E. R. GILL.

ELECTRICALLY CONTROLLED SEMAPHORE.

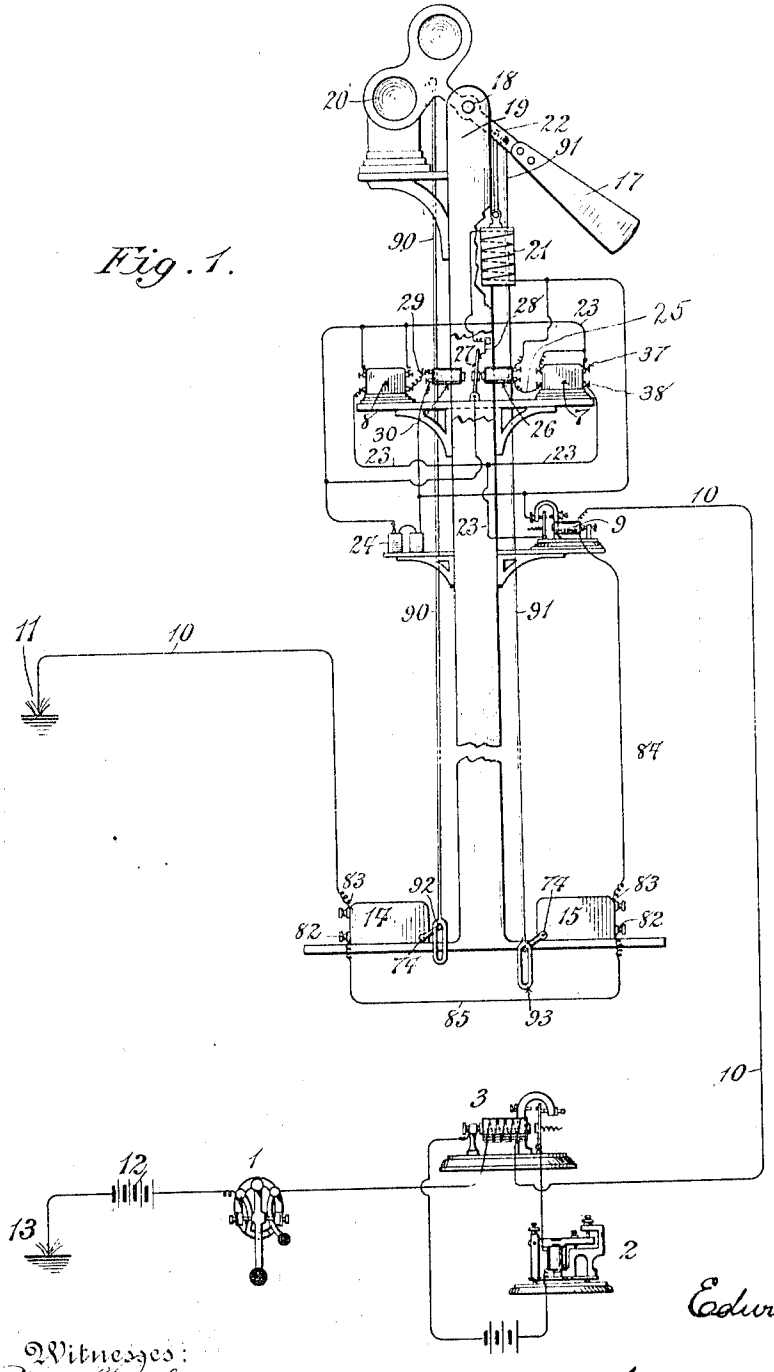
APPLICATION FILED JULY 27, 1907.

1,013,290.

Patented Jan. 2, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



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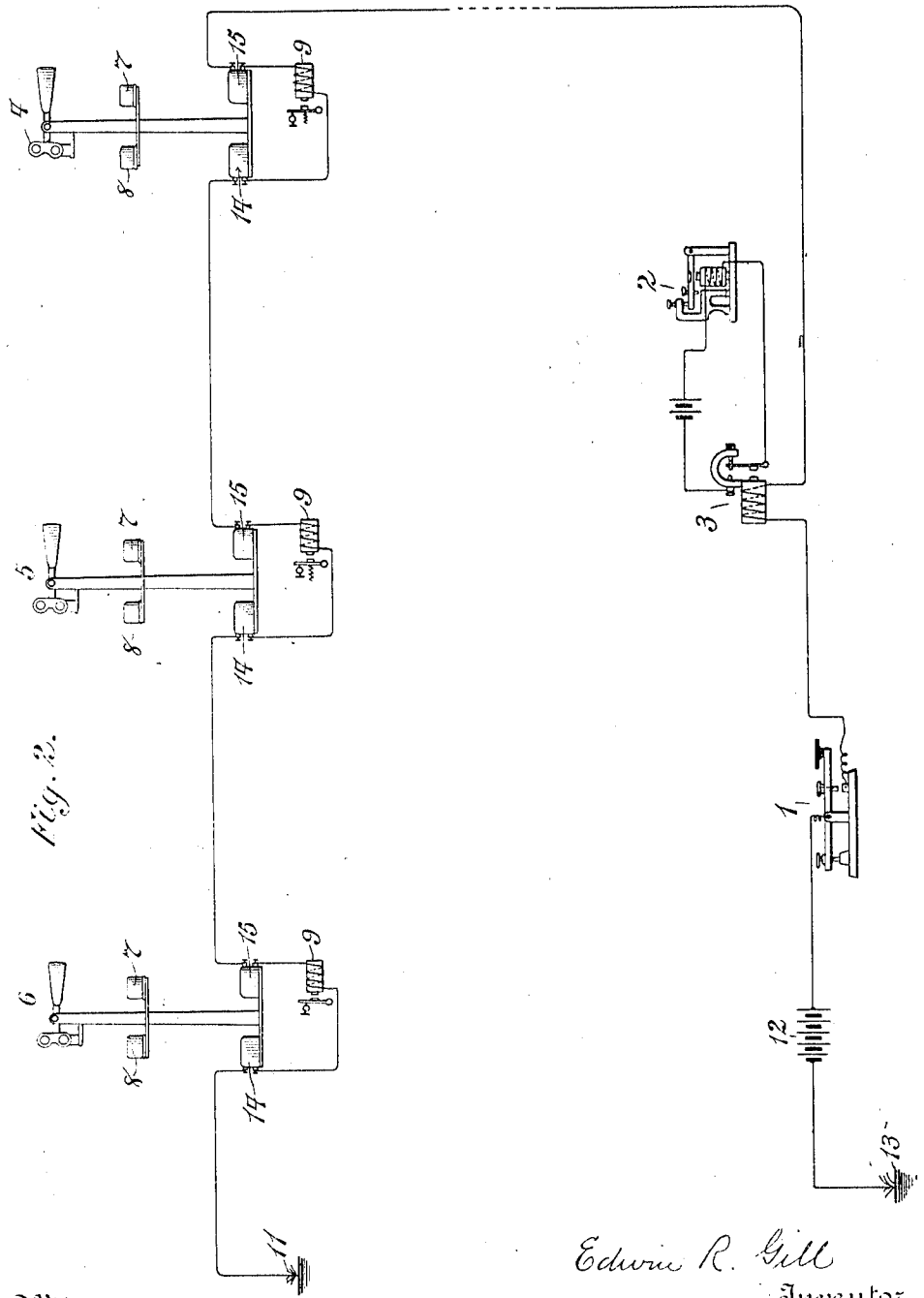

Fig. 2.

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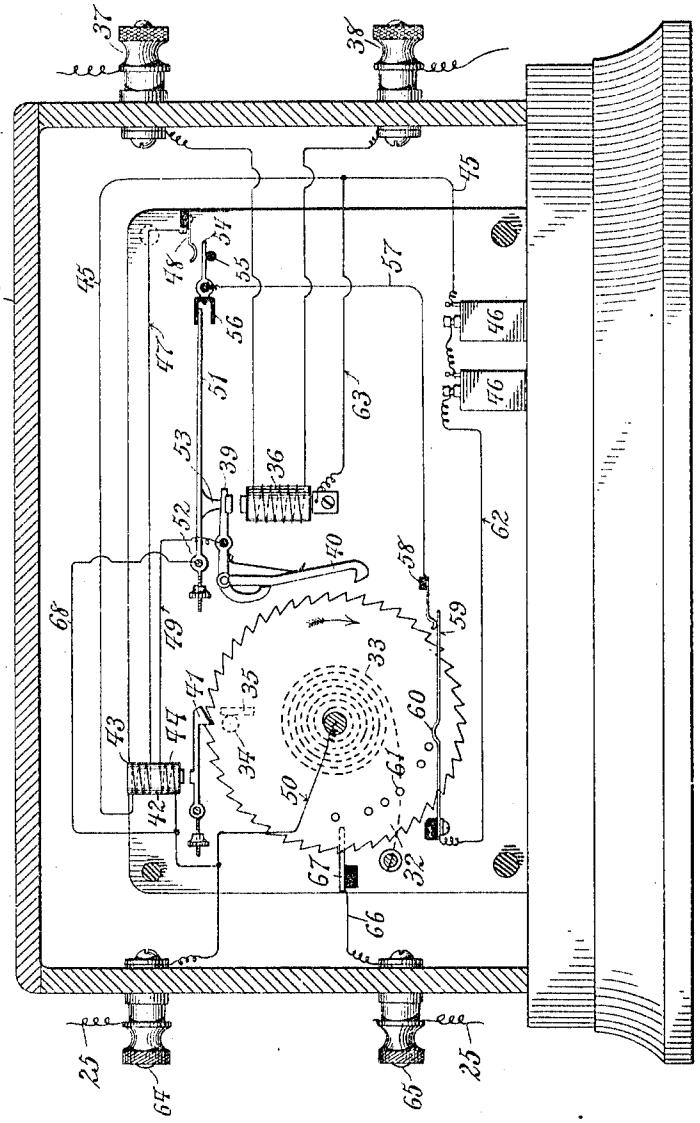
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4

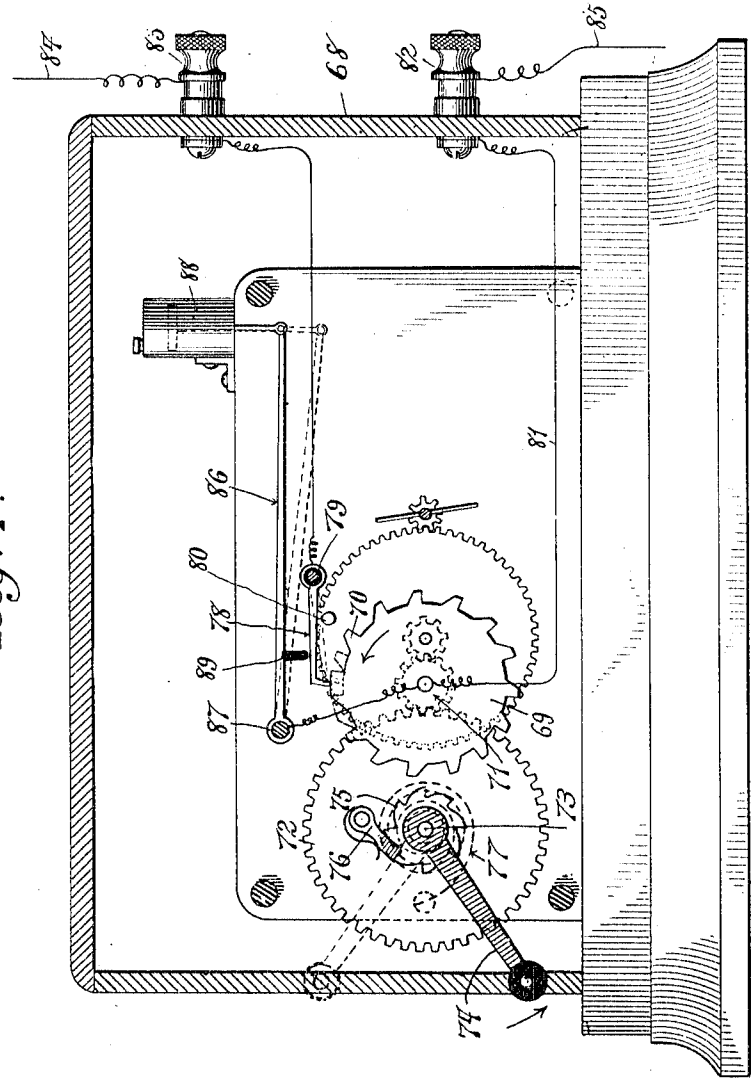

Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRICALLY-CONTROLLED SEMAPHORE.

1,013,290. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed July 27, 1907. Serial No. 385,845.

To all whom it may concern:

Be it known that I, EDWIN R. GILL, a citizen of the United States, residing in the city of Yonkers, county of Westchester, and State of New York, have invented a certain new and useful Improvement in Electrically-Controlled Semaphores, of which the following is a specification.

The present invention has relation to an improvement in means for controlling semaphores and similar signals from a distance.

By the use of this invention an indefinite number of semaphores may be located beside a railway track and any one of the same can be operated for safety, or danger from any point on the line of road.

One principal advantage of my improvement lies in the fact that, in railway practice, any additional battery or circuit wire will be unnecessary.

My improved apparatus is constructed so as to be operated by electricity transmitted over a single telegraph wire, and thus any one of the wires already in place beside the tracks can be used.

The construction and arrangement of my improved apparatus are such that the normal use of a main line wire for ordinary telegraphic purposes is not interfered with, nor does such use affect the apparatus itself.

Another advantage of my improved apparatus is that the train despatcher (or other person operating a semaphore from a distance) is supplied with means whereby he is unmistakably informed of the actual movement of the semaphore to safety or danger in response to his efforts. This is accomplished without the use of any additional batteries or wires.

Another advantage of this invention is that the keys, sounders and relays already standardized and in common use are employed in operating the semaphores and in receiving the signals which announce the fact of actual operation. Thus the use of this invention does not make it necessary to educate operators in the use of unfamiliar instruments.

My invention is illustrated by way of example in the accompanying drawings wherein—

Figure 1 shows a diagram of circuits for operation of a single semaphore, Fig. 2 shows the electric relation of a group of semaphores to the despatcher's instruments, Fig. 3 is a side elevation of an illustrative form of selective circuit closer and Fig. 4 is an elevation of an illustrative form of answer back device.

By placing a series of semaphores at suitable points along a line of railway, each of which can be selectively and individually operated directly by the train despatcher any train can be stopped at any desired point so as to enable the despatcher to communicate fully with the train conductor by telephone or telegraph. Such signals can take the place of the signal towers and extra operators now employed or they may be placed between such towers so as to provide a supplemental service greatly extending the speed and certainty of communication with trains.

The general plan of my improved system is shown in Fig. 2 wherein the despatcher's key, sounder and relay are shown respectively at 1, 2 and 3 and three semaphores are indicated at 4, 5, and 6. At each semaphore is shown a pair of selective circuit closers 7 and 8, controlled by a local circuit (shown in Fig. 1) governed by a relay 9. The relays of the various semaphores are in series with each other and with the main line 10 which is grounded at 11. The main line battery 12 is also grounded at 13.

At each semaphore there is placed a pair of answer back mechanisms, indicated at 14, 15, which correspond to the two selective circuit closers 7, 8 respectively. These devices are all in series with the main line and with the relays 9, to which they are connected by wires 84.

My improved apparatus is capable of adaptation to an indefinite number of kinds of semaphore-operating mechanisms, whether operated directly by electricity or worked indirectly thereby and utilizing other motive power to move the semaphore arm. It is therefore to be understood that this invention is applicable to any semaphore the operation of which is determined by control of an electric circuit.

In Fig. 1 is shown a semaphore the motive agent for which is a simple solenoid,

and this is intended merely to exemplify this part of my invention as a general type thereof.

The semaphore arm 17 is pivoted at 18 to a pillar 19 and is provided with the usual bull's eye 20 on the opposite side of the pivot from the day signal. The entire pivoted signal is so balanced as to tend to assume the horizontal position of Fig. 2 which corresponds to danger. In order to swing the signal to safety the solenoid 21 is provided and its movable core is secured at 22 to the semaphore arm.

As shown in Fig. 1, the semaphore has been brought to safety by suitable operation of the selective circuit closer 7 (as hereinafter described), this being accomplished by the relay 9. This relay closes a local circuit 23 from the battery 24 whenever the main line circuit is broken at the despatcher's key 1. Thus the normal closed circuit condition of the main line leaves the circuit 23 open. The selective device 8 is in parallel with 7 on the same circuit 23, but the arrangement of successive long and short impulses which operates one selective mechanism will not operate the other. Operation of the device 7 closes a circuit 25 through the magnet 26. The armature 27 is thus drawn to the right and the circuit of the solenoid 21 is closed at 28. In the same manner, if the device 8 is operated, circuit 29 is closed through the magnet 30, and the armature 27 being drawn to the left, circuit is broken at 28, so that the arm 17 is free to rise to danger position by its own balance.

From what has been thus far described it will be seen that, by providing two selective circuit closers of any kind capable of operation by long and short electro-magnetic impulses, and so arranged as to open and close (or otherwise suitably control) the circuit or circuits which determine action of the semaphore arm, an operator at a distance can move a given semaphore either to "danger" or to "safety" at will by producing suitably spaced or timed closings of circuit at the key 1. If any number of semaphores, 4, 5, 6, similarly equipped is placed with their relays in series on the same main line circuit, and no two of the selective devices operate on the same combination, any one of such semaphores may be moved to safety or danger at will, and the operation of any one will not interfere with any other.

While my invention may be embodied in apparatus comprising any type of electro-magnetic selective mechanism for controlling the circuits which determine operation of the semaphores, I have shown a simple mechanism of this kind by way of illustration in Fig. 3.

At 31 is shown the casing within which this apparatus is preferably located. A metal ratchet wheel 32 is normally impelled in the direction of the arrow in Fig. 3 by the spring 33 or equivalent means. In its normal position the pin 34 on the rear face of the wheel, (shown in dotted lines) presses against any convenient stop 35.

The operating magnet 36 is connected as shown to the binding posts 37, 38, which are connected to the local circuit 23 as shown in Fig. 1. This magnet attracts the armature lever 39 insulated at its pivot, to which lever is attached the ratchet bar 40 in a well known manner. This bar moves the wheel 32 a tooth at a time each time the magnet 36 is energized. In the intervals between actions of the magnet 36 the bar 40 descends and moves away from the wheel 32 far enough to free the wheel but the return of the wheel under the influence of the spring 33 is prevented by the pawl 41.

The pawl 41 may be drawn out of engagement with the teeth of the wheel 32 by an electro-magnet 42 provided with two separate coils 43, 44. One end of the coil 43 is connected by wire 45 to the small battery 46 while its other end connects by wire 47 to a spring terminal 48 which forms part of the retarded circuit changer hereinafter described. One end of the coil 44 is connected to the insulated lever 39 by wire 49 and the other end is connected by wire 50 with the frame of the machine through the wheel 32.

The retarded circuit changer is constructed as follows. The lever 51 is pivoted at 52 in electrical connection with the framework and is so balanced that its longer end tends constantly to move slowly downward. This lever is normally held up in the position shown by the metallic projection 53 which rests upon the lever 39.

A light insulated switch arm 54 swings between the terminal 48 and the insulated stop 55 and is balanced by a fork 56 of insulating material. The tip of the lever 51 enters this fork and tends normally to hold the arm 54 in the position shown. The arm 54 is connected by wire 57 to an insulated terminal 58 against which presses the tip of a light spring 59, insulated from the framework and provided with a curved offset 60 the apex of which crosses the path of movement of a number of circularly placed metallic pins 61 fixed to the front face of the wheel 32. This spring 59 is connected by the wire 62 to the battery 46 on the opposite side from the wire 45. A wire 63 connects the core of the magnet 36 with the wire 45.

The wheel 32 is connected to the binding post 64, while binding post 65 is connected by wire 66 to a suitable conducting terminal 67 projecting into the path of movement of the pin 34. It is by bringing 34 into contact with 67 that the exterior local circuit 25 is closed through the binding posts 64, 65, whereby the magnet 26 is made to close the circuit of the solenoid 21 which operates

the semaphore. As soon as this has been accomplished, the main line being closed at the despatcher's key 1, the circuit of the magnet 36 is left open.

Movement of the wheel 32 for this purpose is accomplished as follows:—Assuming the pins 61 to be so placed that the first action of the bar 40 brings a pin against the curved portion 60 of the light spring 59, this spring will be pushed away from the terminal 58, breaking circuit at that point, but making electric connection with the framework through the pin 61 and wheel 32. A circuit is thus closed from battery 46 by wire 62, spring 59, pin 61, machine frame, wire 50, coil 44, wire 49, lever 39, core of magnet 36 and wire 63 to battery 46. The effect of this will be to energize the magnet 42 and raise the pawl 41, so that the wheel 32, not being held, will return to the normal position shown as soon as liberated by the pawl 40. The pawl 41 is balanced on its pivot so that it drops onto the wheel 32 slowly, thus giving time for return to normal after the magnet circuit is broken at 36 by release of the lever 39. This return to normal can be prevented, however, by prolonging the active period of the magnet 36 until the projection 53 on the slow moving lever 51 descends so as to touch the lever 39 again. When this occurs a short circuit is formed around the coil 44 by the wire 68 and the pawl 41 will be released so as to hold the wheel when next liberated by the pawl 40. Thus it will be seen that, if at the end of the action of the magnet 36 and pawl 40, a pin 61 presses down the spring 59, it will be necessary to wait before deënergizing 36 until the retarded circuit changer acts. Otherwise the wheel 32 will return to normal as soon as liberated by the pawl 40. On the other hand, if the spring 59 is not depressed by a pin 61 when the magnet 36 acts, no circuit will be formed at first, and the magnet should be immediately deënergized preparatory to another action. If a pause is made during activity of the magnet 36 until the retarded circuit changer can act, the tip of the lever 51 will cause the arm 54 to strike the terminal 48 and circuit will be closed as follows: from the battery 46 by the wire 62, spring 59, terminal 58, wire 57, arm 54, terminal 48, wire 47, coil 43, wire 45 and back to battery. This will raise the pawl 41 and the wheel 32 will return to normal when released by the driving pawl 40. It will thus be seen that, by an appropriate arrangement of the pins 61, a certain prearranged succession of long and short actions of the magnet 36 must be produced in order to rotate the wheel 32 far enough to close the exterior circuit at 67. A mistake at any point in the combination will throw the wheel 32 back to normal.

The mechanism 8 is constructed on the same plan as the device 7 but the pins 61 in the device 8 are arranged differently from those in 7, so that the two shall not be operated by the same combination.

It has been made clear so far by what means the despatcher is enabled to command the position of any one semaphore on the main line 10. But in practice it becomes important to provide means whereby the despatcher may be instantly apprised as to whether or not he has been successful in operating the particular semaphore in the manner desired. For this purpose I provide an automatic answer back device, also on the main line, whereby impulses are transmitted back over the line to operate the despatcher's sounder. A separate answer back is provided at each semaphore to correspond to each movement thereof, and each answer back is preferably arranged to repeat upon the despatcher's sounder the same combination of short and long impulses as that used to operate the corresponding selective mechanism. Of course if desired the combination signal of the answer back may be different from the combination which operates the corresponding selector. A great variety of answer back devices may be used in this manner without departing from my invention, and I have indicated a simple example of this type of mechanism in Fig. 4, by way of example.

Within the usual casing 68 is located a metal wheel 69 having teeth 70, with inclined backs and placed at various distances apart to correspond to the combination answer back signal to be produced. The arrow in Fig. 4 shows the direction in which the wheel 69 is automatically moved. This movement is produced by any desired train of gearing such, for instance, as the pinion 71 on the same shaft as the wheel 69 which pinion is driven by the spur gear 72. This gear is mounted loosely upon the shaft 73 to which are fixed the crank handle 74 and toothed pinion 75. A spring-pressed pawl 76 is carried on the face of the gear 72 and engages with the ratchet 75. When the handle 74 is depressed as shown by the arrow near it the ratchet 75 rides idly under the pawl 76 and the gear 72 does not move. This movement, however, winds up a spiral spring 77 attached to the shaft 73, so that when the handle 74 is liberated this spring returns it to the position shown in dotted lines. During this movement the ratchet 75 and pawl 76 act to turn the gear 72 so as to revolve the wheel 69 as shown by the arrow. The sizes of the gears and pinions are so calculated that the quarter turn given to the wheel 72 produces one complete revolution of the wheel 69. As the wheel 69 turns, the outer surfaces of its teeth move under a tipping lever 78 pivoted and insulated at 79. When not supported by a tooth,

the tip of the lever 78 falls into the space between two teeth, but is prevented from touching the wheel by the stop 80.

The framework of the mechanism is connected, as by wire 81 with the binding post 82, while the insulated lever 78 is connected to the binding post 83. From the post 83 on the answer back 15, the wire 84 leads by the relay 9 to the main line 10. The wire 85 connects the post 82 on the answer back 15 to the same post on the device 14. The post 83 on this latter answer back is connected directly to the main line 10. Thus the relay 9 and both answer-back devices are in series with each other and with the main line. The specific connections just described are not essential as long as this series arrangement is preserved.

If, by any accident, the motion of the wheel 69 should be arrested when the lever 78 is between two teeth, the main line would be left open and all communication would be interrupted. To prevent this disaster I prefer to provide suitable means for closing the main line around the teeth of 69 in case of the occurrence above mentioned. One means for accomplishing this is shown in Fig. 4. Here the light long metal lever 86 is pivoted at 87 at one end, while its opposite end is connected to the movable part of the dash pot 88. This lever is supported by the insulating leg 89 which rests upon the lever 78, so that when this latter is depressed, the lever 86 moves downward, being retarded by the dash pot 88.

During normal operation, the teeth 70 follow each other so rapidly that the retarded lever 86 has not time to fall into the dotted line position, but in case of arrest of the wheel 69 while the lever 78 is depressed and the main line thus opened, the lever 86 will sink into the dotted line position and touch the hub of the lever 78. The lever 86 is connected to the machine framework and thus to the binding post 82. Contact between 86 and 78 thus closes the main line, and restores communication.

Turning now to Fig. 1, there will be seen the preferred mode of correlating the action of the two answer back devices 14 and 15 with their corresponding selective mechanisms 7 and 8. In this figure means are shown whereby movement of the semaphore arm 17 one way or the other will cause operation of one or the other of the answer back devices. In the specific illustrative form shown, I provide two rods 90, 91 pivoted to the semaphore arm on opposite sides of its pivot, and at the lower ends of these rods are provided forked or slotted extensions 92, 93 taking over the handles 74. These slots are wide enough to allow the handles to move in a circular arc. As the arm 17 moves downward to safety in response to the mechanism 7, the rod 91 is depressed and the top of the slot in 93 lowers the handle 74, winding the spring 77 and preparing the mechanism 15 for operation when 91 next rises. At the same time the rod 90 rises and liberates the handle 74 of mechanism 14 which had been previously set by lowering of the rod 90. It is thus seen that the answer back 14 corresponds to selector 7 while answer back 15 corresponds to selector 8.

Any mechanism having similar or equivalent actions to those of the devices 15 and 7 can be substituted in their places and many other changes can be made in the various elements of this apparatus without departing from my invention.

What I claim is—

1. In apparatus of the kind described, a line, a pair of selectors connected to the line respectively answering to different series of impulses, means for impressing such impulses upon the line, a motive engine connected to both selectors and controlled thereby respectively, and a semaphore controlled by the engine.

2. In apparatus of the kind described, a line, a pair of selectors connected to the line respectively answering to different series of impulses, means for impressing such impulses upon the line, a motive engine connected to both selectors and controlled thereby respectively, a semaphore controlled by the engine, and an answer back device connected to the line for each selector, said answer back devices corresponding distinctively with said selectors, and their operation being determined respectively by that of the semaphore.

3. In apparatus of the kind described, a line, a pair of selectors connected to the line respectively answering to different series of impulses, means for impressing such impulses upon the line, an electro-mechanical engine connected to both selectors and controlled thereby respectively, and a semaphore controlled by the engine.

4. In apparatus of the kind described, a line, a pair of selectors connected to the line respectively answering to different series of impulses, means for impressing such impulses upon the line, an electro-mechanical engine connected to both selectors and controlled thereby respectively, a semaphore controlled by the engine, and an answer back device connected to the line for each selector, said answer back devices corresponding distinctively with said selectors, and their operation being determined respectively by that of the semaphore.

5. In apparatus of the kind described, a line, a local circuit, an electro-magnetic engine in said local circuit, a movable contact in said local circuit for opening and closing the circuit, a pair of selectors connected to the main line and adapted respectively

to actuate said movable contact to open and close said local circuit, said selectors answering respectively to different series of impulses, means for impressing such impulses upon the line, and a semaphore controlled by said engine.

6. In apparatus of the kind described, a line, a local circuit, an electro-magnetic engine in said local circuit, a movable contact in said local circuit for opening and closing the circuit, a pair of selectors connected to the main line and adapted respectively to actuate said movable contact to open and close said local circuit, said selectors answering respectively to different series of impulses, means for impressing such impulses upon the line, a semaphore controlled by said engine, and an answer back device connected to the line for each selector, said answer back devices corresponding distinctively with said selectors, and their operation being determined respectively by that of the semaphore.

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