Sept. 5, 1939. E. A. FORD 2,172,061

ELECTROMAGNETICALLY OPERATED SETTING MECHANISM

Filed July 23, 1936 2 Sheets-Sheet 1

FIG. 1.

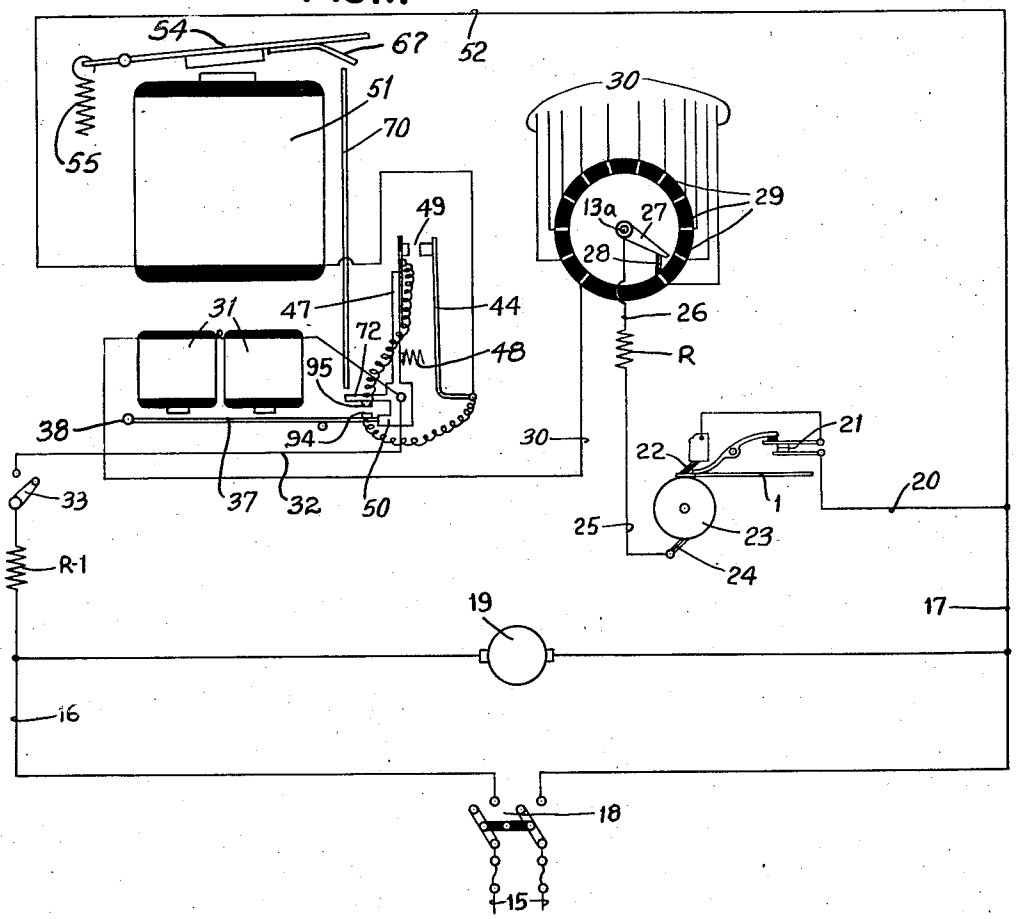
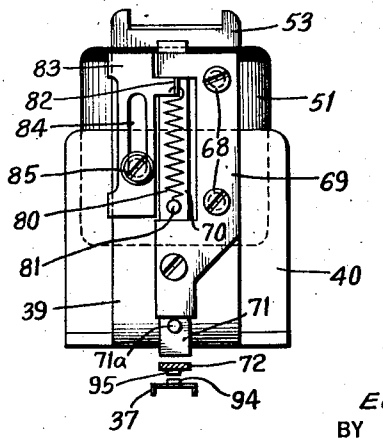


FIG. 2.



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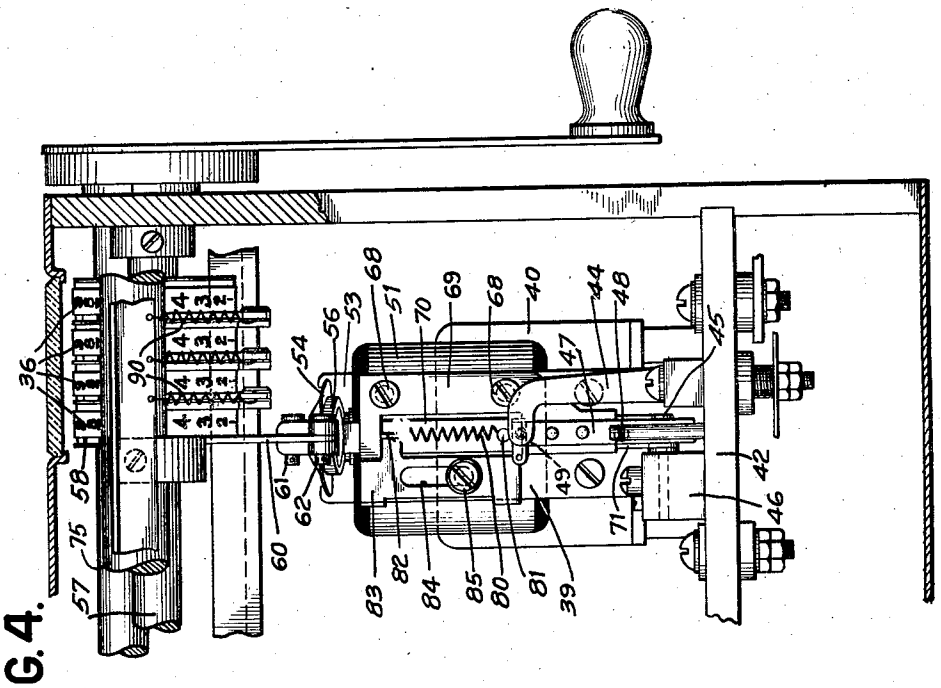


FIG. 4.

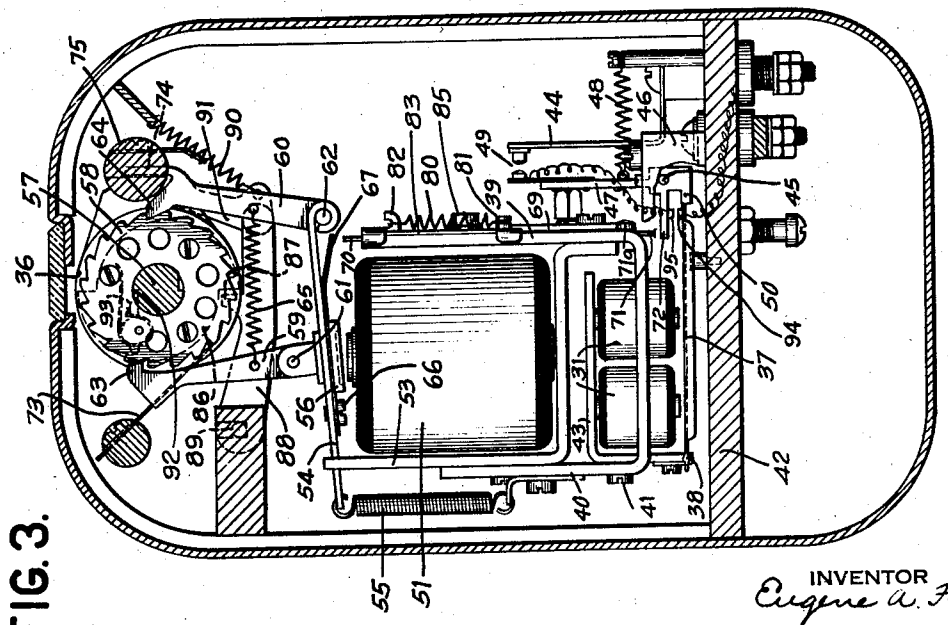


FIG. 3.

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2,172,061

ELECTROMAGNETICALLY OPERATED SETTING MECHANISM

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Application July 23, 1936, Serial No. 92,100

11 Claims. (Cl. 235—92)

This invention relates to improvements in electro-magnetically operated operating mechanisms for setting wheels or the like so as to attain high speeds in machine operations.

It has heretofore been the practice to cause the initiation of the operation of an operating mechanism for a settable wheel by an electro-magnetic means which is rendered operative by an electrical circuit which is closed when a card perforation is encountered. Due to the short time of the impulse transmitted it has been necessary to merely release the operating mechanism for the settable wheel by the electro-magnetic means and cause the operating mechanism to frictionally drive the wheel at a certain speed of operation and independent of the speed of analyzing the perforation. However, such an arrangement is not particularly adapted for very high speed machine operations, approximating nearly a thousand control records a minute.

The present invention has for its object the provision of an electro-magnetically operated operating mechanism operable independently of the driving means and which is capable of effecting the operation of the settable wheel at a rate independent of the rate of electrically analyzing the card perforation.

Due to the obvious requirement that standard cards with oblong perforations must be utilized for control purposes it was not possible to completely energize an electro-magnet which operates mechanism for directly operating a wheel at the high speeds mentioned. For such operations large electro-magnets were required and the short time of the analyzing operation did not permit their full energization.

A relatively important object of the invention is the attainment of the end that permits the use of electrical relays which require little current for energization and are fast in operatiton.

In the improved arrangement the energization of the relay causes the closure of relay contacts and the latter close the circuit to the wheel setting control electro-magnet and sufficient time is given for its complete energization due to the provision of retaining the relay contacts closed. When the operating mechanism for the settable wheel is given a half stroke of operation, by suitable connections the relay contacts are opened, thereby causing the deenergization of the wheel setting control magnet, and the operating mechanism is then restored to normal.

It is a further object to devise a timing control mechanism which controls the speed of operation of the electro-magnetically operated operating mechanism and this is efficiently provided for by adjusting certain mechanism to lengthen or shorten the time required to open the relay contacts.

While the operating mechanism for the settable wheel operates the wheel a half step during the initial stroke and a half step during the return stroke, obviously it would be possible to cause a units step of movement of the wheel by either stroke.

While the mechanism employed is illustrated in connection with operating mechanism for a unit counter with similar advantages the improvements could be incorporated in operating mechanisms for accumulators, or other types of registering mechanism and the like, and the disclosure should be merely viewed as illustrative and not restrictive.

In said drawings:

Fig. 1 is an electrical wiring diagram showing diagrammatically the fundamental parts of a sorting machine and the electrical wiring connections for operating one of a plurality of counters provided for counting the records sorted in respective compartments.

Fig. 2 is a detail view of certain parts.

Fig. 3 is a cross sectional view showing the details of the improved counter operating mechanism.

Fig. 4 is a view in front elevation of a portion of a counter.

In Fig. 1 the record to be sorted is designated by numeral 1 and a plurality of such records which are to be sorted are fed singly by a picker knife and the usual feed rollers to an analyzing brush 22.

Referring to Fig. 1 the current supply is shown at 15 and is connected to the line wires 16 and 17 by a hand operated switch 18. The supply is preferably direct current. Closure of the switch 18 will connect the driving motor 19 across the line wires 16 and 17 to cause the rotation of the drive shaft 13a by said motor.

From the line side 17 a wire 20 is connected to card lever operated contacts 21 which are opened when a record is not beneath the analyzing brush 22. The brush 22 makes contact through the perforation in the single column being analyzed and with a roller 23 because as the record is fed to the left it passes underneath the analyzing brush 22 which is normally adapted to engage with the contact roller 23. The record separates the brush from the roller so that if current is now supplied to the brush it will not close a circuit of a control relay. A commutator

device supplies current to the brush for a short duration of time as each succeeding index point position passes under the brush so that if the brush senses a perforation and engages with the roller 23 it will close the circuit to a selected relay magnet.

Against the cylinder 23 a brush 24 bears and the latter is connected by a wire 25 to a resistance R and by a wire 26 the resistance R is connected to an arm 27 rotated by the drive shaft 13a. The arm 27 carries a brush 28 engageable with commutator segments 29 and the brush 28 is timed to engage with the commutator segments 29 synchronously with the passage of index point positions past the analyzing brush 22. Each of the twelve segments 29 is connected by a wire 30 to a related relay magnet 31 only one of the wires 30 being shown connected to a relay magnet 31 in Fig. 1 in view of the duplication of such connections. A wire 32 is connected to one side of the relay magnet 31 and this wire is connected to the line side 16 through a manually operable switch 33 and a resistance R—1. Hence, depending upon the occurrence of a perforation at a certain position relay magnet 31 will be energized and the length of time it is energized is dependent upon the duration of contact between brush 22 and contact roller 23 and while for high speed record feeding operations the time is relatively short the relay magnets 31 are "fast" relays, that is, they require little current and respond to a short time of energization and energize sufficiently to perform functions now to be described.

The particular sorting control mechanism of sorting machines of the type shown in Patent No. 2,123,237 dated July 12, 1938, and in which the present improvement is preferably incorporated, is capable of sorting cards at extremely high speeds, as high as 800–900 records per minute. It is preferable to be able to count the number of records sorted and to this end the present invention includes improvements that permits the operation of the counter at the high speeds mentioned, since the former constructions shown in Patents Nos. 1,830,756, 1,944,659 and 1,962,735 were not particularly well qualified to accomplish counting at the high speeds mentioned.

As clearly explained in Patents Nos. 1,944,659 and 1,962,735, the records are sorted into twelve sorting compartments and if not in one of these into a reject pocket. To count the number of cards that are disposed in each compartment each compartment has related therewith a series of wheels 36 which constitute an item counter, that is the units wheels is given a units step of rotation for each card disposed in a related compartment to thereby count the number of cards in each compartment. By suitable transfer mechanism, to be more fully described hereinafter, transfers are effective to the wheels of denominational orders above the units.

To control the entry of the units each counter is provided with one relay magnet 31 which upon its energization by the electrical circuit previously described is adapted to attract its related armature 37 which is pivoted at 38. To provide a suitable mounting for the relay magnet 31 a U-shaped member having a front support plate 39 and a back support plate 40 is secured to a base plate 42 by any suitable means. Attached to the back support plate 40 by screws 41 is a bracket plate 43 which carries a related relay magnet 31.

A rigid contact blade 44 is secured by any suitable means to the base plate 42 and pivotally mounted by a pivot stud 45 carried by a block 46 which is fastened to the base plate 42 is an associated contact carrying blade 47. A spring 48 is adapted to rock the contact carrying blade 47 to close contacts 49 carried by said contact blades but this is normally prevented by the engagement of a tail 50 with the free end of the armature 37. However, when the armature 37 is attracted by the cores of relay magnet 31 the right end of the armature 37 will be rocked free of the tail 50 permitting spring 48 to close contacts 49 and such closure will be retained until the contacts 49 are caused to separate by means to be later described.

From the wiring diagram it will be evident that when contacts 49 close, a circuit will be made from the line side 16, through resistance R—1, switch 33, connection 32 to contacts 49, now closed, through the counter control magnet 51, a wire connection 52, to the line side 17, thereby causing the energization of the control magnet 51.

The control magnet 51 is attached to the U-shaped support plate 39—40 by a support bracket 53. An armature 54 of the counter control magnet 51 is pivoted to the bracket plate 53 and attached to the armature 54 is a spring 55. The armature 54 carries a recessed circular element 56 of magnetic material and which is attracted magnetically by the pole piece or core of the counter control magnet 51.

The series of numeral wheels 36 for each counter is journaled in a shaft 57 and each wheel has secured thereto a ratchet wheel 58 which is engaged by a pair of pawls 59 and 60 pivoted at 61 and 62, respectively, to the armature 54. The pawl 59 has a hook 63 which is positioned over a ratchet tooth while the operating end 64 of the pawl 60 is beneath a ratchet tooth, the result being that when the armature 56 is attracted by its magnet 51 pawl 59 will turn the units counter wheel 36 a half step and positioning the operating end 64 of the pawl 60 beneath a lower ratchet tooth. The pawls 59 and 60 are interconnected by a spring 65 which causes the pawls 59 and 60 to bear against the ratchet wheel 58.

At this point in the operation of the machine it should be noted that the passage of the perforation past the analyzing brush 22 transmitted a short impulse to the relay magnet 31 so that the passage of the perforation out of contact with the brush 22 causes the deenergization of magnet 31. Irrespective of the deenergization of magnet 31 contacts 49 were retained closed by spring 48 permitting the counter control magnet 51 to be energized for a longer period of time and for a time dependent upon certain adjustments to be explained more clearly hereinafter.

Attached to the underside of the armature 54 by a screw 66 is a spring plate 67. Attached to the front support plate 39 by screws 68 is a guide plate 69 provided to retain a bar 70 in a slot in the face of the support 39 for a vertical movement said bar 70 having a foot 71 positioned over an extension 72 of the contact blade 47, said extension 72 engaging the foot 71 when the contact blade 47 is unlatched to close contacts 49.

When the armature 54 is attracted the spring 67 carried thereby in engagement with the upper portion of bar 70 will force the bar 70 downwardly as the armature 54 is rocked.

Since at this time the foot 71 is in contact with the extension 72 of the contact carrying blade 47 the depression of the bar 70 will cause blade 47 to be rocked against the action of the spring 48 to position to open the contacts 49 and cause the tail 50 to be re-latched by the free end of the arma

ture 37, which is now in un-attracted position. The resistance offered by spring 48 will cause the spring 67 to be flexed more or less until this resistance is overcome. This will permit a maximum rocking movement of th armature 54 until the contacts 49 open. Thereupon spring 55 together with the spring blade 67 will restore the armature 54 against the tendency of any residual magnetism of the core of magnet 51 to retain it attracted.

Since pawl 64 is now beneath the next lower tooth it will turn the ratchet wheel 58 a half step, the full step of movement now being held by a retrograde preventing spring blade 73. An extension 74 of the pawl 60 enters a hole in a rod 75 which serves as a stop to prevent overthrow by means of the operating end 64 of pawl 60 of the ratchet wheel 58.

Obviously, the time that the contacts 49 are opened depends upon the flexure of the blade 67 given by the amount of resistance offered to the blade in depressing bar 70. This is capable of adjustment in the present machine by the preferred construction now to be described. One end of a spring 80 is attached to a stud 81 carried by the bar 70 and the upper end of the spring 80 is attached to an ear 82 which is integral with an adjustable plate 83. A stop stud 71a attached to the bar 70 coacts with the bottom of edge of guide plate 69 so that by the tension in spring 80 the foot 71 of bar 70 is normally held so that a slight upward movement of the extension 72 is permitted before it comes into contact with the foot 71 of the bar 70. The plate 83 has a slot 84 receiving a screw 85 passing into the plate 39 so as to permit adjustment of the plate 83 and, therefore, spring 80. In the position shown the spring 80 has its maximum tension so that spring plate 67 will receive its maximum flexure before contacts 49 open and hence the counter will be operated at the slowest speed. By lowering plate 83 the tension of spring 80 is relaxed, so that the counter operating speed will be decreased. In any case armature 54 will be given a rocking movement sufficient to operate the units counter wheel a full step.

To effect transfers from each lower order wheel to the next highest order wheel the following construction is preferably employed.

Each wheel except the highest order wheel is provided with a cam disk 86 against which bears a projection 87 of an arm 88 pivoted at 89 and urged by a spring 90. The arm 88 carries a pawl 91 in engagement with a ratchet wheel of the next higher order wheel 36. When the extension 87 drops off a high portion of the cam 86 the lower order wheel has passed through zero causing spring 90 to actuate the arm 88 and pawl 91 to effect the rotation of the wheel of next higher order one step.

Resetting operations for the wheels 36 may be carried out by providing shaft 57 with a slot 92 adapted to engage with and pick up pawls 93 secured to the wheels 36 and turn the wheels to zero as the shaft 57 is turned by a crank or some other suitable means. This form of resetting mechanism is so well-known that it is only generally explained.

While not essential to the proper operation of the improved electro-magnetically operated operating mechanism, in machines of the type in which the card may be stopped with the card perforation maintained in contact with the analyzing brush 22 improper unit adding operations may ensue as will now be explained.

From Fig. 1 it will be evident that when the card is stopped with the perforation continuously engaged by the analyzing brush 22 the circuit through relay magnet 31 is retained closed to keep the relay magnet 31 energized. The bar 70 rocks the contact blade 47 so as to open contacts 49 as before, and cause the de-energization of magnet 51. This will permit the units counter wheel to be operated the second half-step but since relay magnet 31 is retained energized its armature 37 is held attracted in a position in which it will not re-latch the contact blade 47. Hence spring 48 will again close contacts 49 to again energize the counter control magnet 51 and the operation will be repeated with consequent improper adding operations.

To effectively guard against this mis-operation the extension 72 of the contact blade 47 carries an upper contact 95 and the armature 37 carries insulated therefrom a lower contact 94. By suitable wire connections contacts 49 and 94—95 are in shunt and while contacts 94—95 are normally open when armature 37 is elevated to release the contact blade 47, contact 94 is elevated but it will not contact with the contact 95 before the contact blade 47 is unlatched. As the armature 37 strikes the cores of the relay magnet 31 the contact blade 47 now being unlatched will rock to close contacts 49, still further separating contacts 94—95. Thus, only the contacts 49 close to cause the energization of the counter control magnet 51. The counter control magnet 51 will now cause the bar 70 to be depressed, as before, to open contacts 49. Obviously with a card stopped in a position with the perforation retained in continued contact with the analyzing brush 22 the continued energization of relay magnet 31 will cause contact 95 to be held upwardly so that as the bar 70 rocks the contact blade 47 to open contacts 49 the contact 95 will make electrical contact with the contact 94. Hence the circuit through magnet 51 will be retained closed by the contacts 94—95 until by an operation of the machine the card perforation is moved away from the analyzing brush 22 to open the circuit to relay magnet 31. When the latter is de-energized its armature 37 will drop to lower the contact 94 and open the circuit to the counter control magnet 51, so that the released armature 54 of the latter can now be elevated to cause the second half-step of operation of the units counter wheel.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. An operating device for a settable registering element comprising, magnetically operated means for causing the setting of said settable element, means operated by said magnetically operated means for controlling the extent of operation of the latter, and means for adjusting the time of operation of the last named means by said magnetically operated means to cause the setting of said element at varying rates of speed of operation.

2. An operating device for a settable registering element comprising, magnetically operated

means including a magnet energized in response to an electrical impulse transmitted to said magnet for causing the setting of said settable element, means whereby said magnetic means causes the deenergization of said magnet, and means for controlling the duration of time of operation of the last named means for varying the duration of time of energization of said magnet to effect a setting of the settable element at different rates of speed.

3. An operating device for a settable registering element comprising, magnetically operated means for causing the operation of said settable element, a magnet for operating the last-named means and energized in response to an electrical impulse transmitted thereto, means operated by said magnet for causing its deenergization, and means for varying the length of time of energization of said magnet to effect the operation of said settable element at variable speeds.

4. An operating device for a settable registering element comprising, a relay magnet energized in response to an electrical impulse transmitted thereto, relay contacts closed thereby, magnetic means for operating said settable element and operable in response to the closure of said relay contacts, means operated by said magnetic means for subsequently opening said contacts, and means for variably changing the period of operation of the last named means.

5. In a machine of the class described, in combination, a relay magnet having contacts closed by the energization of said relay magnet which is effected by transmitting an impulse to said relay magnet, a settable element, a magnet energized by the closure of said contacts, means operated by the energization of said magnet for causing the operation of said settable element, and means operated by the last-named means for opening said relay contacts to deenergize the second-named magnet.

6. An operating device for a settable registering element comprising, an electrical relay having relay contacts and energized in response to an electrical impulse transmitted thereto to close its contacts, a magnet energized by the closure of said relay contacts for causing the operation of said settable element, means whereby the last-named magnet effects the subsequent opening of said contacts, and means for varying the length of time of operation of the last-named means to cause the operation of said settable element at varying rates of speed.

7. In a machine of the class described, a magnet and a circuit therefor, an operating means operable in response to the energization of said magnet effected by the closure of the circuit of said magnet to cause its energization, automatically operated means for causing an opening of said circuit after an energization of said magnet, and means for retaining the closure of the circuit irrespective of the opening of the circuit by an operation of the automatically operated means.

8. An operating device for a settable registering element comprising, electro-magnetically operated means comprising a magnet which is energized for effecting the operation of said settable element, a magnet energized in response to an electrical impulse for attracting its armature, contacts in the circuit of the first-named magnet, means controlled by said armature when attracted for causing the closure of said contacts to cause the energization of the first-named magnet, means operated by the first-named magnet for opening said contacts whereby said armature if unattracted by the second-named magnet retains the contacts closed, and means controlled by said armature and operable in response to its continued attraction by the second-named magnet for causing a continued energization of the first-named magnet irrespective of the opening of said contacts.

9. An operating device for a settable registering device comprising, an operating means for a settable element, electrical devices controlling the operation of said means, a relay magnet energized in response to an electrical impulse transmitted thereto for effecting the closing of said electrical devices to cause the operation of the first-named means, means rendered operable by an operation of said operating means for opening said electrical devices to condition the operating means for a subsequent operation, and means operable in response to the continuous energization of the relay magnet for preventing a subsequent operation of the operating means irrespective of the opening of said electrical devices.

10. An operating device for a settable registering element comprising, electro-magnetically operated means operable in an operating stroke and a return stroke for causing an operation of said settable element, a relay magnet energized by closure of its circuit and including an armature having an operative position effected in response to the energization of the relay magnet for causing an operating stroke of the electro-magnetically operated means, and means including said armature for preventing a subsequent return stroke in the operation of the electro-magnetically operated means as long as said relay magnet is retained energized.

11. An operating device for a settable registering element comprising, electro-magnetically operated means including an electro-magnet which is energized for causing an operation of the settable element, a relay magnet including an armature positioned in response to the energization of the relay magnet for energizing said electro-magnet for causing an operation of the electro-magnetically operated means, and means controlled by said armature and dependent upon the maintained position of said armature effected by a continuous energization of the relay magnet for retaining the electro-magnet of the electro-magnetically operated means energized.

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