J. A. HULIT.

SELECTIVE SIGNALING SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED OCT. 21, 1911.

1,180,293.

Patented Apr. 25, 1916.

4 SHEETS—SHEET 1.

FIG. 1.

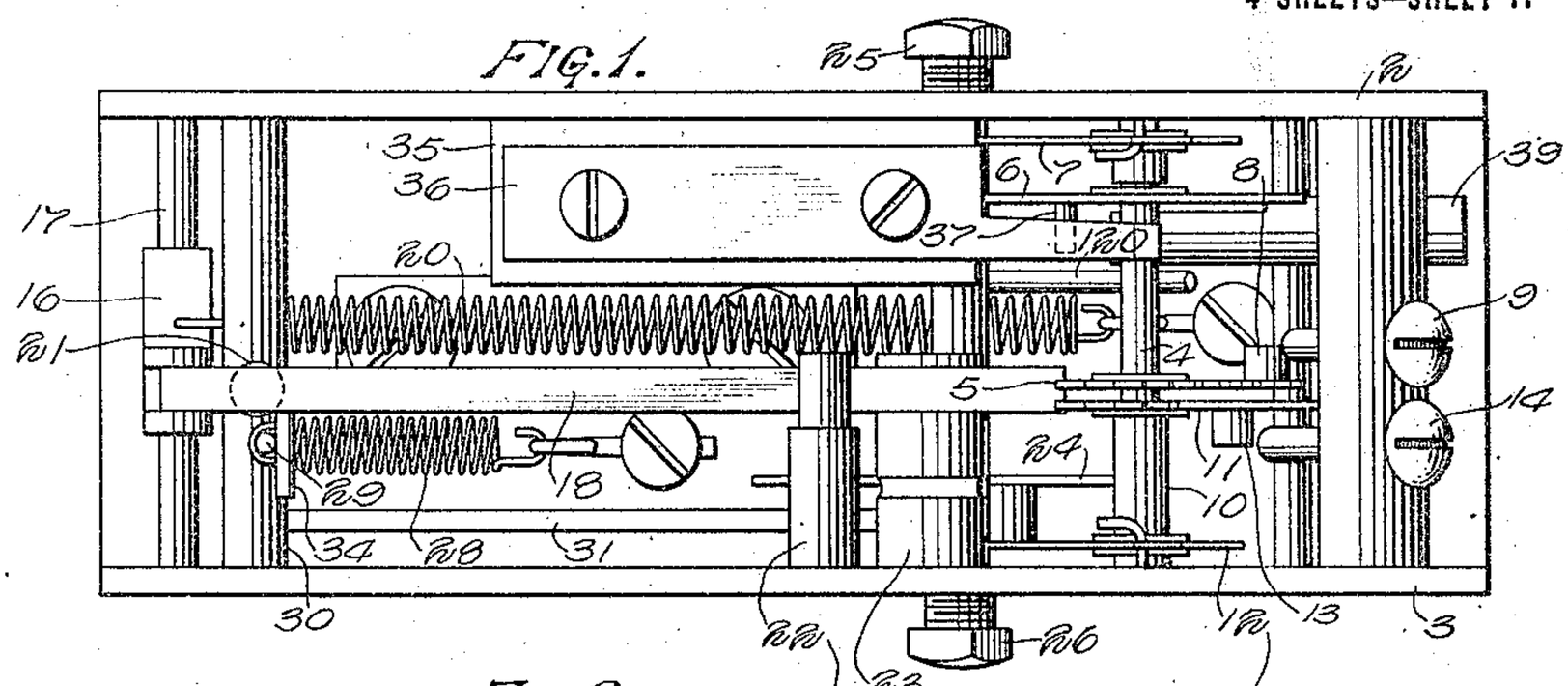


FIG. 2.

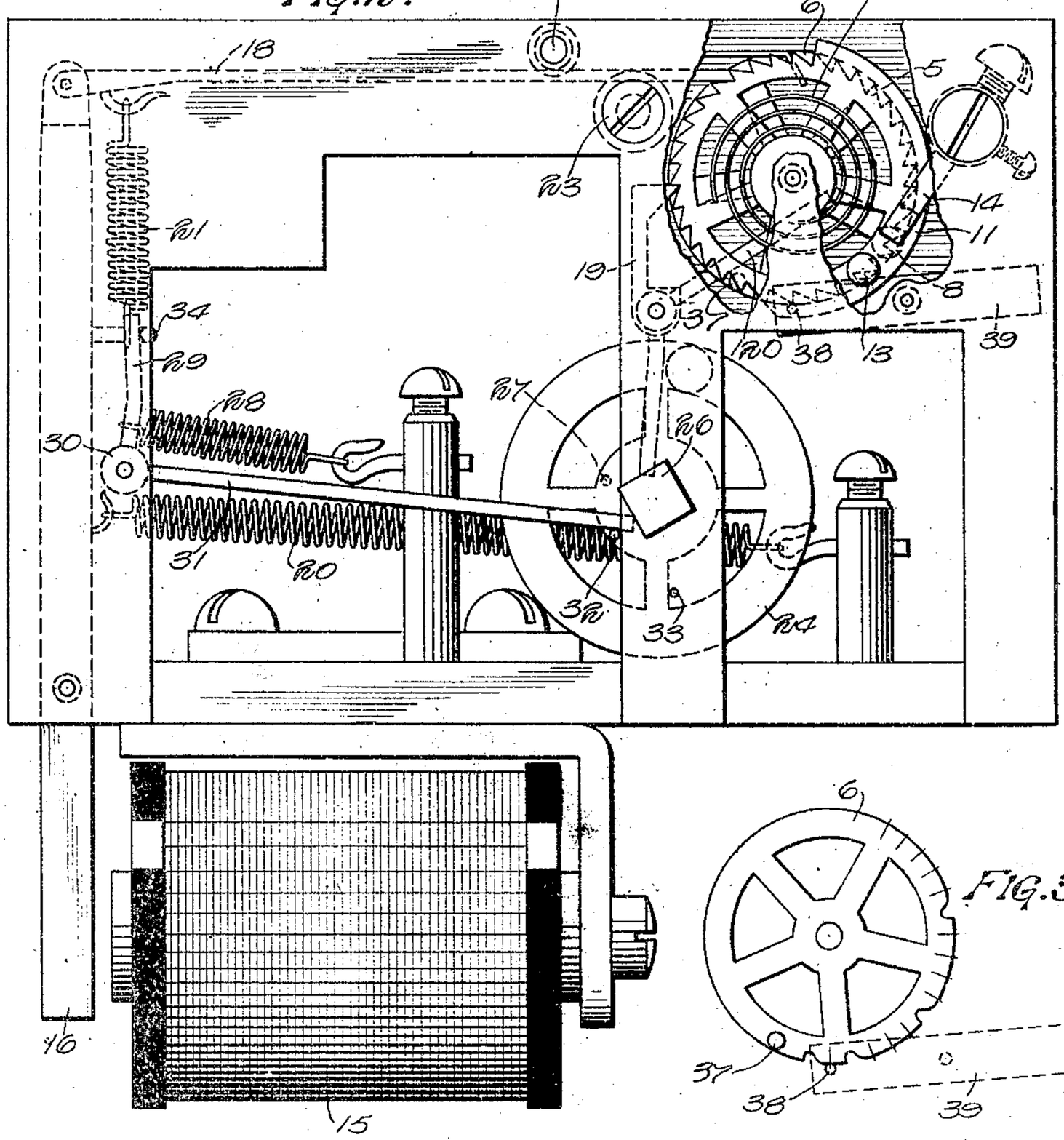


FIG. 3.

WITNESSES
A. Andersen
A. J. Ray.

INVENTOR:
John A. Hulit
By Bulkley & Dunand
ATTORNEYS.

J. A. HULIT.

SELECTIVE SIGNALING SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED OCT. 21, 1911.

1,180,293.

Patented Apr. 25, 1916.

4 SHEETS—SHEET 2.

FIG. 4.

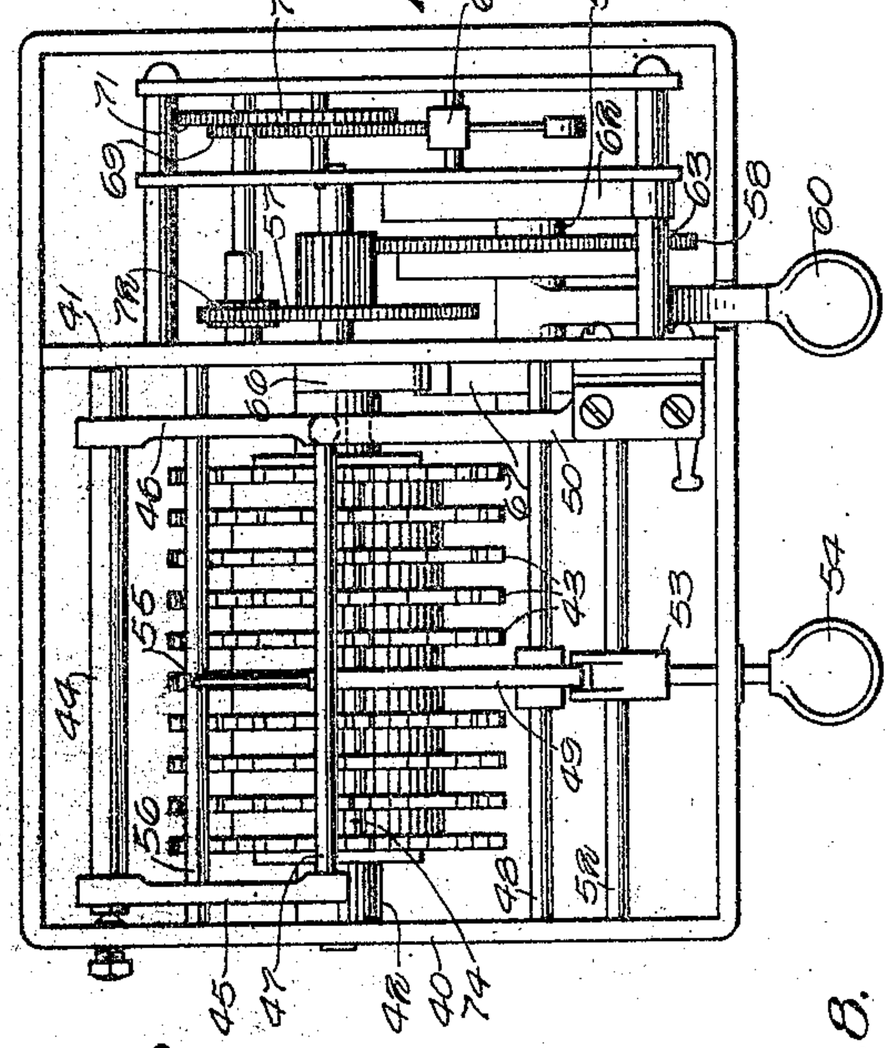


FIG. 5.

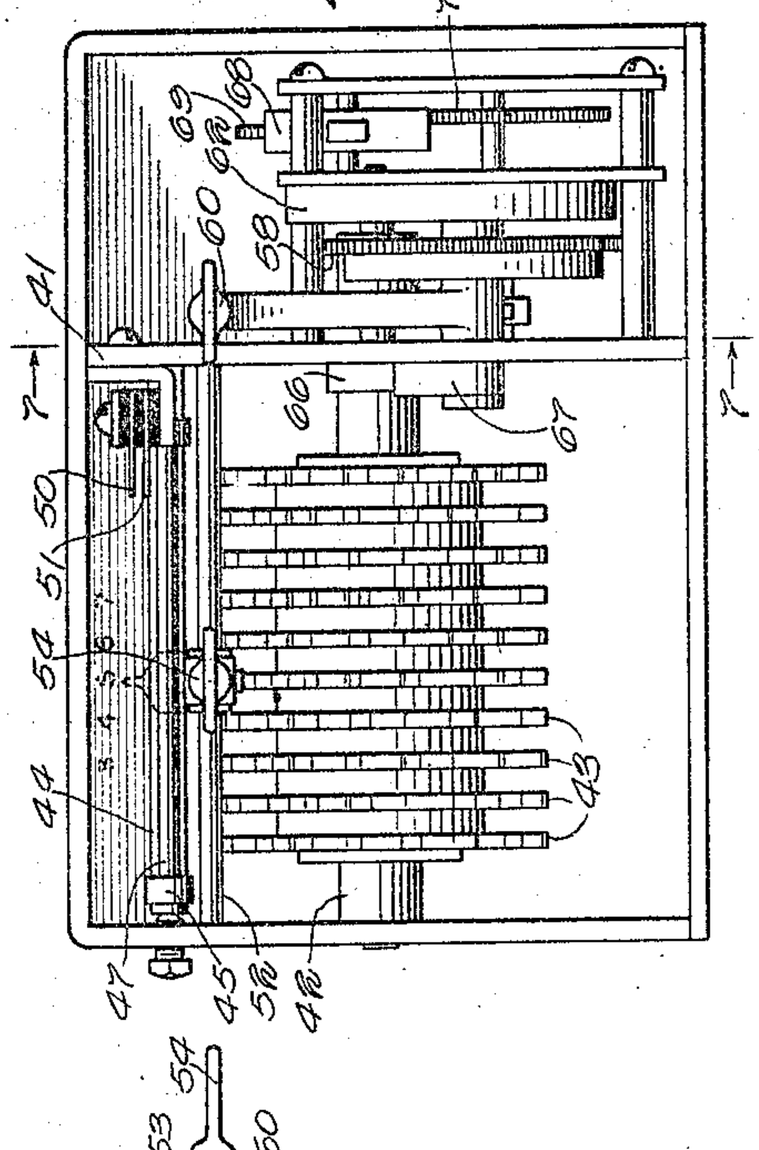


FIG. 7.

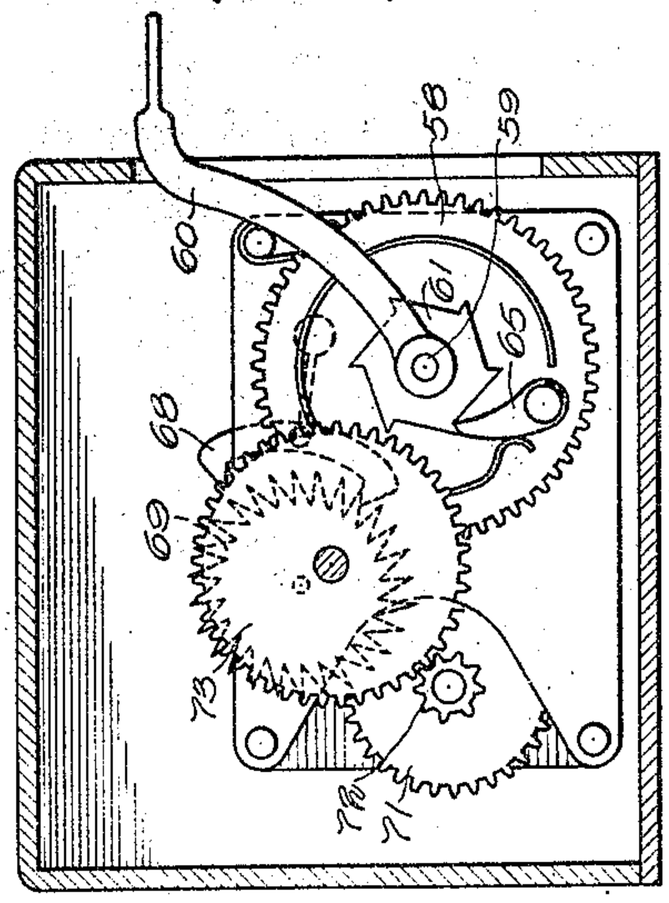


FIG. 8.

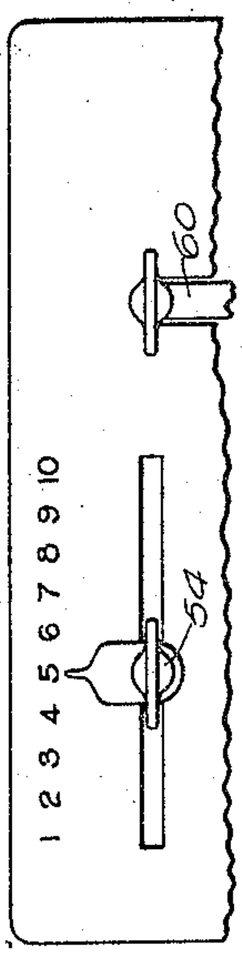
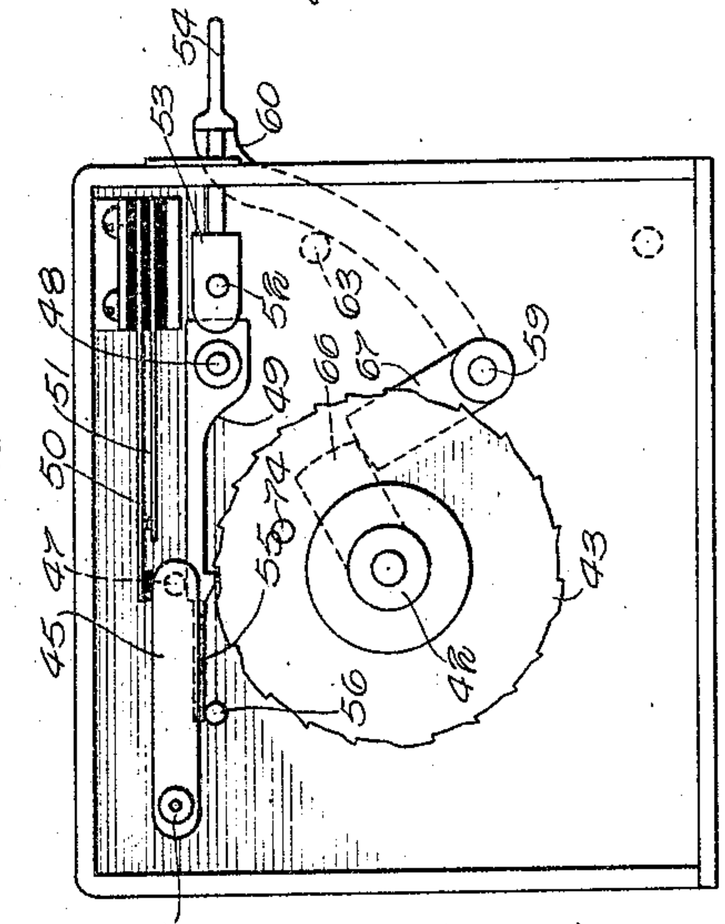


FIG. 6.



WITNESSES

A. Andersen.

A. J. Ray.

INVENTOR:

John A. Hulit

By Bulkley & Linand.

ATTORNEYS.

J. A. HULIT.

SELECTIVE SIGNALING SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED OCT. 21, 1911.

1,180,293.

Patented Apr. 25, 1916.

4 SHEETS—SHEET 3.

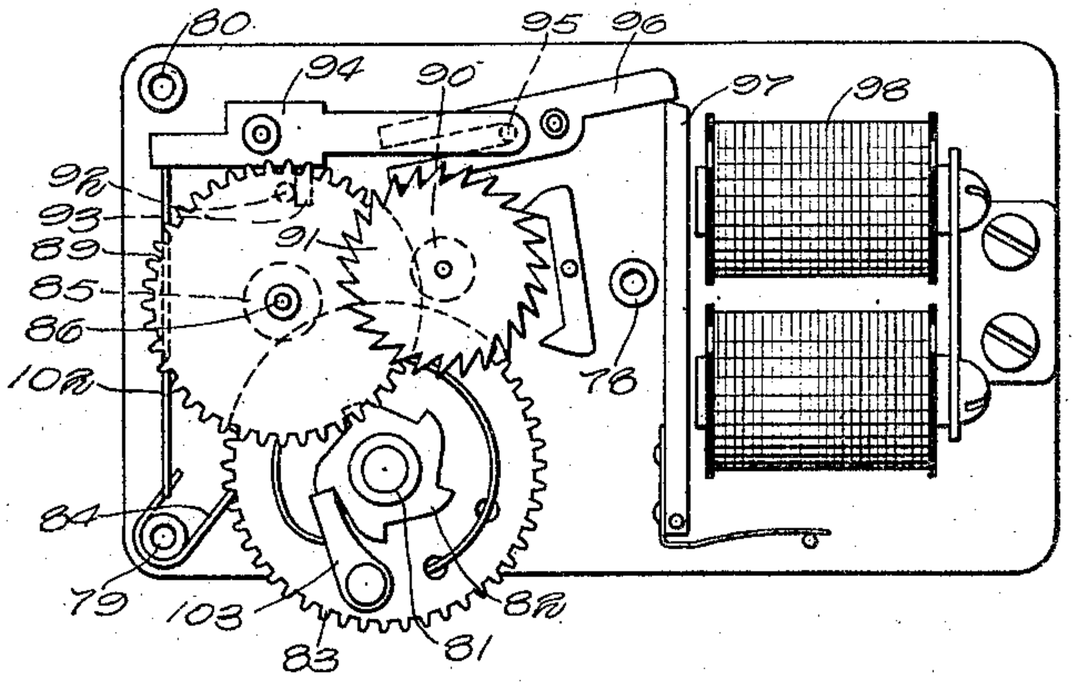


FIG. 11.

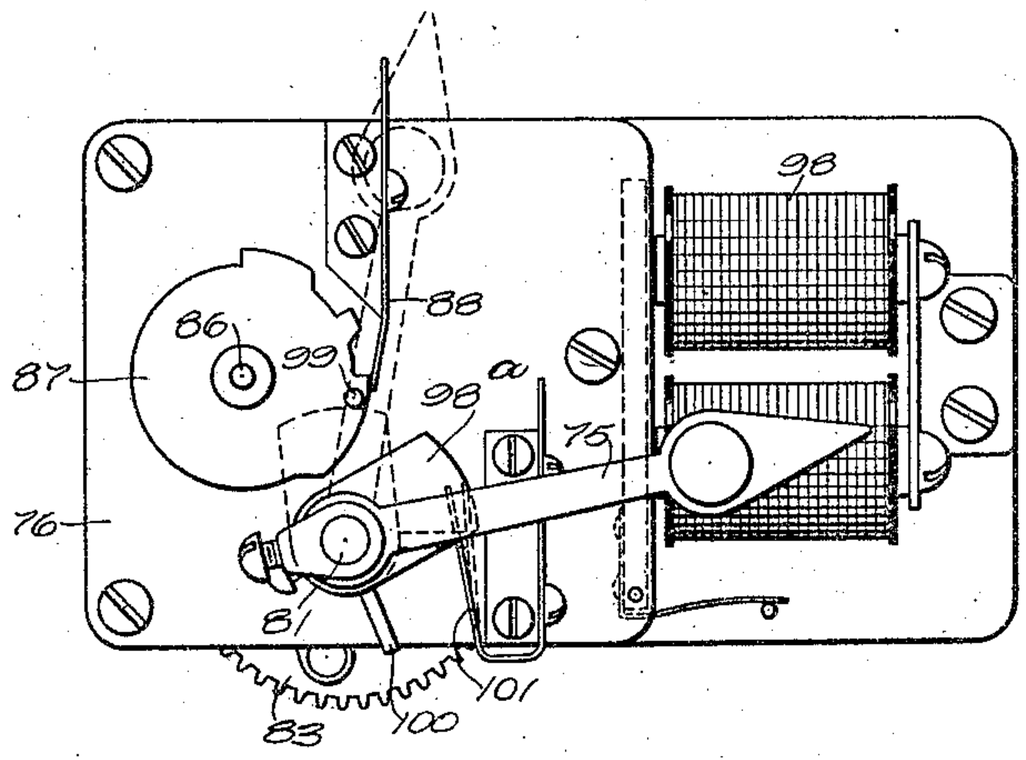


FIG. 10.

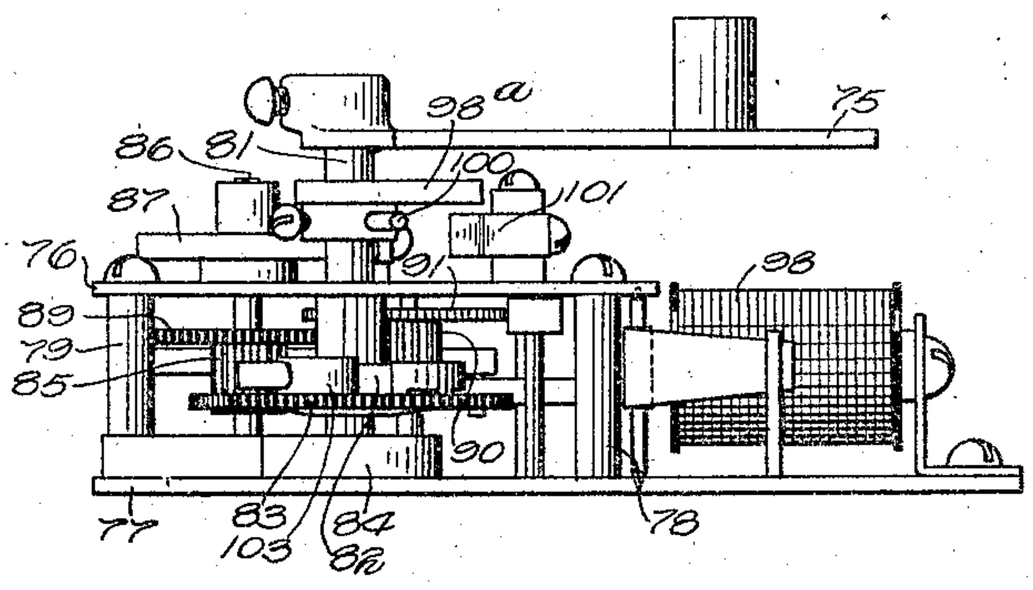


FIG. 9.

WITNESSES

A. Andersen.

A. J. Ray.

INVENTOR:

John A. Hulit

By Bulkley & Pinard

ATTORNEYS.

J. A. HULIT.

SELECTIVE SIGNALING SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED OCT. 21, 1911.

1,180,293.

Patented Apr. 25, 1916.

4 SHEETS—SHEET 4.

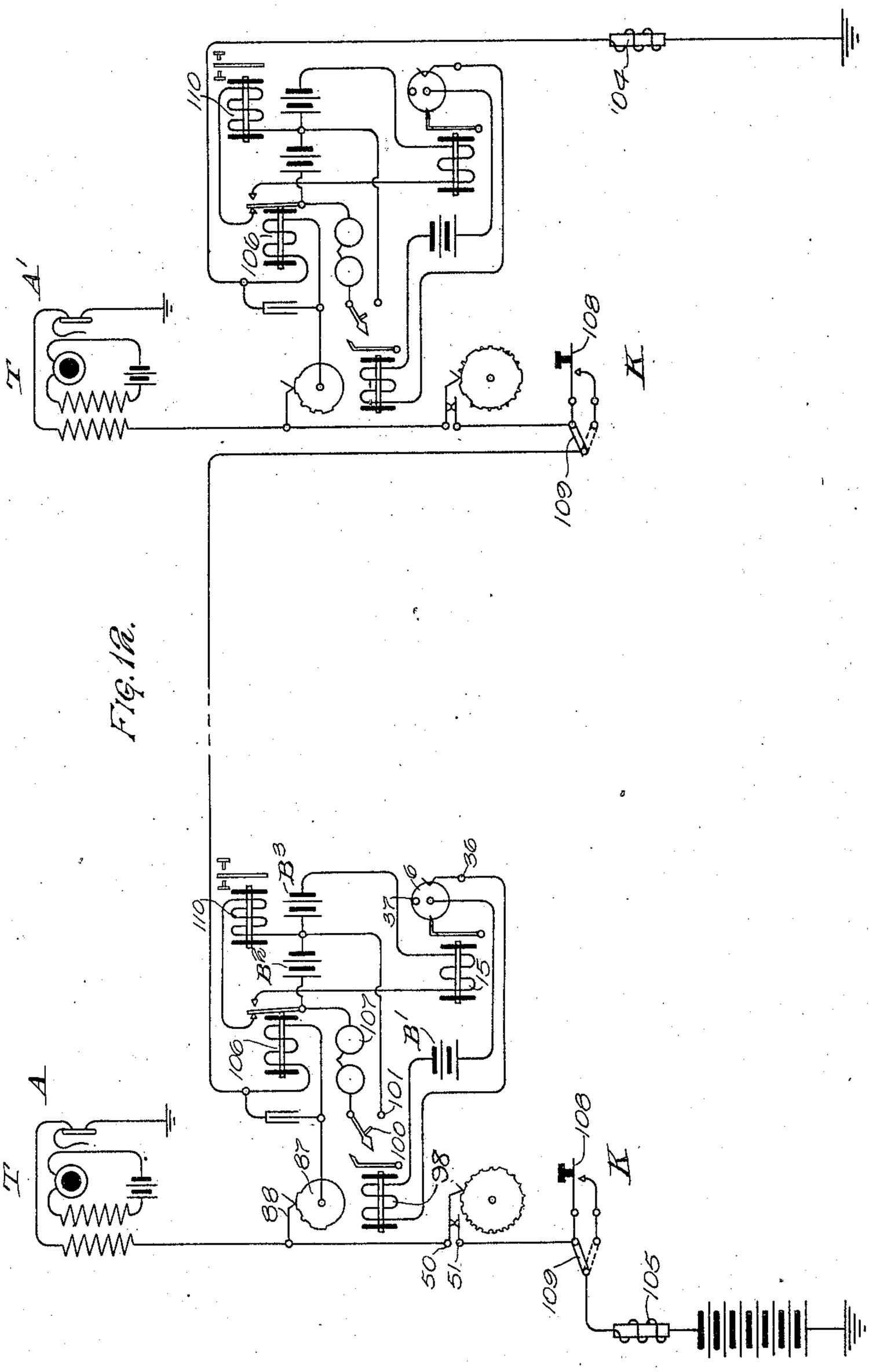


FIG. 12.

WITNESSES

A. Andersen.

A. J. Ray.

INVENTOR:

John A. Hulit

By Bulkley & Durand

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN A. HULIT, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SELECTIVE SIGNALING SYSTEM AND APPARATUS THEREFOR.

1,180,293. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed October 21, 1911. Serial No. 655,946.

To all whom it may concern:

Be it known that I, JOHN A. HULIT, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Selective Signaling Systems and Apparatus Therefor, of which the following is a specification.

My invention relates to selective signaling systems and apparatus for use in connection with said systems, and it relates particularly to selectively signaling stations over a telephone or telegraph line. In this connection, it is designed principally for use in connection with telephone train despatching systems.

Among the objects of my invention are to provide an improved construction for the station selector, signal transmitter and answer-back apparatus for use in such a signaling system. The station selector is an improvement over my prior patents No. 795,836, granted August 1, 1905, and No. 896,832, granted August 25, 1908. It contains various improvements over these patents, which improvements tend to simplify and improve the operation of the apparatus. When apparatus of this type is employed in train despatching telephone systems, it is often desirable to employ the same line for telegraphic purposes. It therefore becomes necessary to devise a selective apparatus which is not responsive to these telegraphic impulses, but is responsive to a code series of impulses.

An object of my invention is to provide such a station selector which is not operated by telegraphic impulses, nor by a succession of regular impulses, but is operated by an irregular succession of rapid impulses.

A further object of my invention is to improve the construction of the call-sending mechanism for transmitting the impulses for controlling the station selector.

A further object is to provide an improved answer-back device whereby the operator is advised of the fact that the proper station is being signaled.

These and other objects of my invention will be more clearly understood by reference to the accompanying drawings, in which—

Figures 1 and 2 are a plan view and elevation, respectively, of the station selector. Fig. 3 is a detail view of the code or combination wheel of the selector. Fig. 4 is a plan view of the combination call-sending device with the cover plate removed. Fig. 5 is a side elevation of the same. Fig. 6 is an end elevation of the same. Fig. 7 is a view of a section taken on the line 7—7 in Fig. 5. Fig. 8 is a view of a portion of the side plate which is removed from Fig. 5. Fig. 9 is an elevation of the substation answer-back device. Fig. 10 is a plan view of the same. Fig. 11 is a top view of the same with the top plate removed. Fig. 12 represents diagrammatically a telephone line in which are connected two substations A and A′, each substation being equipped with a telephone, a station selector, a call-sending device and an answer-back device. Although only two substations are shown, any number of similarly equipped substations may be connected in the line in a similar manner to the two substations shown.

Referring first to the substation selector shown in Figs. 1, 2 and 3, the upright frame plates 2 and 3, which may be rigidly secured to any desired base, form a frame between which the greater part of the mechanism is mounted. Journaled in the plates 2 and 3 there is a shaft 4 carrying rigidly secured thereto a ratchet wheel 5 and a combination or code wheel 6. The small spiral spring 7 normally tends to rotate the shaft 4 in a counter-clockwise direction, as shown in Fig. 2. The shaft 4 is held in normal position against the tension of the spring 7 by the engagement of the lug 8 on the wheel 5 with the stationary screw 9. Loosely mounted on the shaft 4 there is a sleeve 10 to which there is secured a second ratchet wheel 11. The flat spiral spring 12 normally tends to turn the sleeve 10 and ratchet wheel 11 in a counter-clockwise direction, as shown in Fig. 2. The wheel 11 is retained in normal position against the tension of the spring 12 by the engagement of the lug 13 with the stop screw 14. Beneath the frame 2—3 there is an electromagnet 15 provided with a movable armature 16 secured to the shaft 17, which shaft is journaled in the plates 2 and 3. The upper end of the armature 16 extends upward to a point near the top of the side plates, where it is provided with a long propelling pawl 18 for rotating the ratchet wheels 5 and 11. The pawl 18 is broad enough to extend across the face of both wheels. A holding pawl 19 also extends across both wheels to hold

them in their advanced positions. When the magnet 15 is deënergized, the propelling pawl is pulled forward by the helical spring 20 to rotate the ratchet wheels. The spring 21 serves to hold the pawl down into the teeth of the ratchet wheels. The pin 22 serves to prevent the pawl 18 from rising out of the teeth of the ratchet when it is pulled forward, and the pin 23 serves as a stop to prevent the propelling pawl from falling more than enough to engage the next notch of the ratchet wheels when the magnet 15 is energized. Thus each time the magnet is energized and deënergized, the wheels 5 and 11 are rotated one tooth.

A throw-off is provided for the holding pawl 19 and comprises a balance wheel 24 mounted upon a shaft which is pivoted in the ends of the screws 25 and 26. This balance wheel is weighted so that when freed it turns slowly in a clockwise direction. When the wheel has completed a certain portion of a revolution from the position shown in Fig. 2, the pin 27 strikes the tail-piece of the holding pawl 19, forcing said pawl out of engagement with the teeth of the ratchet wheels and allowing them to be retracted. The balance wheel 24 is held in the position shown in Fig. 2 by the spring 28 acting through the medium of the arm 29, the rotatable shaft 30 and the arm 31, which arm 31 engages the pin 32 in the wheel. The pin 33 in the plate 3 serves as a normal stop for the balance wheel. Attached to the upper end of the armature 16 there is a hook 34 which, when the magnet 16 is energized, engages the arm 29 so as to rotate the shaft 30 slightly to raise the arm 31 from the pin 32 to free the balance wheel 24. Attached to the inside of the plate 2 there is a block of insulation 35 upon which there is mounted a contact spring 36, the end of which spring is adapted to be engaged by a pin 37 in the wheel 6 after said wheel has been rotated through a certain predetermined distance. Around the periphery of the wheel 6 there are a number of notches the spaces between which correspond to the spaces between a certain number of teeth of the ratchet wheel 5. These notches in the wheel 6 are adapted to be engaged by a pin 38 in a balance lever 39 (Fig. 3), whereby said wheel and the shaft 4 may be held in certain advanced positions independently of the holding pawl 19. The lever 39 is nearly balanced, so that the pin 38 moves into the notches slowly, so that as the wheel 6 is returning to normal position the notches pass the pin 38 so rapidly as not to permit it to drop into them and arrest the motion.

The holding pawl 19 has only a slight preponderance of weight on the side which tends to turn it in a clockwise direction to hold it in the teeth of the wheels 5 and 11. Therefore, when said wheels are rotated forward by the propelling pawl 18, the holding pawl 19 is thrown back some distance and returns into engagement with the wheels slowly. Thus, if the propelling stroke be of very short duration, the propelling pawl may be withdrawn from the ratchet teeth before the holding pawl falls into engagement therewith, and said wheels will thereby be released. The pin 120, which is secured to the same shaft as the holding pawl 19, by its engagement with the shaft 4, limits the backward movement of the holding pawl to prevent it from being thrown back too far.

The method of operation of the selector is as follows: In order to signal any station, the wheel 6 at that station must be rotated to bring the pin 37 into contact with the spring 36 so as to close the signal circuit. It will be seen that the teeth on the ratchet wheel 11 do not extend entirely around the periphery. Thus, if said wheel is rotated a certain distance (eight steps from normal in the particular instance shown), the smooth surface of the wheel 11 will engage the holding pawl 19 and force it out of engagement with the ratchet wheel 5, so that when the propelling pawl is withdrawn, said wheel 5 and the wheel 6 will be restored to normal position. The number of steps through which the wheels may be rotated before they are released in the above manner by the wheel 11 is not sufficient to carry the pin 37 into engagement with the spring 36. It will thus be seen that the station cannot be signaled by simply sending in enough impulses to step the wheels around the desired distance. In order to complete the signal circuit the wheel 6 must be rotated a portion of the desired amount and then be held in this position while the pawl 19 is withdrawn to permit the wheel 11 to be released and returned to normal position. It is the purpose of the notches in the wheel 6 and the lever 39 to hold the wheel 6 in its advanced position when the pawl 19 is withdrawn to permit the wheel 11 to be retracted.

In detail the manner of completing the operation is as follows: The magnet 15 is first energized to withdraw the pawl 18 and is held energized long enough to permit the throw-off 24 to rotate far enough to throw off the pawl 19, whereupon the wheels 11, 5 and 6 return to normal position, they being held one step advanced therefrom when the magnet 15 is deënergized. The magnet is then deënergized and energized momentarily a sufficient number of times to advance the wheels 5 and 11 step by step until a notch in the wheel 6 comes opposite the pin 38 on the lever 39. The energizations of the magnet between these steps must be only momentary, so as not to permit the throw-off to throw off the holding pawl 19, and the

deënergizations must be long enough to permit the holding pawl to drop in each time before the magnet is energized. After the last step which permits the pin 38 to drop into a notch, the magnet 15 is energized for a longer period, whereupon the throw-off withdraws the holding pawl 19. This permits the ratchet wheel 11 to be retracted, but the wheels 5 and 6 remain in their advanced positions by reason of the engagement of the pin 38 with a notch in the wheel 6. After the wheel 11 has had time to be released, the above operations are repeated to rotate the wheels until the pin 38 drops into the next notch in the wheel 6, when the wheel 11 is again released. These operations are repeated until the pin 37 finally engages the spring 36. Assuming that the notches of the wheel 6 are spaced as shown in Fig. 3, and that the pin 38 in the normal position of the wheel engages the lowest or first notch, it will be seen that two steps are required to bring the wheel to the next stop position, four more steps will bring it to the next stop position, five to the next, and then five more steps will bring the pin 37 against the spring 36. Thus the number of the instrument containing the wheel shown in Fig. 6 may be said to be 2455. It is to be understood that the combination wheels 6 of all the different selectors on a line are arranged for a different combination of impulses—that is, the notches are spaced differently. Thus, although the operating magnets of all the selectors may be operated in unison by any combination of impulses, only the selector having a combination wheel corresponding to that particular combination of impulses will be operated to close its signal circuit. The combination wheels of all other selectors will be automatically released one or more times during the operation. Although the notches of the combination wheels of all the selectors are spaced differently, the total number of steps required to close the signal circuit is preferably the same in all the selectors. There is no notch in the wheel 6 to be engaged by the pin 38 when said wheel is in its most advanced position, so that said wheel is released the first time the magnet 15 is energized after the call has been made.

Referring now to Figs. 4, 5, 6, 7 and 8, the construction of the call-sending apparatus is as follows: The entire mechanism is contained in a metal case. Journaled between the end wall 40 and the partition 41 there is a shaft 42 to which are firmly secured a plurality of toothed wheels 43. Above these wheels there is a swinging frame comprising the pivoted shaft 44, the side arms 45 and 46 securely fastened to said shaft, and the cross bar 47. Loosely mounted upon a shaft 48 there is a pawl 49 the end of which is adapted to be engaged by the teeth of one of the wheels 43 during their rotation. The cross bar 47 of the swinging frame described above rests upon the top of the end of the pawl 49, and the end of the spring 50 of the pair of contact springs 50 and 51 rests upon the top of the arm 46. When the pawl 49 is raised by the teeth of the wheel 43 it swings the frame upward, thereby separating the springs 50 and 51. Slidably mounted upon a shaft 52 there is a member 53 provided with a fork which fits over the rear end of the pawl 49. To the member 53 there is attached a handle or lever 54 which extends out through a slot in the wall of the case. By means of this handle the pawl 49 may be moved laterally to engage any one of the wheels 43 desired. An indicator on the outside of the case (Fig. 8) shows which wheel the pawl is in position to engage. To prevent the pawl 49 from falling down between the wheels, it is provided with a projecting rod 55 which slides upon a shaft 56. Upon the end of the shaft 42 which projects through the partition 41 there is attached a gear wheel 57 which meshes with a gear wheel 58 which is loosely mounted upon a shaft 59. Securely attached to the shaft 59 there is a lever 60 and a ratchet wheel 61, which latter is adapted to be engaged by a pawl 65 on the side of the gear wheel 58. On the opposite side of the gear wheel there is a flat coiled spring 62 one end of which is secured to the stationary post 63, while the other end is secured to the rotary shaft 59. With this arrangement, when the lever 60 is pulled down, the gear wheel 58 remains stationary, but the spring 62 is wound up and the ratchet wheel 61 is rotated until the pawl 65 engages the next tooth in advance of the one with which it was previously resting in engagement. When the lever 60 is released it is returned to its upper position by the spring 62, and the ratchet wheel 61 engaging the pawl 65 forces the gear wheel 58 to rotate with it. The rotation of the gear wheel 58 is transmitted to the shaft 42 to rotate the impulse wheels 43. One complete stroke of the lever 60 is sufficient to rotate the shaft 42 and wheels 43 through a complete revolution. In order to positively stop the shaft 42 after it has completed its revolution, there is secured to said shaft a stop lever 66 which is adapted to engage the stop 67 on the shaft 59 when the lever 60 is at the top of its stroke. When the lever 60 is pulled down, the stop 67 passes out of the path of the lever 66, thereby releasing the impulse wheels; but before the wheels have completed a revolution, the stop 67 is returned to its normal position to be engaged by the lever 66. The speed of rotation of the impulse wheels is governed by the escapement 68 operating through the medium of the gear wheel 69. In

order to provide means for properly lining up the impulse wheels, a hole is placed through each wheel in exact relation with regard to the normal or starting point, and a pin 74 is then run through all the wheels. This insures that the normal or starting point of all the wheels will be in a straight line when said wheels are assembled on the shaft 42.

The teeth on the wheels 43 are arranged to correspond to the combination wheels of the various selectors previously described. In the system shown herein, the operating magnet of the selector is controlled through the back contact of a relay. The relay is controlled by the springs 50 and 51 of the call-sending apparatus. Therefore, the operating magnet deënergizes to step the ratchet wheels around each time the pawl 49 of the call-sending device drops into a notch to permit the springs 50 and 51 to close. The codes will then be represented on the wheels of the call-sending device by a number of series of short teeth representing momentary energizations of the operating magnet of the selector, followed by a longer tooth representing a longer energization of the magnets. The long teeth on each wheel will correspond to the notches in the combination wheel of the particular selector represented by that impulse wheel in the call-sending device. Before beginning the code proper, there are two long teeth on each of the impulse wheels which are for the purpose of insuring that all the selectors will be returned to normal position before the impulses of the code are being sent in. These two impulses will cause two successive long energizations of the operating magnets of the selectors, which will insure that all of the combination wheels will be returned to normal position whether they are resting with the pin 38 in a notch or not. The spaces between the teeth of the impulse wheels are comparatively long. This is to insure that the magnets of the selectors shall remain deënergized long enough each time to allow the holding pawl 19 to drop into the teeth of the ratchet wheels before the magnet is again energized. Thus, while the impulses sent out by the call-sending device are of the proper character to progress the ratchet wheels, the short dots and dashes representing Morse characters, as produced by an ordinary telegraph key, will be too short to permit the holding pawls of the selectors to drop into the ratchet teeth while the operating magnets are deënergized, and said Morse characters will, therefore, not progress the ratchet wheels. Thus, since the ordinary dots and dashes representing Morse characters are incapable of progressing the ratchet wheels of the station selectors, a line equipped with said selectors may be used as an ordinary telegraph line without falsely operating the selectors.

The answer-back device shown in Figs. 9, 10 and 11 comprises a frame consisting of two plates 76 and 77 secured to the posts 78, 79 and 80. Journaled in the plates 76 and 77 there is a shaft 81 to the upper end of which there is secured a pointer or indicator 75. Between the plates 76 and 77 there is firmly secured to the shaft 81 a ratchet wheel 82, and just beneath this ratchet, and loosely mounted on the shaft, there is a gear wheel 83. Beneath the gear wheel there is a coiled spring 84, the inner end of which spring is attached to the shaft 81, while the outer end of the spring is secured to the post 79. Upon the top of the gear wheel 83 there is a pawl 103 which engages the ratchet wheel 82. The gear wheel 83 meshes with a pinion 85 on a shaft upon the upper end of which there is a toothed wheel 87, the teeth of which wheel are arranged to correspond to the dots and dashes representing a Morse character. The teeth on the wheel 87 at each station are to be arranged to give a different character. The teeth or raised portions of the wheel 87 are adapted to contact with the insulated spring 88 during the rotation of said wheel. The gear wheel 89 is also secured to the shaft 86 and meshes with a gear 90 which is secured to the escapement wheel 91 through the medium of which the speed of operation of the device is controlled. The apparatus is normally locked in the position shown in Figs. 10 and 11 by the engagement of a pin 92 in the wheel 89 with a pin 93 in the side of the lever 94. In the end of the lever 94 there is a pin 95 which extends downward into a slot in a lever 96, the end of which lever 96 strikes upon the end of the armature 97 of the electromagnet 98 and thereby prevents the pin 93 from being moved out of the path of the pin 92. When the magnet 98 is energized, the armature 97 disengages the lever 96, which permits the pin 93 to free the pin 92. The shafts 81 and 86 then begin to rotate. When the shaft 81 has made a portion of a revolution to bring the stop 98^a down into the path of the pin 99, as shown in dotted lines in Fig. 10, the wheel 87 has made a complete revolution, and the engagement of the pin 99 with the stop 98^a brings the mechanism to rest. In this position of the shaft 81 the pin 100 makes contact with the insulated spring 101. Just before the shaft 86 completes its revolution, the pin 92 in the wheel 89 strikes the rod 102 and turns the lever 94 so that the pin 93 again comes into the path of the pin 92 to lock the mechanism, when the indicator 75 is manually returned to its original position.

The returning of the indicator to its original position restores the tension to the spring 84 and turns the ratchet wheel 82 so that the pawl 103 engages the next notch,

so that the next time the magnet 98 is energized the above operations may be repeated. It will be seen that the lever 96 is continually exerting a force against the armature 97, and will therefore slip off and release the mechanism the instant the magnet 98 is energized. It will thus be seen that only a very short impulse through the magnet is required to release the mechanism and cause it to make a complete cycle.

In Fig. 12 each of the substations A and A′ are shown provided with a station selector, a call-sending device and an answer-back device of the character described in the preceding paragraphs. In this figure, however, the apparatus is represented only diagrammatically, the various parts of both substations being represented by the same reference numerals as in Figs. 1 to 11, inclusive. The line connecting the substations comprises a single line conductor, the ground being used as a return. Beyond the substation A′ the line is grounded through an impedance coil 104, and before reaching the substation A the line passes from ground through a battery B and impedance coil 105.

The course of the line circuit through the substation is as follows: Upon entering the substation the line passes in series through the impulse springs 51 and 50 of the call-sending device, spring 88 of the answer-back device, wheel 87 and frame of the device, and thence through a relay 106 to the next substation. One terminal of the magnet 98 of the answer-back device is connected through a battery B′ with the frame of the station selector, and therefore with the pin 37. The other terminal of the magnet 98 is connected with the spring 36. The frame of the answer-back device or the pin 100 is connected through a bell or other suitable signal 107 with one terminal of a battery B^2, the other terminal of which battery is connected with the spring 101. The operating magnet 15 of the selector is included in the connection between the back contact of the armature of the relay 106 and the battery B^3. Each station is shown provided with an auxiliary telegraph key 108 and short-circuiting switch 109. At each substation a telephone T is bridged between the line and ground. The telephone may be provided with any suitable hook switch or key for opening and closing its circuits as desired. An ordinary telegraph sounder 110 is also provided, which sounder is connected with the front contact of the relay 106.

The complete operation by which one station signals another is as follows: The operator at the calling substation sets the indicator of his call-sending device to the number of the desired substation and then pulls down the lever 60. As the lever returns to normal position, the particular impulse wheel 43 of the call sender over which the pawl 49 has been placed first separates the springs 50 and 51 twice for a comparatively long time, each time breaking the circuits of all the relays 106 on the line. Each time these relays deënergize they close the circuits of the magnets 15 at their respective substations. These two preliminary impulses, as has been explained, are for the purpose of insuring that the combination wheels 6 at all the substations shall be returned to normal. The calling device impulse wheel then proceeds to send out the particular combination of long and short impulses, corresponding to the station desired. As previously explained, the combination wheel 6 at this station will be rotated to bring the pin 37 into contact with the spring 36, whereby the circuit of the magnet 98 of the answer-back device is closed. The magnet 98, upon energizing, releases the mechanism, as previously explained, and allows the wheel 87 to make a complete revolution and the pin 100 to come into contact with the spring 101. The engagement of the pin 100 with the spring 101 closes the circuit of the bell 107 to signal the attendant. The wheel 87, during its revolution, first opens the line, then closes it a number of times, in accordance with the Morse character of the station called, and returns the line to normal closed condition. The first opening of the line allows the relays 106 to fall back and close the circuits of the magnets 15. At the called substation this energization of the magnet 15 releases the combination wheel of the selector. The closing of the line in accordance with the Morse character of the called substation causes this character to be sounded on the sounders 110 at all the stations. The operator at the calling station, upon hearing this character, knows that the proper substation has been called and that the bell at said station is ringing. The attendant at the called substation, upon hearing the bell, restores the indicator of his answer-back device to normal position to break the circuit of the bell and to set the apparatus for the next call, and then converses with the attendant at the calling substation in the usual manner.

Although in the drawings each station is shown provided with a call-sending device, it will be evident that if the system is one in which the various substations on the line are not supposed to call each other, but in which the substations are only to be called by a master station, only the master station need have a call-sending device. Also, instead of a single line conductor and a ground return, two line conductors may be used if desired and the controlling relays 106 may be bridged across the line instead of being connected in series, as shown herein. Likewise, while I have shown but a pair of

substations, it is evident that any number may be connected in the line circuit, these stations being connected either in series or in multiple.

What I claim as my invention is:—

1. In a signaling system, a station selector, means for operating said selector by an interrupted series of regular impulses of greater duration than telegraphic impulses when said impulses and interruptions are in a predetermined order, and for preventing said selector from being operated by a succession of telegraphic impulses, and means for preventing said selector from being operated by an uninterrupted series of said regular impulses.

2. In a signaling system, a line circuit, means for transmitting telegraphic impulses over said line circuit, station selectors connected with said line, means for transmitting an interrupted series of impulses of greater duration than said telegraphic impulses over said circuit, means controlled by said impulses for selectively operating said selectors when said impulses and interruptions are in a predetermined order, and for preventing said selectors from being operated by said telegraphic impulses, and means for preventing said selectors from being operated by an uninterrupted series of regular impulses of greater duration than telegraphic impulses.

3. In a signaling system, a line circuit, means for transmitting telegraphic impulses over said circuit, station selectors connected with said line, means for transmitting a plurality of series of regular impulses of greater duration than telegraphic impulses over said circuit, each of said series being separated by one or more prolonged impulses for selectively operating said station selectors, means for preventing said station selectors from being operated by said telegraphic impulses, and means for preventing said selectors from being operated by an uninterrupted series of regular impulses.

4. In a signaling system, a station selector including an electromagnet, a ratchet wheel, a propelling pawl for said ratchet wheel controlled by said electromagnet, a holding pawl, a ratchet wheel segment loosely mounted upon the same shaft with said ratchet wheel, means controlled by said segment for releasing said holding pawl from the ratchet wheel to permit the same to return to normal position after a certain number of propelling strokes of said propelling pawl, a third wheel rigidly mounted on the shaft with said ratchet wheel and provided with a series of notches on its periphery, and a holding pawl therefor for holding said ratchet wheel in advanced position when said pawl is in engagement with one of said notches.

5. In a signaling system, a station selector including a ratchet wheel, a propelling pawl for operating said wheel in a step-by-step manner in one direction, a spring for returning said wheel to normal position, a holding pawl normally engaging with the teeth of said ratchet for holding said ratchet in advanced position, said holding pawl being so balanced that when said ratchet wheel is operated by a series of rapid operations of said propelling pawl, said holding pawl is thrown out of engagement with said ratchet teeth to thereby prevent said ratchet from being operatively rotated.

6. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, means for holding said wheels in advanced position, and means controlled by said second wheel when it has been advanced a predetermined distance for rendering said holding means inoperative.

7. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, a holding pawl for holding said wheels in advanced position, independent means for holding said ratchet wheel in certain selected advanced positions, and a throw-off for disengaging said holding pawl from said wheels to permit said second wheel to return to normal.

8. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, a holding pawl for holding said wheels in advanced position, a third wheel rigidly mounted on said shaft and provided with a series of selectively arranged notches, a holding pawl for engaging said notches for holding said third wheel and ratchet wheel in certain advanced positions, and a throw-off for disengaging said first-mentioned holding pawl from said first two wheels to permit said second wheel to return to normal.

9. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, a holding pawl for holding said wheels in advanced position, independent means for holding said ratchet wheel in certain selected advanced positions, and a throw-off for disengaging said holding pawl from said wheels to permit said second wheel to return to normal, said throw-off being slow acting, whereby it is

only brought into operation during a pause between the series of operations of said propelling pawl.

10. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, an electromagnet for controlling said propelling pawl, means for transmitting a varying number of impulses through said magnet to selectively operate said ratchet wheel, means for holding said wheels in advanced position, and means controlled by said second wheel when it has been advanced a predetermined distance for rendering said holding means inoperative.

11. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, an electromagnet for controlling said propelling pawl, means for transmitting a varying number of impulses through said magnet to selectively operate said ratchet wheel, a holding pawl for holding said wheels in advanced position, independent means for holding said ratchet wheel in certain selected advanced positions, and a throw-off for disengaging said holding pawl from said wheels to permit said second wheel to return to normal.

12. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, an electromagnet for controlling said propelling pawl, means for transmitting a varying number of impulses through said magnet to selectively operate said ratchet wheel, a holding pawl for holding said wheels in advanced position, a third wheel rigidly mounted on said shaft and provided with a series of selectively arranged notches, a holding pawl for engaging said notches for holding said third wheel and ratchet wheel in certain advanced positions, and a throw-off for disengaging said first-mentioned holding pawl from said first two wheels to permit said second wheel to return to normal.

13. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, an electromagnet for controlling said propelling pawl, means for transmitting a varying number of impulses through said magnet to selectively operate said ratchet wheel, a holding pawl for holding said wheels in advanced position, independent means for holding said ratchet wheel in certain selected advanced positions, and a throw-off for disengaging said holding pawl from said wheels to permit said second wheel to return to normal, said throw-off being slow acting, whereby it is only brought into operation during a pause between the series of operations of said propelling pawl.

14. In a signaling system, a station selector including a shaft, a spring-returned ratchet wheel rigidly mounted thereon, a second spring-returned wheel loosely mounted on said shaft, a propelling pawl engaging said wheels, an electromagnet for controlling said propelling pawl, means for transmitting a varying number of impulses through said magnet to selectively operate said ratchet wheel, a holding pawl for holding said wheels in advanced position, a third wheel rigidly mounted on said shaft and provided with a series of selectively arranged notches, a holding pawl for engaging said notches for holding said third wheel and ratchet wheel in certain advanced positions, and a throw-off for disengaging said first-mentioned holding pawl from said first two wheels to permit said second wheel to return to normal.

15. In a signaling system, a station selector including a spring-returned ratchet wheel, propelling and holding means therefor, a slow acting throw-off for the holding means, means including a ratchet wheel segment for controlling the forward movement of the ratchet wheel, and selective means associated with the ratchet wheel for holding the ratchet wheel progressed.

16. In a signaling system, a station selector including a spring-returned ratchet wheel with propelling and holding means therefor, means including a ratchet wheel segment for disengaging said holding means to permit the ratchet wheel to return to normal after a succession of propelling strokes, and means independent of said segment for holding the ratchet wheel, whereby the ratchet wheel segment may be returned to normal without returning the ratchet wheel

17. In a signaling system, a station selector including a spring-returned ratchet wheel, propelling and holding means therefor, means including a ratchet wheel segment for disengaging said holding means to permit the ratchet wheel to return to normal, and means for restoring both the ratchet wheel and segment simultaneously.

18. In a signaling system, a station selector including a spring-returned ratchet wheel, propelling, holding and releasing means therefor, and means whereby only a succession of uninterrupted ratchet-progressing strokes will render the holding means ineffective.

19. In a signaling system, a station selector including a spring-returned ratchet wheel, propelling and holding means there-

for, mechanical releasing means for the holding means, whereby a long pause between propelling strokes will restore the ratchet wheel, and an independent means for positively holding the ratchet wheel progressed.

20. In a signaling system, a station selector including a spring-returned ratchet wheel, propelling, holding and releasing means therefor, and means whereby a succession of uninterrupted ratchet progressing strokes will render the holding means ineffective, said ratchet wheel moving in a continuous direction in response to said succession of strokes.

Signed by me at Chicago, Cook county, Illinois, this 18th day of October, 1911.

JOHN A. HULIT.

Witnesses:

ARTHUR J. RAY,

EDWARD D. FALES.