig. 2, key for user "20" has projected the third pin (marked a^{17}) of the tens order and the first pin (marked a^{18}) of the units order. Two fixed pins a^{19} on the wheel, following the groups of settable pins a^{13} in peripheral position, supplement said settable pins in operation. The settable pins a^{13} do their work as they pass the switch-controlling mechanism, that is appurtenant to the signal switch a' ; and during the further progress of the wheel the key-projected pins are pushed back to normal position by a fixed incline a^{16} . The signal switch a^1 has a disabling cam a^{20} rotatable to four positions. Normally it leaves the switch a^1 free to follow the signal wheel notches. Turned 90° it disables the switch by bracing it open; at 180° it frees the switch again, and at 270° it disables the switch a second time. A ratchet-cylinder a^{21} having four teeth moves the cam a^{20} and is in turn moved against the tension of snap-spring a^{22} by the key selected pins a^{13} and fixed pins a^{19} . The key-projected pins a^{13} and the fixed pins a^{19} move in a circle intersecting ratchet cylinder a^{21} , the non-projected pins a^{13} miss the cylinder.

Consequently when the signal wheel a rotates, (with its pins a^{13} set as shown) the signal switch a' closes three times, according to the first three notches of the tens group t of the user's signal and then the first projected pin a^{17} turns ratchet a^{21} that, through cam a^{20} disables signal switch a' . The disability continues until the first fixed pin a^{19} operates the ratchet cylinder, turning

the cam to its 180° position. Then one notch of the units-group *u* affects switch *a'* before the next projected pin, *a¹⁸*, throws the ratchet-cylinder to disabling position, and later the last fixed pin *a¹⁹* removes the disability so that the switch may answer freely to the permanent box-number notches of wheel *a*.

10 *The starting means "D" and lock-out potentiation.*

The three wires *p*, *n* and *l* (positive, negative and lock-out) to which all of the boxes are connected in multiple, extend to the central station where the wire *p* is connected direct to the positive terminal, say, of a central battery CB¹, while wire *n* is normally connected to the negative terminal of the battery and lock-out wire *l* is connectable to wire *n'* and the negative terminal of said battery through a switch 20 that stands normally open. The negative wire *n* leads into a normally closed switch 21 that has connection by wire 22 through a starting-magnet 23 with the battery end *n'* of the negative line wire. Consequently the system has no normally closed circuit, and the only circuit normally closable directly by any box is that which includes the starting magnet 23. Thus the system, when idle, consumes no current.

When the transmitter preliminarily connects the wires through switch *a'*, the circuit for the starter magnet 23 is established via CB¹, *p*, *a'*, *n*, 22, 23, *n'*, CB¹. The energized starting-magnet 23 attracts its armature 24 that controls a switching lever 25. When the armature is attracted a pin on the lever 25 escapes past the stop 26 on armature 24 and comes in contact with another stop 27, its motion being sufficient to close the negative line switch 20, that is used only in the lock-out circuit but without otherwise changing the condition of the switches associated with the lever 25. (See Fig. 4.) Thus the lock-out circuit is potentiated, but the signaling circuit is not. Should any other user now try to signal, he will be locked out as shown in Fig. 3.

50 The signaling circuit should not be closed until switch *a'* opens, else the switch *a'* would give a signal-impulse rather than only a preliminary-to-the-signaling impulse. When switch *a'* opens and the magnet 23 is deenergized, retraction of armature 24 enables switching lever 25 to pass on to its final position. (See Fig. 5.) In so doing it opens switch 21 (to cut out magnet 23) and closes the switches 28 and 30. Switch 60 28 connects wire 29 with the negative wire *n* to cut the "step-up devices" into service and switch 30 connects wire 31 with the already closed switch 20, thereby to cut in the "shifter devices."

65 *The general relation of step-up devices E*

and shifter devices F is this: The step up magnet is controllable by the signal switch of the transmitter, and its circuit extends, therefore, to the boxes; the shifter-magnet is controlled by a switch worked by the step-up devices, and its circuit may be local to the central apparatus. The shifter-magnet in the system shown, is energized only when the step-up devices rest inert, and consequently the shifter magnet may be operated only during dwells in the operation of the step-up devices. Since the step-up devices are initially inert the shifter magnet will be energized preliminarily before the step-up magnet begins to work at all. 80

The recorder mechanism.

Because of its preferred construction in a form affording a plurality of number wheels, as heretofore suggested, the recorder mechanism is provided with two electro-magnets, one for stepping up the recorder shaft in response to line impulses and the other for shifting the operative connections between the respective wheels and the recorder shaft. Also this novel construction necessitates the use of special releasing devices. 85 90

It will be understood that while I have herein shown a form-wheel recorder that may conveniently print numbers from "00" to "99" as to both the box-numbers and individual numbers, the apparatus might be made with six wheels (for 1000-service) or with two wheels for service of as many stations and users as could be conveniently be enumerated on the periphery of a single wheel. Mere addition or subtraction of parts without reorganization in arrangement would accomplish this change of quantity of service on the part of the recorder, and of course the transmitter could be made to send three-digit signals, or one-digit signals in place of the two-digit identifications of user and of transmitter herein expressly provided for. 100 105 110

When the starting apparatus functions as heretofore described, so that lever 25 is fully thrown to the left to close switch 30, (Fig. 5) a circuit is established for the shifting magnet 32 and the apparatus F via CB¹, *n'*, 20, 30, 31, shifter-magnet 32, 33, yet-closed switch 34 (controlled by the step up magnet) wire 35, positive wire *p²*, *p*, CB¹. Thus, preliminarily, the shifter magnet 32 is energized and its armature 32' is thrown forward, acting through pawl 36 on a ratchet 37 fast on a shifter shaft 38, advancing the ratchet one step, to be held by pawl 37'. 115 120

This shifter, in the particular construction shown, mechanically functions to control connection of the recorder number-wheels *b¹*, etc., with their shaft and to control appropriate switch mechanism. For its recorder controlling functions the shaft carries arms 39, equipped with anti-friction 125 130

rollers and projecting from the shaft at angles spaced in accordance with the tooth spacing of the ratchet 37. This preliminary forward step of the shaft conditions the first number wheel b^1 to respond to the first impulse group, as follows:—The rotative advance of the first arm 39 moves an arcuate clutch-element 40 that is pivotally carried by the first number wheel b^1 , and pressed outwardly by spring 40', so that a tooth 41 of said arc engages in a pinion 42, that is fast on the shaft 43 of the recorder. This clutch arc, of course, is normally spring disengaged from the clutch pinion 42, and the wheel segment b^1 is spring returnable to initial position by a spring shown in dotted lines at 44. Of course, as long as the first arm 39 stands in the fore-mentioned position any rotation imparted to shaft 43 will, through the clutch connection described, carry with said shaft the wheel b^1 and the holding pawl 45 for the number wheel will restrain it in advanced position until release takes place. On the next step of the shifter shaft, however, the first arm 39 will pass out of operative connection with the corresponding clutch arc 40 while the second arm 39 will act similarly to connect the second wheel b^2 with the recorder shaft 43.

When the preliminary energization of the shifter magnet 32 has taken place, as aforesaid, connecting the first number wheel b^1 of the recorder with the register shaft, the mechanism is ready for the reception of the signal. When the signal switch a^1 is closed and opened by the notches of the transmitter wheel a , (Fig. 7) it connects the line wires p and n , making and breaking a circuit for the step up magnet 50 via the path $CB^1, p, a^1, n, 28, 29$, a normally closed switch 51, wire 52, step-up magnet 50 and wire 53 to battery wire n^2 and battery CB^1 . Consequently the magnet 50 responds to the line impulses, its armature 50', through pawl 54, operating the ratchet wheel 55 on recorder shaft 43.

The first impulse sent through magnet 50 opens the switch 34 that is in circuit with the shifter magnet 32 and the shifter magnet is deenergized. Again to close the shifter-magnet circuit the armature 50' on the step-up magnet must fall clear back to normal or inert position. This it does not do as long as an uninterrupted sequence of impulses is being transmitted over the line, as is the case when the transmitter wheel is sending an impulse-group representing one digit of the number signal. In practice the parts may be readily so proportioned that the armature 50' cannot fully retract between the rapid signal impulses, but for more graphic illustration of this desired coordination I show (Fig. 1) the armature 50' as working, in its retraction movement, against a retard wheel 56, so that it may advance

rapidly but will retract slowly for the last or idle part of its return stroke. Consequently, it will be understood, the shifter magnet is idle while the first group of signal impulses is being transmitted.

During the dwell that occurs between the transmission of successive impulse-groups the armature 50' for step-up magnet 50 has time fully to retract, and consequently during the dwell after the first impulse-group has been transmitted switch 34 for the shifter-magnet is again closed, shifter magnet 32 is energized, and a step of the shifter occurs, disengaging the clutch for the first number wheel b^1 and engaging the clutch of the second number wheel b^2 . In like fashion the shifter advances after the second and the third impulse groups, and of course after the fourth impulse group has been transmitted there is a terminal dwell in signal transmission that results in the fifth forward progression of the shifter shaft.

Thus in general it will be seen that there will be a responsive movement of each recorder wheel to the particular impulse group to which said wheel is assigned, and after all the wheels are set forward to their intended position, there will be an additional progression of the shifter for other purposes. In the particular installation shown this fifth progression of the shifter is made to govern the action of the printer, and conveniently the printing mechanism in turn is caused to initiate the releasing operation.

Printing.

For circuit controlling functions the shifter shaft is provided with a cam member 60 shown as having three projections 61, 62 and 63. The projection 61 is so shaped that on the fifth or final step aforesaid it closes a normally open switch 64 that is included with the printing magnet 65 in a circuit: $CB^1, p^2, 66, 64, 67$, magnet 65, 68, n^2, CB^1 . Consequently the printing magnet 65 is energized on the fifth step of the shifter, and throws forward its armature 65' so that its printing hammer 70 may strike a paper strip 71 against the number wheels that are suitably inked, thereby to make an impression of the signal, together with the time, which is indicated by the selected number of horological wheels b^h . This printing operation completes the primary function of the recorder.

Releasing.

It will be realized that the printing operation takes place almost instantly after the final digit of the number signal has been transmitted, and after this printing-movement, but before the transmitter completes its operation there is an interval during which the cam a^8 of the transmitter is closed

ing the answer back switch a^2 . It is during this interval that the releasing operations take place.

Of course, were an ordinary tape recorder employed to record the signals, the releasing operation could be confined in the circuit-changing apparatus, but with a recorder such as herein specifically described, provision must be made for the restoration of the mechanically set parts. With the settable recorder herein shown, provision may best be made for releasing the mechanical parts before the circuit controlling parts are restored to normal position to condition the line for further signaling, thus to avoid the possibility of a subsequent signal catching the register out of step. In the particular installation shown, current for the releasing operations is supplied in part by battery CB^1 and in part by a second battery CB^2 .

The fifth step of the shifter, that conditions the printing devices for operation, also results in the shifting of the long blade 51' of switch 51 into connection with a back contact so closing the switch 71, cam 63 performing this operation. This switch 71, when closed, is latched by a latch 72 to be held in closed position until the shifter is fully restored to initial position when a releasing link will lift the latch to releasing position.

When the printing armature 65' is thrown forward, also on the fifth shifter step aforesaid, it mechanically closes two switches 75 and 76 that are latched in closed position by appropriate latches 75' and 76'. Closure of switch 75 establishes a circuit for releasing magnet 77 via CB^1 , p^2 , 78, magnet 77, 80, switch 75, 81, 68, n^2 , CB^1 . The magnet 77, thus energized attracts its armature, which is connected to the holding pawl 37' for the shifter ratchet 37, releasing said ratchet. Also a tail of the armature lifts the live pawl 36 for said shifter ratchet-wheel out of engagement with the ratchet, the latch 83 locking the armature in its attracted position. Spring impelled restoration of the shifter shaft thereupon begins, but it is preferably retarded by a one-way retard escapement 84, at or before the fifth step of the shifter it has moved cam 62 to permit a switch 85 to open. At a proper time in the retarded return of the shifter wheel, cam 62 closes switch 85, that is arranged in series with a switch 76 as part of the releasing system. The idea of using the switches 85 and 76 in series is to hold off the second part of the releasing operation until the shifter gets suitably near. These two switches, thus concurrently closed, establish a releasing circuit for the magnet 87 that acts upon the switching lever 25 of the starting device D. Such circuit may be traced from CB^2 , via 89, magnet 87, 90, 91,

92, 76, 93, 85, 94, CB^2 . The magnet 87 draws over the switch lever 25 of the starting device D, and said switch lever is latched in attracted position by the armature 24 of the starting magnet 23, pending commencement 70 of another signaling operation.

When the shifter wheel 60, after its retarded return movement gets almost home an arm 100 of the shifter operates a lever system, graphically shown in general as 101, 75 that throws out the pawls 45, for the recorder wheels, releases the latch 83 for the armature 37' of release magnet 77, and also throws out the latches 75' and 76' for the switches 75 and 76 so that the latter, 80 springing open, break the circuits heretofore described for the two release magnets 77 and 87. Of course, the recorder wheels then rapidly return to normal position under the stress of their springs. 85

Time wheel movements.

As incident to the particular form of recorder shown the horological wheels b^h are caused regularly to advance by the operation of an electric clock 105 that is shown as controlling a step-up magnet 106, the armature 106' of which operates the ratchet wheel for the power receiving one of said horological wheels, a circuit for these electrical parts being provided via CB^2 , 89, 108, 109, 105, 110, 106, 111, 94, CB^2 . 90

Paper feed.

The paper feed that should take place after each printing operation may conveniently be made to be a concomitant of the action of the printer, but subsequent thereto in point of time, by making its operation coincident with that of the releasing devices that are controlled by the printer. In the specific illustration a paper feed magnet 115, the armature 115' of which controls a step up pawl for a ratchet wheel 116 for feeding the paper strip 71, is bridged by wires 117 and 118 between the wires 92 and 109, so that when switches 76 and 85 are closed, simultaneously, as heretofore described, a circuit for said magnet is established via CB^2 , 89, 108, 109, 118, 115 magnet 115, 117, 76, 93, 85, 94, CB^2 . 105

Emergency release.

The retarded emergency releasing-device G is intended to be thrown into operation and maintained in non-effective operation during the time that, normally, the first four steps of the shifter device are taking place, to be thrown out of operation on the fifth step (when full completion of the cycle of operations of the recorder is assured). During the time of its normal activity the device G works constantly (but ineffectually) toward establishing release circuits, the retarding device being thrown back to 130

its starting point, incidentally to the regular operation of the recorder, at intervals too short to permit it to perform its releasing functions if the recorder is operating normally. A failure of recorder-operation, however, continuing for a certain period, gives the device time to function, and it then operates to effect a release of the recorder parts. This device, it will be understood, is a refinement that may be wholly omitted if desired.

For illustrating the construction and operation of such an emergency release, we will assume that two makes-and-breaks of the signaling circuits between wires p and n have accidentally been made, as an incident, say, of some line-repairing work. The result of this accident upon the recorder may be the same as the result of a preliminary impulse and one signal-impulse of a regularly operating box; that is to say, the starting magnet is energized and deenergized and the starting switch-devices controlled by lever 25 are thereby worked; the shifter makes one step forward, and the second impulse steps forward the number wheel b^1 one step. Then this accidental, partial operation ceases. The recorder is out of step and, except for the emergency-release device G, would so remain pending the next box operation.

The first advance of the shifter cam wheel 60 causes cam 61 to close a switch 120 (which will be retained closed until the cam passes from under it incidentally to the fifth shifter-step). This switch closes a circuit for the operating magnet 121 of the emergency-releasing device G, via CB^1 , n^2 , 123, 120, 124, magnet 121, 125, normally closed switch 126, 127, p^2 , CB^1 . The armature 121' of the magnet 121 controls the switch 126, so that the magnet makes and breaks its own circuit after the fashion of a bell-movement. The armature, through a suitable pawl 129, works a ratchet 130, the holding pawl 131 of which is subject to dual control, herein shown as effected through suitable links and levers. One releasing lever 132 for this pawl is controlled by the switch lever 25 for the starting magnet D, so that when the starting-switch lever is in normal position the holding pawl 131 is thrown out. The other lever 133 for throwing out the holding pawl (linked to 132) is controlled by the armature 32' for the shifter magnet 32 and will be worked to throw out the holding pawl each time the shifter magnet is deenergized. Since, under the conditions now assumed, the shifter magnet is energized and will remain energized, and the starting magnet has been worked and will remain in shifted position pending automatic restoration, the holding pawl of the emergency device is free to do its work.

The continuous operation of the armature 121 for the emergency device, therefore, will advance the ratchet 130 through its full range of operation. When the recorder is working normally such full advance cannot take place, because the time-moment necessary to a full operation of the device G is greater than the interval between any operations of the shifter magnet 32 that may occur in the normal operation of the system. Under the assumed emergency conditions, however, the ratchet 130 is fully advanced and finally closes the two switches 75^a and 76^a that are arranged in parallel with the releasing switches 75 and 76 that have heretofore been described. These switches, when thrown closed, are latched in closed position by a latch 135 releasable by a link mechanism 136 that is operated upon full return of the ratchet 130. The switch 75^a has connection by wires 68^a and 80^a to the wires n^2 and 79, just as have the corresponding wires 68 and 80 of the switch 75; while switch 76^a has connection 91^a and 94^a to the wires 91 and 94, so as to be in parallel with the two switches 76 and 85 that are in series in the regular releasing circuit. Consequently closure of the two switches 76^a and 75^a will energize both the releasing magnets 77 and 87, restoring the recorder parts to normal position and, (incidentally to the deenergization of magnet 32 after switch 30 is open) causing the holding pawl 131 for the emergency device to be thrown out, thereby freeing the ratchet 130 to return to normal position and, at the end of its return movement to throw out the latch 135 for the switches 75^a and 76^a through the tripping system 136.

The answer back apparatus.

While I have shown the answer back apparatus at C as a separate apparatus, it involves in effect only a set of electrical connections, for the electro-mechanical appliances employed in manipulating these connections are substantially a duplicate of certain parts of the recorder mechanism shown, and if a recorder of the type herein illustrated is employed, it will be obvious that the mechanisms of the selector and the recorder might be united. Both for schematic clearness and practical reasons I prefer separate recording and selecting devices, however. Essentially the answer back in the embodiment shown, consists of a pair of movable contacts 150 and 153 that are stepped forward in precise accordance with the tens and units groups of impulses of the individual number signals (just as are the wheels b^1 and b^2 of the recorder), and that sweep over stationary contacts 151 and 154 which are connected by wires 152 and 155 in tens grouping and units grouping respectively, to

the plug sockets c^4 of the plug-board c^1 . The movable contacts are connectible with the wires p and n of the signaling circuit, preferably through a switch that is closed by the recorder mechanism subsequently to the setting of the full signal. In the construction shown the switch 71 of the recorder that, as has been described, is closed by the fifth progression of the shifter device, establishes connection between the wire 29 (that is in turn connected with negative wire n ,) and a wire 156 that leads to the "tens" movable contact 150, while "units" contact 153 has direct connection with a continuation of the wire n^2 . Thus when the recorder mechanism opens the switch 51 and closes the switch 71 it cuts the step up magnet 50 out of the signaling circuit and cuts in, in place thereof, the closable connection through the two selector contacts 150 and 153. (See Fig. 8). It will be apparent, now, that if a plug c^2 has been inserted in a certain plug socket, say that numbered 22, when the operation of the device by user 22 brings the two contacts 150 and 153 into electrical connection with the said plugged socket, the answer-back circuit is closed at central station, and, accordingly, when the transmitter that is in use connects the answer-back buzzer a^{10} with the signaling circuits by closure of switch a^9 , an answer-back circuit is established via CB^3 , p , a^9 , buzzer a^{10} , n , 28, 29, 71, 156, 150, 151, 152, the plugged socket c^3 , 155, 154, 153, n^2 , CB^1 .

A special socket c^4 may be bridged across the wires 156, n^2 so that, when it is plugged, no matter what user transmits the signal he will receive an answer-back call, since this connection short circuits the movable contacts 150 and 153.

Since the step-up operations of the contacts 150 and 153 are intended exactly to correspond with the advances of signal wheels b^4 and b^5 that set the user's individual signal on the recorder, the apparatus for effecting such advance of the selector contacts (if a separate selector be used) may be in substance a replica of the corresponding apparatus of the recorder, and the operations of the step-up magnet and the shifter magnet for the selector, as well as the release magnet, may be made to take place synchronously with corresponding operations of the recorder parts.

As a matter of convenience I use a separate battery CB^3 for energizing the step-up and shifter magnets of the selector and control the magnet circuits by switches associated with the correspondingly-functioned recorder parts.

Specifically the step-up wheels c^4 and c^5 are clutchable to the selector shaft by shifter mechanism, operated by magnet 32° precisely as is the recorder-shifter heretofore de-

scribed; and the step up mechanism for the selector ratchet-wheel 55° is controlled by a step up magnet 50°. The magnet 50° has its circuit controlled by a switch 170 that is closed every time step up magnet 50 of the recorder throws its armature forward, while the shifter magnet 32° has its circuit controlled by a switch 171 that is closed every time the armature 32' of the recorder is thrown forward. The circuit for magnet 50° may be traced: CB^3 , 173, 174, 50°, 175, 170, 176, CB^3 . The circuit for the shifter magnet runs CB^3 , 173, 177, 32°, 178, 171, 176, CB^3 .

The release magnet 87° for the selector parallels one of the recorder-releasing magnets, preferably the magnet 87, and to this end has its wires 180 and 181 connected respectively to wires 89 and 91 in direct parallel with recorder magnet 87, so as to respond to the same releasing influences. In this way it is assured that the selector will remain set until the shifter of the recorder has substantially completed its return movements to normal position, and as heretofore suggested, it is during this time that the answer-back buzzer at the user's station may operate.

I prefer that, even when the plug is not inserted to answer back the user who is signaling, the answer back circuit be employed to give him a distinctive notification of the fact that his signal has been received, so showing that the apparatus is in working order. To this end I provide in the selector C a switch 185 having its wires 186 and 187 bridged directly across the answer back wires n^2 and 156, and arrange a lug on a cam wheel 187 of the shifter-mechanism of the answer back selector so that it will momentarily close the switch 185 just before completing the fifth step of the shifter. At the time when this momentary circuit closure takes place the answer back circuit will have been otherwise completed by the recorder and by the cam a^8 at the transmitter, and consequently a very short operation of the answer back buzzer occurs. An answer back is readily distinguishable from this test signal, as the true answer is a relatively long ring.

As far as I am aware, this invention is the first to embody a system wherein any user may key-set any one of a plurality of settable electro-mechanical transmitters to send his individual code-signal and may, at whatever transmitter he is operating, receive an answering signal that is selectively set by the central operator to answer his individual code-signal only.

It will be understood that in its broader aspects my invention is not limited to the particular devices and specific circuit arrangements herein employed for full disclosure for many variations in specific em-

bodiment may be made without departure from the spirit of my invention, within the scope of the appended claims.

Having described my invention, what I claim is:

1. The combination of a plurality of telegraphic signal-transmitters each having an electro-responsive lock-out mechanism and signal-impulse transmitting means, a central station signal-responsive device, a signaling circuit for said impulse-transmitting means and signal-responsive device, a lock out circuit for the lock out mechanism, and means operable prior to the signal responsive device for potentiating the lock out circuit for all other transmitters during the operation of any transmitter.
2. The combination of a plurality of telegraphic signal-transmitters each having an electro-responsive lock-out mechanism and signal-impulse transmitting means, a central station signal-responsive device, a signaling circuit for said impulse-transmitting means and signal-responsive device, a lock out circuit for the lock out mechanism, means operable independently of said signal responsive device for potentiating the lock out circuit for all other transmitters at the commencement of signal-circuit-closing operation of any transmitter and means for automatically releasing said potentiating means after conclusion of the signaling-operation of said transmitter.
3. The combination of a plurality of telegraphic signal-transmitters each having an electro-responsive lock-out mechanism and a signal-wheel and switch, a central station signal-responsive mechanism, a signaling circuit for the signal switches of the transmitters and the signal-responsive device, a lock-out circuit for the lock-out mechanism, means at the central station responsive to the signal-circuit-closing operation of any transmitter for potentiating the lock-out circuit for the other transmitters, and means associated with each transmitter for closing the connection of the lock-out mechanism of that transmitter with said lock out circuit preliminarily to its signaling transmitting operation.
4. The combination of a plurality of telegraphic signal-transmitters each having an electro-responsive lock-out mechanism and a signal-wheel and switch, a central station signal-responsive mechanism, a signaling circuit for the signal switches of the transmitters and the signal-responsive device, a lock-out circuit for the lock-out mechanism, means at the central station responsive to the signal-circuit-closing operation of any transmitter for potentiating the lock-out circuit for the other transmitters, means associated with each transmitter for actuating said lock-out potentiating means for other transmitters preliminarily to the signaling operation of the transmitter, and means associated with each transmitter for closing the connection of the lock-out mechanism of that transmitter with said lock out circuit preliminarily to its signaling transmitting operation.
5. The combination of a plurality of motor-operated, manually-wound signal-transmitters, each having an electro-responsive lock-out mechanism for preventing motor-winding when energized and each having signal-impulse transmitting means, a signal responsive device at a central station, a signaling circuit for said impulse transmitters and signal-responsive device, a lock-out circuit for the lock-out mechanism, and means operable preliminarily to the signal responsive device for effecting potentiation of the lock out circuit during the operation of any transmitter.
6. The combination of a plurality of motor-driven, manually-wound signal-transmitters, each having an electro-responsive lock-out mechanism for preventing motor winding when energized, a switch for said lock-out mechanism closable at the transmitter preliminarily to winding of the transmitter, and a signal-wheel and switch; a central station signal-responsive device; a signaling circuit for the signal-switches and responsive devices, a lock-out circuit for the lock out mechanisms of the several transmitters, and central station electro-responsive means for potentiating the lock-out circuits incidentally to the operation of any transmitter and subsequently to its own closure of the switch for its lock-out mechanism.
7. The combination of a plurality of telegraphic signal transmitters, each having an electroresponsive lock-out mechanism and a signal-wheel and switch, a central station signal-responsive device, signal circuit wires for connecting the signal responsive device and signaling switch, a starting magnet normally operatively connected with said wires for response to the first operation of any transmitter, a lock-out circuit for the lock-out mechanisms of the several transmitters normally open at the central station, and means controlled by the starting magnet for closing said circuit at the central station thereby to potentiate for operation the lock-out mechanisms of all the transmitters except the acting one.
8. In a system of the character described, a line, at a plurality of signal-sending stations, signal initiating means and answer back means, and at a receiving station signal receiving means and settable means co-acting with the signal receiving means to condition for operation the answer back means at the sending station when the signal transmitted accords with that for which the settable means is set.
9. In a system of the character described,

a line, variable-signal initiating means at one station, answer back means associated therewith, signal receiving means at another station differently responsive to the various signals and locally-controlled settable means at the last said station coacting with the signal-receiving means to condition the answer back for operation when the signal receiving means responds to the signal for which the settable means is set.

10. In a system of the character described, a line, a plurality of transmitters associated therewith, each adapted to transmit its permanent number signal and a variable user's signal, an answer-back signal device associated with each transmitter, and cooperating equipment comprising a settable device and a signal responsive device jointly instrumental in conditioning for operation the answer back of the sending station in response to a user's signal in accord with the setting of said settable device.

11. In a system of the character described, the combination of a line, a plurality of impulse-occasioning transmitters at respective sending stations, an electro-responsive answer-back signal means at each such station and, at a central station, a transmitter-actuated circuit-controlling selector and means selectively settable by the central operator cooperating with the selector to establish a circuit for potentiating the answer-back means only when the transmitter-occasioned operation of the selector corresponds with the setting of said settable means.

12. In a system of the character described, the combination of a line, a plurality of impulse-occasioning transmitters at respective sending stations, each comprising a variable-signal, selectively-settable impulse initiator, an electro-responsive answer-back signal means at each such station and, at a central station, a transmitter-actuated circuit-controlling selector and means selectively settable by the central operator cooperating with the selector to establish a circuit for potentiating the answer-back means only when the selectively set transmitter-occasioned operation of the selector corresponds with the setting of said settable means.

13. In a system of the character described, the combination of a line, a plurality of impulse-occasioning transmitters at respective sending stations, each comprising a key-wound motor, and a key-set variable-signal impulse-initiator driven by the motor, an electro-responsive answer-back signal means at each such station and, at a central station, a transmitter-actuated circuit-controlling selector and means selectively settable by the central operator cooperating with the selector to establish a circuit for potentiating the answer back means only when the selectively-set transmitter-occasioned operation

of the selector corresponds with the setting of said settable means.

14. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a plural-digit signal transmitter and an electrically-operated answer-back signal means; and a central station equipment comprising circuit-controlling-means manually settable to accord with the plural-digit signal and a signal-responsive circuit-controlling selector having parts respectively movable in response to impulse groups of the signal-digits, said selector coacting with the manually-settable-means to potentiate the answer-back means of a calling station when the signal transmitted from said station corresponds with that for which the central-station means is manually set.

15. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a plural-digit signal-transmitter adapted to transmit a selectively-set signal individual to the user and an electrically-operated answer-back signal-means; and a central station equipment comprising circuit-controlling-means manually settable to accord with the plural-digit signal and a signal-responsive circuit-controlling selector having parts respectively movable in response to impulse groups of the signal-digits, said selector coacting with the manually-settable means to potentiate the answer-back means of a calling station when the user's signal transmitted from said station corresponds with that for which the central-station means is manually set.

16. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a plural-digit signal-transmitter adapted to transmit a selectively-set signal individual to the user and a constant station-number signal, and an electrically-operated answer-back signal-means; and a central station equipment comprising circuit-controlling-means manually settable to accord with the plural-digit signal and a signal-responsive circuit-controlling selector having parts respectively movable in response to impulse groups of the signal-digits, of the user's signal, said selector coacting with the manually-settable means to potentiate the answer-back means of a calling station when the user's signal transmitted from said station corresponds with that for which the central-station means is manually set.

17. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a plural-digit signal transmitter and an electrically-operated answer-back signal-means controlled in part by the transmitter for operation subsequently to the signal trans-

mission; and a central station equipment comprising circuit-controlling-means manually settable to accord with the plural-digit signal and a signal-responsive circuit-controlling selector having parts respectively movable in response to impulse groups of the signal-digits, said selector coacting with the manually-settable means to potentiate the answer-back means of a calling station when the signal transmitted from said station corresponds with that for which the central-station means is manually set.

18. In a system of the character described, the combination of signal circuit connections, lock out circuit connections; a plurality of sending-station equipments each comprising a plural-impulse signal-transmitter, a transmitter-disabling or lockout means in the lock-out circuit arranged to prevent transmitter operation while any other transmitter is working, and an electrically-operated answer-back signal-means associated with the signal circuit; and a central station equipment comprising means automatically to potentiate the lock-out circuit for all other stations during the operation of the transmitter of any station, circuit controlling means selectively settable to accord with any signal to be answered, and an automatic circuit-controlling selector, responsive to the transmitter-initiated signals, cooperating with said settable means to potentiate the answer-back means of the calling station when the signal transmitted accords with that for which the said settable means is set.

19. In a system of the character described, the combination of signal circuit connections, lock out circuit connections; a plurality of sending station equipments, each comprising a transmitter associated with the signal circuit constructed to transmit different user's signals, an answer back signal means associated with said signal circuit and electro responsive lock-out means associated with the lock-out circuit and adapted to prevent transmitter operation, each said transmitter adapted to preliminarily close the lock-out-circuit at the sending station and thereafter to effect its signal circuit closures; and a central station equipment comprising means for potentiating the lock-out circuit connections for all other transmitters upon signal-circuit closure by the sending transmitter, and means responsive to the signal transmission instrumental in closing the circuit for the answer-back means at the sending station.

20. In a system of the character described, means at one station for transmitting different selected signals, answer-back means associated therewith, means at another station for automatic response to any selected signal, means at the last said station locally controlled and selectively settable to accord with any chosen signal and cooperating with the

signal responsive means to condition the answer back means for operation only when the signal transmitted accords with that for which said means is selectively set.

21. In a system of the character described, the combination of a three-wire line, at each sending station signal-circuit switches and an answer back means bridged across two of said wires, lock-out means and a switch therefor associated with the third wire, and transmitter mechanism for working the said switches of the lock out means, signal circuit and answer back in proper sequence; and at a central station means associated with the signal circuit wires for potentiating the lock out wire, settable circuit closing means for correspondence with any signal to be answered, and, in cooperation with the last said means, a signal-responsive circuit controlling selector for potentiating a circuit for the answer back means at the calling station when the signal transmitted accords with that for which said central station means is set.

22. In a system of the character described, the combination of a line, a plural digit signal-transmitter, answer-back means associated with said transmitter, a central station apparatus comprising electro-responsive means movable to different positions in response to different plural-digit signals, and means operable to correspond with some selected plural-impulse-signal, and means controlled by the transmitter and other means controlled by the position of said electro-responsive means jointly instrumental in closing a circuit for the answer back means after the transmitter has sent its signal.

23. In a system of the character described, the combination of a line; a plural-digit impulse-transmitter; and a number-indicating-means comprising a step up device responsive to the signaling impulses, a shifter device controlled by said step up to advance after each signal-digit, and number wheels successively conditioned, by the shifter, for operation by the step up device, each to record its digit of the signal and means for automatically releasing the parts of said number-indicating means after completion of a signal-registration.

24. In a system of the character described, a line, a plurality of sending-station equipments each having a self-restoring, plural-digit electrical-impulse transmitter, each said transmitter having means to close the line preliminarily to signal transmission, and central station equipment comprising starting means responsive to a preliminary impulse to condition the signal-displaying devices for operation, and signal displaying devices comprising a step up device responsive to the transmitter-impulses, a shifter controlled by said step up device for operation after each impulse group, number-

wheels successively conditioned, by said shifter, for operation by the said step-up means, and automatic means, timed in operation by said shifter-means for restoring the central devices to normal.

25. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a self-restoring transmitter adapted for manual setting to transmit a selected plural-digit signal of an ascertained number of digits; and central station equipment comprising recorder means having a step-up device responsive to the signal impulses, a shifter controlled by the step-up device for actuation during dwells in the signaling sequence, number-wheels successively conditioned, by the shifter, for operation by the step up means, and means automatically to print the record of said wheels.

26. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a self-restoring transmitter adapted for manual setting to transmit a selected plural-digit signal of an ascertained number of digits; and central station equipment comprising recorder means having a step-up device responsive to the signal impulses, a shifter controlled by the step-up device for actuation during dwells in the signaling sequence, number-wheels successively conditioned, by the shifter, for operation by the step up means; means timed by the shifter automatically to print the record of said wheels and shifter-timed means thereafter to release the recorder parts.

27. In a system of the character described, the combination of a line; a plurality of sending-station equipments each comprising a self-restoring transmitter adapted for manual setting to transmit a selected plural-digit signal of an ascertained number of digits; and central station equipment comprising recorder means having a step-up device responsive to the signal impulses, a shifter controlled by the step-up device for actuation during dwells in the signaling sequence, number-wheels successively conditioned, by the shifter, for operation by the step up means; means timed by the shifter automatically to print the record of said wheel and means controlled by the printing means for releasing the recorder means.

28. In a system of the character described, the combination with a line, of a signal transmitter having a definite cycle of operations, signal receiving means cyclically operable in response to said transmitter operations, automatic release means for said receiving means, operable in predetermined relation to the signaling cycle, and automatic emergency release means, operable to release the signal-responsive means, and controlled by said signal responsive means for

restraint from performing its releasing operation during the normal cyclic operation of said signal-responsive means.

29. In a system of the character described, the combination of a line, a transmitter having a definite signaling cycle and adapted to transmit plural-digit number signals in definite time; signal responsive means including a part movable at each dwell in the signaling cycle, normal, automatic release means for the signal responsive means, operable to release the latter at a predetermined point in the signal-receiving cycle; and emergency release means for said signal-responsive means retarded and controlled by the said part that moves during dwells and operable to release upon undue prolongation of time between operations of said part, whereby the signal-responsive means is self-restoring after a complete or an incomplete signal.

30. In a system of the character described, the combination of a line, a plural-digit signal transmitter, signal responsive means comprising a step up responsive to signal impulses and a shifter controlled by said step up and actuated upon dwells between digit-groups of impulses; recorder parts controlled by the shifter and moved by the step-up device; normal releasing means for said recorder parts; and emergency releasing means comprising an electro-responsive device operable to effect a release of the recorder parts upon predetermined continuous operation and means controlled by the shifter means for interrupting its continuity of operation, thereby to prevent emergency release as long as the shifter device operates at its normal-signal-responsive times.

31. In a system of the character described, the combination of a line, a signal transmitter comprising means for preliminarily closing the line connections and thereafter transmitting a plural digit number-signal, and a receiving station equipment comprising an electro-responsive starting device responsive to the preliminary impulse, an electro-responsive shifter means and an electro-responsive step up means, both said means connectible with the line by the starting device, said step up device controlling the shifter, for operation of the latter during signal-dwells, means for indicating the signals having number wheels successively conditioned, by the shifter means, for operation by the step up means, whereby each group of impulses representing a different digit sets forward a different wheel, and automatic releasing means for said indicating means.

32. In a system of the character described, the combination of a line, a plural digit signal transmitter, an answer-back signal means having its circuit controlled in part by the transmitter, means responsive to the