J. McFELL.

SELECTIVE SIGNALING MEANS.

APPLICATION FILED JULY 27, 1910.

1,024,590.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 1.

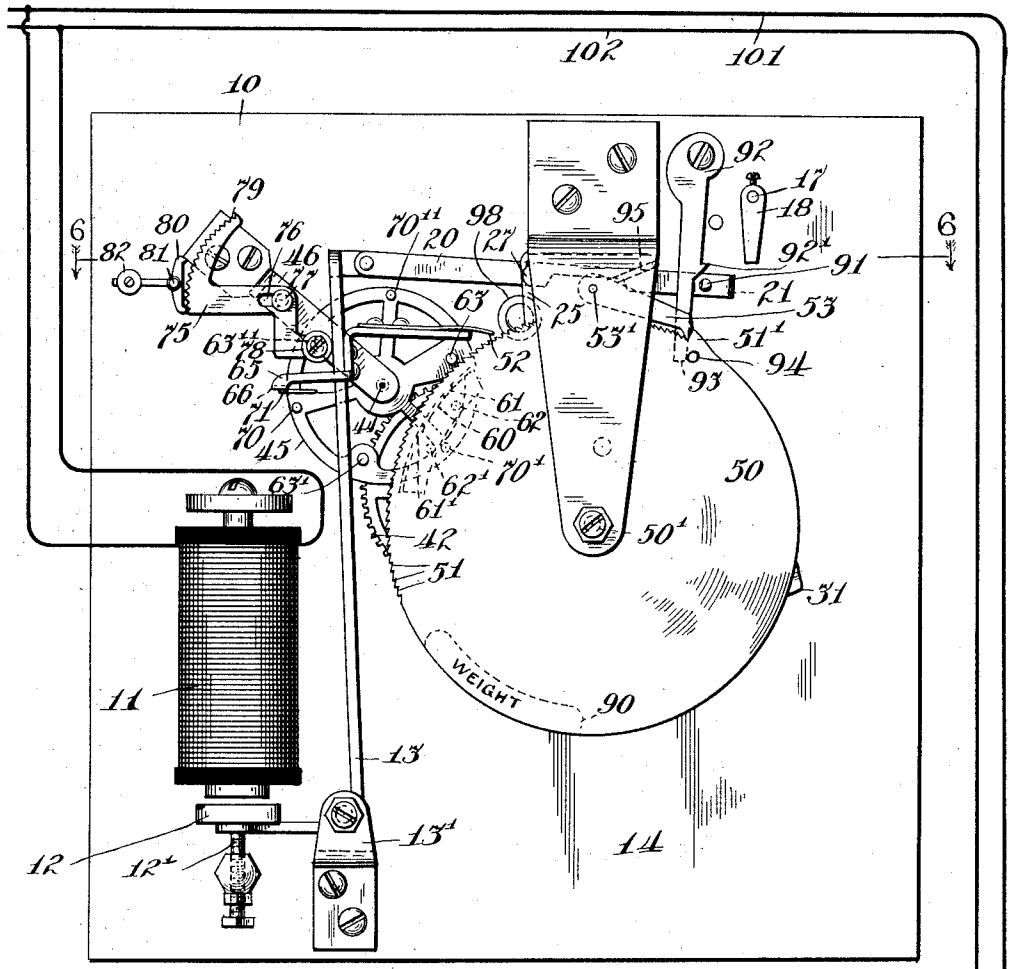


Fig. 1.

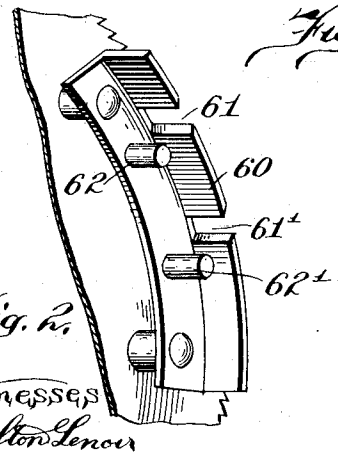
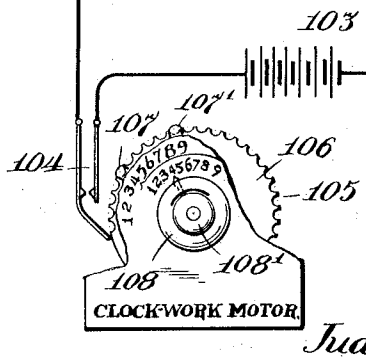


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

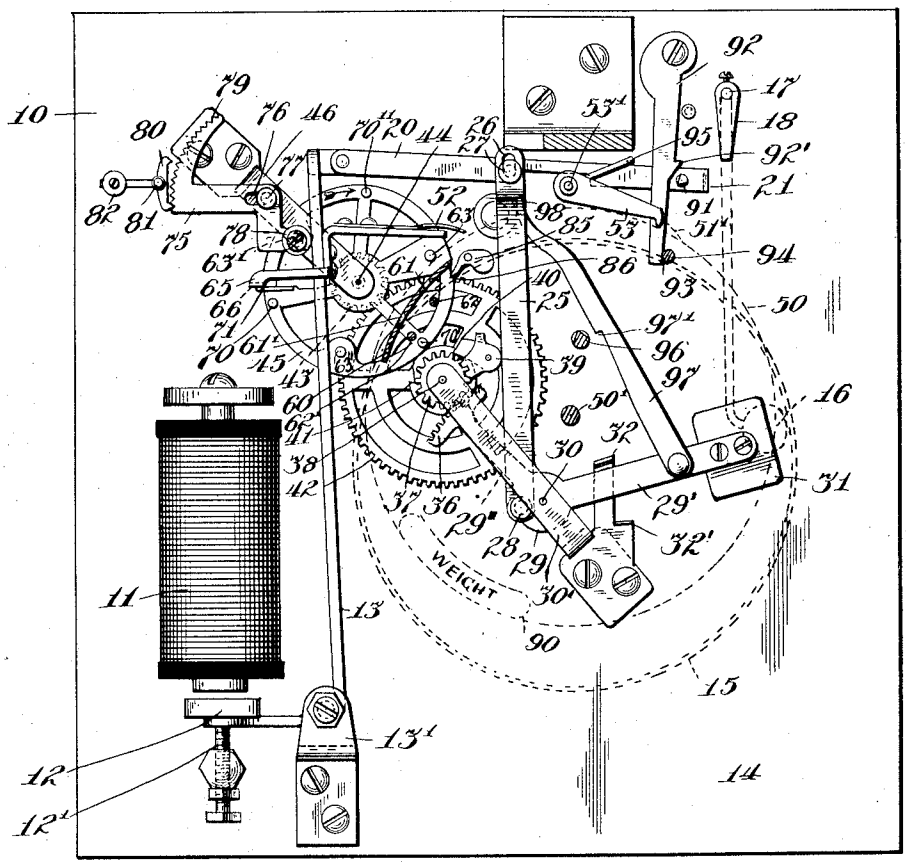


Fig. 4.

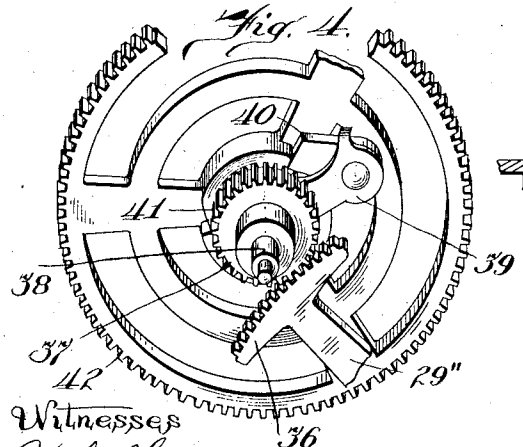
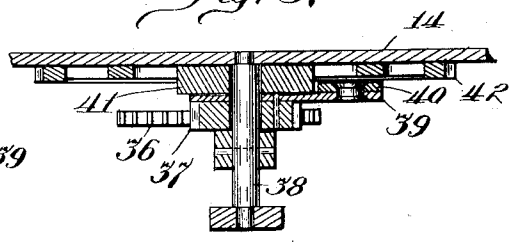


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

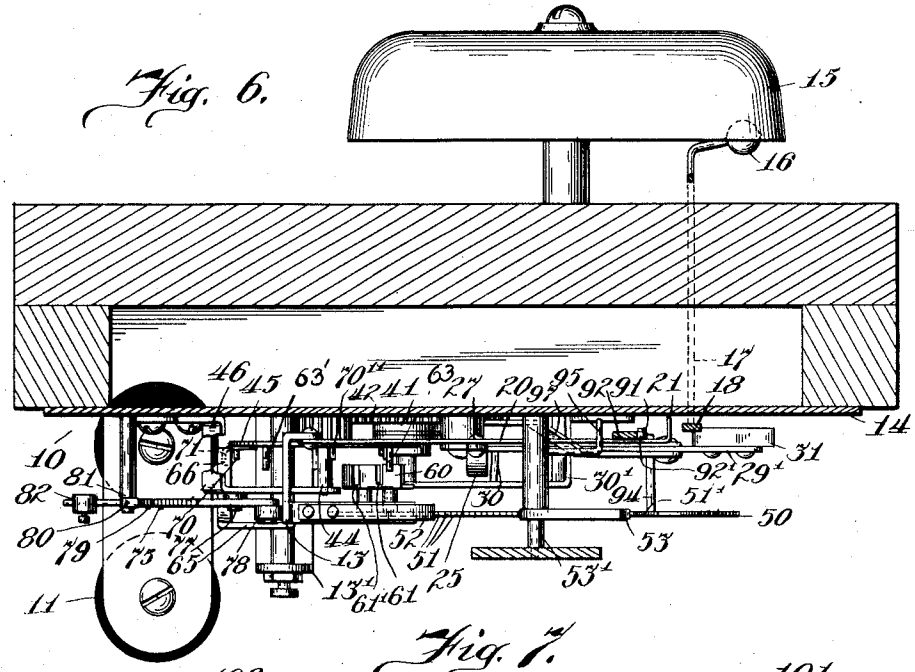


Fig. 7.

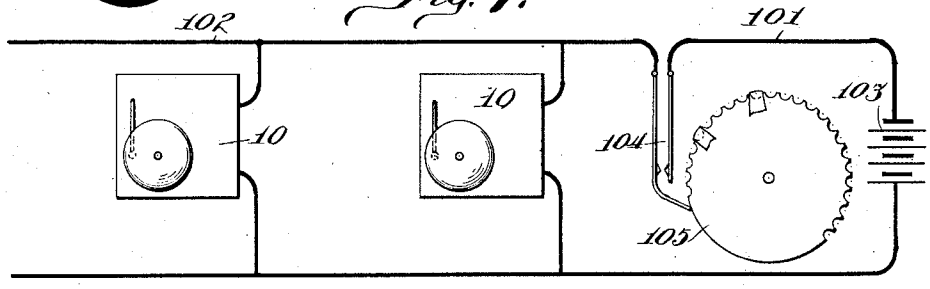
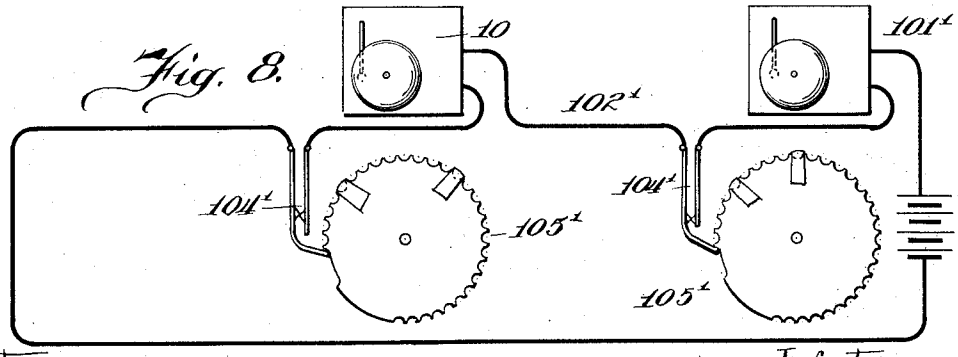


Fig. 8.



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SELECTIVE SIGNALING MEANS.

1,024,590. Specification of Letters Patent. Patented Apr. 30, 1912.

Application filed July 27, 1910. Serial No. 574,157.

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 Selective Signaling Means, of which the following is a specification.

My invention relates to improvements in selective signaling means, and particularly to those systems designed to enable any desired one of a plurality of stations upon a common line circuit selectively to be called by the transmission over the line of a number signal individual to said station.

Among the general objects sought to be attained are to provide a selector apparatus which will respond only to the predetermined number signal for which it is structurally set to condition for operation the annunciator which serves to attract the attention of the operator, and to provide for the automatic restoration of the devices at the respective stations to normal condition upon completion of each call.

One of the more specific objects of my present invention is to provide such a system wherein the signaling apparatus at each call-receiving station contains only a single electro-magnet, and wherein all of the controlling devices associated with said electro-magnet to cause the annunciator at the station to respond only to a predetermined code signal, are mechanical in operation.

Many other objects of my invention will become apparent to those skilled in the art from the within description, taken in conjunction with the accompanying drawings, wherein I have illustrated an embodiment of my invention, and wherein,

Figure 1 is a front elevation of suitable selector apparatus, shown in connection with a wiring diagram suitable for embodiment of my invention; Fig. 2 is an enlarged detail of a fragment of the selector mechanism; Fig. 3 is an elevation of selector mechanism with parts broken away; Fig. 4 is an isometric perspective showing the relation of such gearing parts; Fig. 5 is a horizontal section of the same parts assembled. Fig. 6 is a section on line 6—6 of Fig. 1, and Figs. 7 and 8 are wiring diagrams.

My invention may advantageously be embodied in a single circuit system supplied by a single battery at some convenient point and having associated therewith the selective apparatus for any appropriate number of stations, and one or more signal transmitting devices, as desired. It is well known that in some installations,—as for example, in a signaling system for a train despatcher, whereby the despatcher may call any station operator along the line,—it is deemed advisable to employ only one transmitting apparatus at the despatcher's office; whereas in other installations it is desired that the various stations along the line may intercommunicate with one another, and under such circumstances a transmitting apparatus at each station is necessary. The selector or call-responsive apparatus, hereinafter described, may be used in either arrangement.

The signal transmitting appliance, or appliances, may be of any desired character to permit or cause to be sent over the line impulses in groups constituting digits of a plural digit number signal, each group being followed by a dwell or pause, longer than the spaces between uninterruptedly-sequent impulses. By "impulse" I mean an impulsive variation in line conditions which may actuate an electro-responsive device, and by "dwell" I means any continuance of one phase of such changing line conditions longer than it endures in the transmission of an uninterrupted sequence of impulses.

The selective apparatus, at each station, contains electro-responsive means in operative association with the line to respond to the impulse-groups transmitted thereover; also an annunciator of any suitable form to attract an operator's attention, and, further, controlling means coöperating with the annunciator and the electro-responsive device, arranged to condition the annunciator for operation only when the electro-responsive device receives a plural digit number signal for response to which said controlling apparatus is structurally set.

In the particular embodiment of my invention shown, the selector device 10 comprises an electro-responsive part in the form of an electro-magnet 11, provided with a weight-retracted armature 12, mounted on the short arm of bell crank lever 13, pivoted between a base plate 14 and a bracket 13′, so that the armature may vibrate between the poles of the magnet and a back stop 12′. The long arm of the bell crank 13 rises vertically, and is intended for connection with mechanism to be described. Further, in the specific construction shown, 15 indicates an annunciator in the form of a gong on the back of frame 14, having a clapper 16, pendent from a crank 17, extending through the frame 14 and carrying on the front thereof an operating finger 18.

The free extremity of the armature lever 13 has pivotally connected thereto an arm 20, having its free end 21 bent to form a finger for engagement with the finger 18 of the gong clapper only when raised to its operating plane, said finger 21 normally standing below the operating plane. Thus whenever arm 20 is raised from the normal position shown in Fig. 3 to its operating plane, every vibration of the armature lever 13 in response to energization of the magnet 11 will cause the sounding of the gong, whereas so long as the arm 20 remains depressed below this operating plane no operation of the annunciator occurs. This arrangement of the gong to be operated by direct connection from the armature lever is advantageous, but broadly the devices described include an annunciator and suitable, normally-disabled means for operating it.

In the specific construction shown the arm 20 has connected therewith, to raise it, a link, 25, having near its upper extremity a slot 26 engaging a pin 27 upon the arm 20, the lower extremity of said link 25 being pivotally connected as at 28, to a lever member 29, which is pivotally mounted on a shaft 30 journaled in the frame 14 and a bracket 30′. The lever 29 provides an arm 29′ on the opposite side of the pivot 30 from the link connection aforesaid, and said arm 29′ is weighted, as at 31, and arranged to play between stops 32, 32′. The action of lever 29 is such that as weighted arm 29′ descends from its highest position, shown in Fig. 3, to its lowest position, the link connection 25 will elevate the arm 20 to its gong-operating plane just before two-thirds of the downward movement of said weighted arm is completed, the last third of the movement of the arm 29′ further elevating arm 20 to attain another result to be described. Broadly it will be seen, the weighted lever 29′ is a motor part or means for actuating the part 20, which has to be moved from normal position to establish connections through which the annunciator is occasioned functionally to operate.

Since the annunciator is intended to be conditioned for operation only in response to a definite number signal consisting of a plurality of digit groups of impulses, movements of the lever arm 29′ from raised to lowered position is made subject to dual control, first by a number-control step-up device operating in accordance with the impulses received by the electro-responsive magnet 11, to permit the lever 29′ to descend only upon receipt of predetermined numbers of impulses, and second, by a time-control or retarding device, operated by an impulsively moved part, such as armature lever 13, to be responsive only to dwells in the operation of said electro-responsive device to play its part in freeing the lever for descent, whereby the annunciator may be conditioned for operation only by the occurrence of dwells after the critical digit groups of impulses.

The control of both the step-up device and the timer over the part ultimately to be moved is effected through a secondary controller, which in this specific embodiment, takes the form of a rotatable governor wheel.

In the specific construction shown I so connect the lever arm 29′ to a governing wheel, 45, that said wheel must rotate during the descent of the weighted arm 29′. Thus the lever 29 has an extension 29″ from the weighted arm 29′, carrying at its end a gear segment, 36, engaging a small pinion, 37, loosely mounted on a shaft, 38, journaled in the frame 14 and the bracket arm 30′. The pinion 37 has connected thereto for rotation an arm, 39, carrying a pawl 40, coöperating with a ratchet hub, 41, of a large gear, 42, mounted upon the shaft 38. Thus it will be understood, as the sector 36 rises during the descent of the weighted arm 29′ the pinion 37 is rotated in an anti-clock-wise direction and carries with it in rotation the gear wheel, 42, by reason of the ratchet and pawl connections 40—41 between the pinion and gear, but upon the elevation of the weighted arm 29′, and return movement of the sector, 36, the clock-wise rotation of the pinion 37 produces no movement of the gear 42, the pawl 40 merely slipping over the ratchet hub, 41.

The gear-wheel, 42, is connected to a pinion 43, fixed to a shaft 44, which also carries the governing wheel, 45, said shaft 44 bearing in the frame 14 and a bracket arm, 46, suitably secured thereto.

The gearing relation between the governor wheel 45 and the actuating arm lever 29′ is such that during the full downward movement of the lever arm 29′ the wheel 45 makes one complete revolution, and it

will be obvious that when the weighted arm 29′ is elevated, or potentiated, for operation, it may descend to effect its functional operations only at such times as the wheel 45 is freed from restraint.

In the specific construction shown it is through two successive movements of this governing wheel or secondary controller and the parts coöperating therewith, that the selective device is made to respond only to a predetermined number; said governing device being under the control of a step-up device arranged to free it only when in certain positions to which the step-up device is advanced by predetermined digit groups of impulses, and also under the control of means for restraining its operation except during dwells in the operations of the electro-responsive device.

In the specific construction shown the step-up device comprises a ratchet wheel, 50, provided with a stop tooth 51′, and a peripheral series of teeth, 51, acted upon by a live or active pawl, 52, carried by the armature lever arm 13, and also acted upon by a holding pawl, 53. The shaft 53′ for said pawl, and shaft 50′ for ratchet 50 are journaled in the frame 14 and a bracket arm 55 attached thereto. The active pawl 52 is arranged to engage the ratchet teeth 51, during only approximately the latter half of its forward stroke, and obviously, with each impulse transmitted through the magnet, 11, the pawl 52 advances the ratchet wheel 50 one step and the wheel is retained in advanced position by the holding pawl, 53.

The ratchet wheel, 50, carries on its back an arcuate wall, or rim-segment, 60, projecting laterally and having therein suitable notches, or openings, herein shown at 61 and 61′, confronted by stop lugs, 62—62′, set slightly inward from the rim in suitable position for the operation to be described. The controlling wheel, 45, bears three long projecting pins or stops, 63, 63′, and 63″, arranged in their movement with the rotation of the wheel, to intersect the path of movement of the rim, 60. It will, therefore, be apparent that the controlling wheel will not be permitted to revolve as long as a solid portion of the rim confronts any one of the pins, 63, etc. However, it will be apparent that as soon as a notch 61 or 61′ in the rib comes into register with the pin confronting the rim, the pin may slip through the notch, but only to strike against the appropriate stop 62, or 62′, corresponding with said notch. With the next advance step of the ratchet wheel, 50, however, the stop 62, or 62′, is removed from engagement with such pin, so that the governing wheel is left free to travel rotarily until the next succeeding pin strikes the rim 60. Thus it will be obvious that the step-up device permits rotative movement of the governing wheel at only certain predetermined points in its successive stepping movements corresponding with successive predetermined number digits, and the positions of notches 61 and 61′ on the ratchet wheel structurally set the selector for its response to a predetermined number-signal. The entire length of the rib is such that its rear end does not interfere with any pin which has passed through a rim-notch, and obviously when the advance of the ratchet carries the rim entirely beyond the path of the pins 63, etc., the governing wheel is freed from all restraint by the step-up device.

In order that any functional movement of the governing wheel may take place only during dwells in the transmission of signaling impulses such as indicate the completion of successive impulses to constitute a digit group, I arrange the governing wheel for control by the electro-responsive device in an arrangement such that as long as a continued or uninterrupted series of impulses is being transmitted to the electro-responsive device, the governing wheel 45 may never functionally operate.

In the specific construction shown I provide upon the armature lever 13 a finger 65 having a laterally off-set stop 66 arranged to stand respectively in or out of the path of the movement of three short pins, 70, 70′ and 70″, carried by the governing wheel 45, accordingly as the armature is attracted or retracted these pins 70, etc., being made short so as to have no coöperation whatever with the rim, 60, of the ratchet wheel. An additional pin, 71, is provided on the wheel, 45, arranged to coact with the stop 66 when the armature is in retracted position, but to be freed by the stop when the armature is moved to attracted position.

Acting upon the armature lever 13, to delay its rearward movements, I provide a retard mechanism of simple and convenient form, that shown comprising a bell crank lever, 75, pivoted by means of an elongated slot, 76, upon a pivot pin 77, secured to the bracket 46, the short pendant arm of the bell crank bearing a roller, 78, arranged to receive the armature lever, 13, near the free end thereof, and the long horizontal arm of the bell crank carrying at its end a ratchet arc, 79, with which coöperates an escapement pawl, 80, pivoted as at 81, to the frame, and suitably weighted, as at 82.

In Fig. 3, the retard device is shown in the position which it occupies when the lever 13 is in rearmost position; and it will be seen that as the lever 13 advances the bell crank lever 75 is freed from rearward pressure and may readily slip forward slightly on its pivot out of operative connection with the escapement pawl 80, so that the ratchet

arc, 79, quickly descends to lowest position. Upon return movement of the lever 13, however, the rearward pressure upon the roller 78, forces arc 79 into engagement with escapement pawl 80, and then as said arc is forced to rise the escapement retards its motion, so that the return of the armature lever through the last half of its movement is considerably retarded in point of time. The time moment thus to be considered should be proportioned to the rate in which the signaling impulses are intended to be transmitted, the idea being that it shall take a period of time greater than that which will elapse between any two impulses of a continuous series of impulses to enable the armature lever to return to rearmost position from its forwardmost position. Thus, it will be seen that when once the armature lever is thrown forward by the commencement of a series of impulses, it never returns to rearward position so long as the impulse-series is uninterrupted, but it will return to rearwardmost position if an interruption occurs in the series of impulses, such as that which occurs after each digit group of a number signal.

The relative arrangement between the short pins 70, etc., and the long pins, 63, etc., is such that when pin 70 is conditioned for coöperation with the shiftable stop 66, long pin, 63, is positioned for contact, or almost-contact with the rim, 60, and similar relations prevail as to short pins, 70′, 70″ and long pins, 63′, 63″, respectively. The additional pin, 71, is provided merely to determine the proper normal position of the governing wheel, 45, and to assist in securing this proper initial position of the wheel, I provide a small gravity pawl, 85, to coöperate with a notch, 86, in the periphery of the wheel, to prevent backward rotation of the governing wheel from normal position.

Now, it will be apparent that in order for the controlling mechanism of the annunciator to be conditioned for operation, there must occur a dwell in the signaling impulse series, at the two points where the step-up device can free the annunciator-controlling mechanism for operation.

Specifically to describe the sequence of actions which conditions the annunciator for operation, it is assumed that the selective apparatus is set for the number 44; and that the parts stand in the position shown in Fig. 3. If now, four impulses are successively sent through the magnet 11, and then a dwell is caused to occur followed by four impulses and another dwell, so to designate station "44", and then an arbitrary succession of impulses is transmitted before a long, final dwell, or cessation of the impulses, the following operations transpire: With the first impulse attracting the armature 12, of the magnet 11, the lever 13 moves forward to its forwardmost position and the retard-ratchet-arc, 79, drops to lowest position. The forward movement of the armature lever 13 advances the ratchet wheel, 50, one step, and, moving the stop finger, 66, out of the path of pin, 71, on the governor wheel, 45, permits the governor wheel to move in the direction indicated by the arrow (Fig. 3,) the practically negligible distance sufficient to bring the first short pin, 70, into contact with the under surface of the stop 66, and the first long pin, 63, into practical contact with the outer surface of rim 60 of the ratchet wheel 50. As the magnet is deënergized upon the completion of the impulse, the armature 12 starts to drop, retracting the armature lever 13, but the return movement of the armature lever is retarded by the escapement mechanism 79—80, as heretofore described, so that the stop member 66 can not move rearwardly out of the path of the pin 70 before the second impulse occurs, throwing the armature lever 13 forward a second time and advancing the ratchet 50 a second step. Similarly the third and fourth impulses occur and advance the ratchet 50 correspondingly, thereby bringing the first notch 61 into register with the first long pin 63 of the governor wheel 45. After said fourth impulse terminating the digit group indicative of number "4" there occurs a dwell, or interruption of the signaling impulses. During this dwell the weight of armature 12 forces rearwardly the lever-arm 13, which has time, during the dwell, to overcome the resistance of its retard escapement and returns to rearwardmost position. Such return of the armature lever 13 withdraws the shiftable stop, 66, from engagement with the first short pin 70, and so in virtue of the coincidence of a dwell in the signal transmission and a prescribed position of the step-up device, the long pin, 63, is freed to slip through the registering aperture 61, in the rim 60 of the ratchet 50 to strike the stop pin 62. The purpose of this stop pin is, obviously, to prevent the complete rotation of the wheel 45 before the signaling operation is resumed.

Following the dwell, four successive impulses occur, and with the first impulse which moves the ratchet 50 forward a step, the pin 63 is freed from the stop 62 and the governor wheel 45 completes the first third of its revolution, rotating until the second short pin 70′ encounters the vibrating stop 66, and the second long pin 63′ is brought into substantial contact with the rim 60, of the step-up wheel 50. Thus the weighted lever arm 29′ drops one-third of its excursion, and arm 20 is lifted somewhat, but not enough to reach its operative plane.

Of course during these four successive impulses, no further release of the governor wheel occurs, as the stop 66 and rim 60 both restrain the wheel 45, but when the fourth impulse of the second group has occurred the second notch 61′ registers with the pin 63′, the dwell occurs, and armature-lever 12 is fully retracted again, so that said second pin 63′ slips through its notch 61′ in the ratchet wheel rim, and, with the first impulse of the arbitrary series of impulses following said second dwell, the governing wheel 45 completes the second-third of its complete rotation. This two-thirds rotation of governor wheel 45 enables the weighted lever to descend through two-thirds of its course and thereby raises the connecting arm 20 into the plane in which it coöperates with the finger 18 of the gong clapper. Consequently, during the transmission of the arbitrary series of impulses following the two digit groups of impulses constituting number "44," each vibration of lever 13 causes arm 20 to operate on finger 18, thereby to sound the gong. As long as this uninterrupted series of arbitrary impulses continues, no further movement of the governing wheel 45 takes place, but the ratchet wheel 50 is advanced as far as its teeth will cause it to proceed, thereby completely removing the rim 60 from coöperation-relation with the long pin 63″ of governor wheel 45. Consequently when the arbitrary series of impulses ceases, and the final dwell occurs, the armature lever falls clear back, overcoming the resistance of its retard mechanism, thereby removing stop 66 from engagement with short pin 70″, and freeing the governor wheel for the last third of its rotation to bring the positioning pin 71 again into contact with the under side of the stop 66, rebound from such position being prevented by the reëngagement of pawl 85 in its notch 86 of wheel 45. While thus the transmission of the number "44" conditions the annunciator for operation, it will be seen that any other number could not produce such results upon the particular selector at station forty four. Thus it will be obvious that in the transmission of the signal "55" the uninterrupted group of five impulses will move notch 61 past the pin 63 while the governor wheel is continuously held under restraint by the vibrating stop 66, and so when the dwell occurred after the five impulses, and vibrating stop 66 moves out of engagement with the pin 70, rim 60 on the ratchet wheel 50 holds the pin 63 and prevents the governor wheel from moving, and correspondingly, lack of simultaneity in the occurrence of the second dwell and registering of pin 63 with notch 61′ prevents the governor wheel from being freed by the transmission of the second numeral five. It will be obvious, however, that when the arbitrary series of impulses has been completed and the rim 60 entirely removed from the path of the pin 63, etc., the cessation of vibration of armature lever 13 and its return to rearward-most position frees the wheel 45 for a continuous complete rotation back to original or normal position. Furthermore it will be obvious that if the number transmitted were say "45," which would produce the first release of the governor wheel 45 for the first-third of its rotation but not the second portion, the annunciator would not be conditioned for operation, for in no case, save where the dwell coincides with both critical positions of the step-up device, is the governor wheel freed for two-thirds rotation until after the line impulses have ceased. Thus, while the completion of the revolution of all the governor wheels 45 at the several stations, incident to every signal transmitted brings the arm 20 momentarily into its operating plane, such action occurs after all possibility of operating the annunciator is past. In short, the parts moved impulsively by magnet 11, actuate both a number control and a timer, which jointly act upon a secondary control or governor wheel, and the latter in turn affects the actuating mechanism for the annunciator, to condition the annunciator for operation only when the governor wheel has made a plurality of step-by-step movements.

To make the mechanism self-restoring to normal position after operation, I make provision as follows: Upon the ratchet wheel 50 I provide an unbalanced weight 90 tending constantly to return the wheel to such position that stop tooth 51′ strikes holding pawl 53, and upon the lever 20 I provide a latch pin, 91, for coöperation with a nose 92′ of a pivoted gravity dog 92, when, and only when, the lever is elevated more than two-thirds of its total play, and I provide upon the wheel 50 a releasing lug, 94, arranged to strike the tail 93 of said gravity dog 92 just before the ratchet wheel 50 reaches its normal or original position. The holding pawl 53 I provide with a finger, 95, overlying the connecting lever 20, so that when said lever is elevated to the position for engagement with the nose 92′, it lifts the holding pawl 53 out of engagement with the teeth 51 of the ratchet. Likewise I provide upon the ratchet wheel 50 a catch pin, 96, arranged when the ratchet is fully advanced and lever 29′ is fully depressed, to engage the notch 97′ in a link 97, pivoted at one end to said lever 29′, and tending by gravity to fall into engagement with said pin 96 on the wheel. A roller 98 is provided on the base, 14, to receive the free end of the link 97, as it is being carried upward

by pin 96, during the return movement of the ratchet wheel, to force said link out of engagement with the pin 96. The operation of these restoring devices will be as follows: Assuming the step-up wheel 50 to have been advanced to its maximum extent, and the governor wheel 45 to have been freed to complete the last third of its rotation, or such final portion of its single rotation as has not previously been completed, obviously, the weighted arm 29′ in traveling down to its limitation stop 32′ elevates arm 20 to its highest position where the pin 91 is engaged by the nose 92′ of pawl 92, while the holding pawl 53 of the ratchet 50 is lifted out of engagement with the ratchet wheel. Under these conditions the ratchet wheel 50 is free to revolve backward to normal position under the influence of its unbalanced weight 90. Remembering that the descent of the weighted arm 29′ serves to free the link 97 from engagement with roller 98 so that the notch 97′ engages with notch pin 96, it will be apparent that return movement of the ratchet wheel will serve to elevate the weighted lever-arm 29′, the movement of which in an upward direction is substantially unimpeded on account of the ratchet and pawl connection between pinion 37 and gear 42, and on account of the slot-and-pin connection 26—27 between the link 25 and the arm 20. When the weighted arm 29′ is lifted so far that pawl 40 takes a new hold on the ratchet 41, the contact of link 97 with roller 98 throws the link off of pin 96, leaving the weighted arm in potentiated position. When the ratchet wheel 50 has almost reached its normal position, stud 94 strikes the tail 93 of dog 92, causing it to relaese the arm 20, which drops to lowest position and frees the holding pawl 53 to return to operative relation to the step-up wheel 50.

It will be clear that at all stations in one line the primary controller or step-up ratchet wheel makes its full cycle of operations, and the secondary controller or governor wheel and the motor weight, likewise sweep through their full cycle, for every signal transmitted, so that it is positively insured that all selectors remain in step at all times.

It will be observed that the apparatus described includes only a single ratchet wheel or step-up device as part of its means for response to a predetermined plural-digit number, involves only a single electrical coil for connection with the line circuit; involves no electrical contacts of any kind; is simple and durable in construction; is fully automatic in its operation; and may be constructed, as herein described, without use of any springs.

The ratchet wheel and its pawl are of simple construction and the entire device may be made of relatively rugged, heroic construction, not susceptible to easy derangement.

In its broader aspects, however, my invention is not limited to purely mechanical governing devices, and in my co-pending application, Serial No. 574,158 filed July 27, 1910, I show a structure embodying the broad idea of this invention, wherein the controlling devices involve electric contacts. Further in the aspect that the present mechanism provides as a primary controller for the annunciator the step-up wheel, and as a secondary controller the governor wheel, each of whose plural movements to condition the annunciator for operation is controlled by the step-up device, this invention is related to my pending application, Serial No. 556,403, filed April 15th, 1910, wherein such arrangement is broadly claimed.

Such an apparatus as I have described may be connected in circuit in different ways, of which I have herein shown two, for the purpose of showing the adaptability of the selector and of indicating that my device is not restricted in some of its aspects to the particular character of the connection.

In the arrangement shown in Figs. 1 and 7 the selectors 10 at the several stations are connected in parallel to line wires 101—102, supplied with current from a single source of supply 103, and normally open at a signaling switch 104, which constitutes part of the transmitter apparatus generally indicated at 105. This transmitter includes a signal wheel 106 normally holding the switch 104 open, and provided with peripheral notches, which in passing the long pen of the switch permits it to close, said signal wheel being arranged to be driven by a suitable clock work motor, or the like, in order that it may operate with regularity. Spacers, 107 and 107′, are provided for closing any suitable notches in the periphery of the wheel and are adjustable to any desired position by means of handles 108 and 108′ respectively. The wheel makes one complete rotation each time a signal is transmitted, thereby sending a two-digit code number with each digit thereof followed by a dwell, and said number followed by an arbitrary series of impulses preceding the final opening of the circuit.

The transmitter is only diagrammatically shown, but a specific construction suitable for use with my selector is described in my copending application, Serial No. 556,404, filed April 15, 1910.

It will be observed that in the open circuit wiring shown in Figs. 1 and 7, the electromagnet 11 at each station is normally deenergized, so that the selector appliances at

all stations stand in the position shown in Fig. 1.

In Fig. 8 I have shown a closed circuit arrangement in which the electro responsive devices of the selectors are all connected in series in the wire 101′, and each station is provided with a transmitter 105′, coöperating with a normally closed switch 104′. This particular arrangement is one of those which may be employed where intercommunication between the stations is desired, and the selector apparatus may be used in unchanged construction with such wiring.

The only change made in the transmitter is that a notch is provided in the wheel normally to receive the long pen of switch 104′ so that after a long terminal dwell following the arbitrary impulses, the circuit is finally closed. This occasions a slight variation in the operation of the selector, namely, that the normal position of the armature is attracted, the normal position of governor wheel 45 is with pin 71 above instead of below stop 66, and the normal position of the ratchet wheel is one step advanced from zero, so that a selector which would respond to signal "44" in an open circuit connection is set for signal "34" on a closed circuit connection. Obviously, too, the coils of the magnet 11 must be wound appropriately for series or parallel connection, according to known usage.

What I claim is.

1. Selective signaling means comprising, in combination, an impulse receiver; mechanism impulsively movable thereby including a step-up device; a movable motor part operatively associated with said step-up device to be restrained thereby except at predetermined number-indicating release-positions of the step-up device, positive restraining means for said motor part arranged to be actuated by the impulse-receiver to release the said motor part, and retarding means operatively associated with said restraining means to retard its releasing movement.

2. Selective signaling means comprising, in combination, an impulse-receiver, a vibratable lever moved thereby, a step-up device actuated by the vibratable lever, a movable motor part, means for positively restraining movement of the motor part, movable with the step-up device, and arranged to release the motor part at predetermined number-indicating positions; other positive restraining means for said motor part movable by the vibratable lever to release the motor part; and a retard device arranged to retard the releasing movement of the last said restraining means.

3. Selective signaling means comprising in combination a magnet; an armature lever therefor; a step-up device actuated by said armature lever, said lever having a movement in excess of that necessary to operate the step-up device; retard mechanism arranged to delay the excess movement of the armature lever; a movable motor part; an annunciator mechanism controlled by said motor part; positive restraining means for the motor part, movable with the step-up device, and arranged to release the motor part at predetermined positions; and other positive restraining means for the motor part associated with the armature lever for movement thereby to releasing position only when said lever effects its excess movement against the action of the retard mechanism.

4. Selective signaling means comprising in combination a part to be moved; motor means to move it; a rotatable controller governing the operation of said motor means; a step-up device coacting with said controller, arranged to restrain or release the controller according to the position of the step-up device; mechanical retarding means for said controller part; and an impulse-receiver arranged to actuate both the step-up device and the retarding means.

5. Selective signaling means comprising in combination a part to be moved; motor means to move it; a rotatable controller governing the operation of said motor means and providing a plurality of stops; a step-up device providing a movable wall having therein a plurality of openings, arranged to restrain or release said controller according to the relation of the wall-openings to the controller stops; other positive restraining means for said controller; a retard device arranged to delay the releasing operation of the last said restraining means; and an impulsive receiver arranged to actuate both the step-up device and the other said restraining means.

6. Selective signaling means comprising in combination a part to be moved; motor means to move it; a rotatable controller governing the operation of said motor means and providing a plurality of stops; a step-up device providing a wall having therein a plurality of openings, and arranged to restrain or release the said controller according to the relation of the wall openings to the controller stops; operating means for said step-up device; and means arranged to restore said motor part and said step-up device to their initial positions automatically upon predetermined rotation of said controller, said means being governed by said controller.

7. Selective signaling means comprising in combination a part to be moved; motor means to move it; a unidirectionally rotatable controller governing the operation of said motor means; a step-up device governing the rotation of said controller; restrain-

ing means arranged to restrain or release said controller; a retard device governing said restraining means; an impulse receiver arranged to actuate the step-up device and the retarded restraining means; and means arranged to restore said motor part and said step-up device to initial position automatically upon predetermined rotation of said controller, said means being governed by said controller.

8. Selective signaling means comprising in combination an annunciator having a vibratable part; an impulse receiver; normally-disabled operating connections between said impulse receiver and said vibratable annunciator part; and means to make effective said connections comprising a motor part, a step-up device, and a retard device, both the step-up and retard devices governing the motor part, and both actuated by the impulse receiver.

9. The combination of an annunciator having a movable part, an electro-magnet having an armature, normally disabled means for connecting the armature with said annunciator part to be moved, and controlling means for said connecting means comprising a step-up device, and timed means both operatively connected with the armature to permit operation of the connecting means only in response to dwells in the operation of the magnet following predetermined advances of the step-up mechanism.

10. The combination of an electro responsive device having a movable element, a step-up device mechanically operable thereby, retarded mechanism associated with said movable part of the electro-responsive device and controlled thereby, a mechanically actuated governing mechanism, controlled both by said step-up device and said retarded mechanism, and a part to be moved controlled by said controlling mechanism.

11. The combination with an electro-responsive device, a step-up means for actuation thereby, a part to be arranged for operation, means, including a member movable through a plurality of steps, to arrange said part for operation, each movement of said member being controlled by the step-up device, and timed means operated by the electro-responsive device arranged to positively prevent or freely permit the steps of said governor member, whereby a plurality of coincidences of predetermined positions of the step-up device and time intervals in the operation of the electro-responsive device are requisite to condition said movable part for operation.

12. The combination of an electro-responsive device; a step-up device actuated thereby; a gear train; means to actuate it through a plurality of steps; a part to be moved, movable by said train; means restraining the gear train operable by the step-up device to liberate the train at certain positions of said step-up device; and other means restraining the gear train controlled by the electro-responsive device and movable to release the train; and a retarding device arranged to delay the releasing movement of the last said restraining means, whereby each release of the gear train is effected only by coincidence of predetermined positions of the step-up and dwells in the operation of the electro-responsive device.

13. The combination of an electromagnet having an armature-lever; a part to be moved; a motor part; a rotatable governor geared to said motor part; a step-up device actuated by the armature lever, arranged to restrain said governor against movement when in certain positions, and to release it when in others; other restraining means for said motor part controlled by the armature lever, arranged to release the motor part when in certain positions; and means to retard movement of said last named restraining means toward the releasing position.

14. The combination of an electromagnet having an armature lever; a part to be moved; a motor weight, a governor wheel geared thereto and rotatable thereby in one direction only, a step-up wheel actuated by the armature lever and having surfaces to restrain the governor wheel and openings to permit rotation thereof, a restraining device for the governor wheel vibratable in harmony with the armature lever and releasing the governor wheel upon movement of the armature lever in excess of its step-up-actuating movement; and a retard device arranged to apply at each excessive movement of the armature lever.

15. The combination of an electro-magnet having a vibrating armature, a step-up device for actuation thereby, arranged for self-restoration to normal position after predetermined advance, a part to be moved, actuating means therefor, operatively connected to the step-up device to be moved to potential position during the return of the step-up device to normal position, a governor wheel connected to said actuating means for rotation by movement of said actuating means from normal position, means operated by the step-up device controlling the movement of said governor wheel arranged to permit a partial cycle of movement of the governor wheel at each of a plurality of positions of the step-up device, and to permit a complete cycle of operations of said governor wheel after a predetermined further advance of the step-up device.

16. The combination of an electro-responsive device, a step-up device arranged for

actuation thereby, means for effecting restoration of the step-up device to normal position after predetermined advance thereof, a part to be moved, actuating means therefor, a governor wheel controlling the operation of said actuating means, and means carried by the step-up device controlling the movements of the governor wheel arranged to permit a partial cycle of movement of the governor at each of a plurality of positions of the step-up device, and a complete cycle of operations of the governor wheel after predetermined further advance of the step-up device.

17. Selective signaling means comprising in combination an electro-responsive device; a step-up device actuated thereby in one direction; a rotatable controller arranged for cyclic movement from and to normal position, said controller being governed by the step-up device and arranged for step-by-step movement at certain advances of the step-up device and for complete cyclic movement at a further advance thereof; a working part governed by the controller and operatively responsive to partial movement of the controller; and means to restore the step-up device to normal position operatively responsive to complete cyclic movement of the governor.

18. Selective signaling means comprising, in combination, an electro-responsive device; a step-up device actuated thereby in one direction; a movable motor part; a rotatable controller actuated thereby arranged for cyclic movement from and to a normal position, governed by the step-up device, and permitted to effect step-by-step movements at certain advances of the step-up device and complete cyclic movement at a further advance thereof; a working part governed by the controller and operatively responsive to partial cyclic movement thereof; and means to restore the step-up device to normal position and to move the motor part to potential position, operatively responsive to complete cyclic movement of the governor.

19. Selective signaling means comprising, in combination, an electro-responsive device; a step-up device actuated thereby in one direction; a retard device; a movable motor part; a rotatable controller actuated thereby arranged for cyclic movement from and to a normal position, governed by the step-up device and the retard device, and permitted to effect step-by-step movements at certain advances of the step-up device and complete cyclic movement at a further advance thereof; a working part governed by the controller and operatively responsive to partial cyclic movement thereof; and means to restore the step-up device to normal position and to move the motor part to potential position, operatively responsive to complete cyclic movement of the governor.

20. The combination with an electro-magnet having an armature, a step-up device arranged for actuation thereby, a part to be moved, governing means therefor including a rotatable wheel, restrained or released by the step-up device according to its position, other means for restraining the governor wheel movable to releasing position by the armature, and means for retarding said releasing movement.

21. The combination with an electro-magnet having an armature, a movable part to be controlled by the action of said armature, means for restraining said movable part, movable to releasing position by the armature, and means for retarding such movement.

22. The combination with an electro-magnet having an armature, a movable part to be controlled by the action of said armature, means for restraining said movable part, movable to releasing position by the armature, and means for retarding said movement comprising an escapement.

23. The combination with an electro-magnet having an armature, a movable part to be controlled by the action of said armature, means for restraining said movable part, movable to releasing position by the armature and means for retarding such movement comprising an escapement having a toothed member and a pawl relatively shiftable to mutually engage for retarding the releasing movement and to disengage for quick return upon the opposite movement.

24. Selective signaling means comprising in combination, a magnet and armature, a step-up wheel advanced thereby, means to restore the wheel, a part to be moved, a movable motor part therefor, controlling means for the motor part governed by the step-up wheel, holding means for the step-up wheel released by predetermined movement of the motor part, and operative connections between the step-up wheel and motor part whereby restoration of the step-up wheel, moves the motor part to potential position.

25. Selective signaling means comprising, in combination, a magnet and armature, a step-up wheel advanced thereby, means to restore the wheel, a part to be moved, a movable motor part therefor, a retard device, controlling means for the motor part governed by the step-up device and retard device, released by predetermined advance of the step-up device, coincident with the operation of the retard device, and returned to normal position by full movement of the motor part, holding means for the step-up wheel controlled by the motor part and released by full movement thereof, and op-

erative connections between the step-up wheel and motor part, whereby restoration of the step-up wheel moves the motor part to potential position.

26. The combination of an electro-responsive device having a vibratable part moved in one direction by magnetic action and restored by mechanical means, a step-up device actuated by the vibratable part, a movable motor part operatively associated with the step-up device to be positively restrained thereby except at predetermined release positions, other positive restraining means for the motor part arranged to be actuated by restoration movement of the vibratable part of the electro-responsive device to release the motor part, and a retard mechanism opposing the restoration movement of the said vibratable part.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

JUDSON McFELL.

In the presence of—
MARY F. ALLEN,
W. LINN ALLEN.