J. M. KELLER, JR.

TIMING MECHANISM AND APPARATUS INVOLVING THE SAME.

APPLICATION FILED MAR. 13, 1916.

1,215,166.

Patented Feb. 6, 1917.

4 SHEETS—SHEET 1.

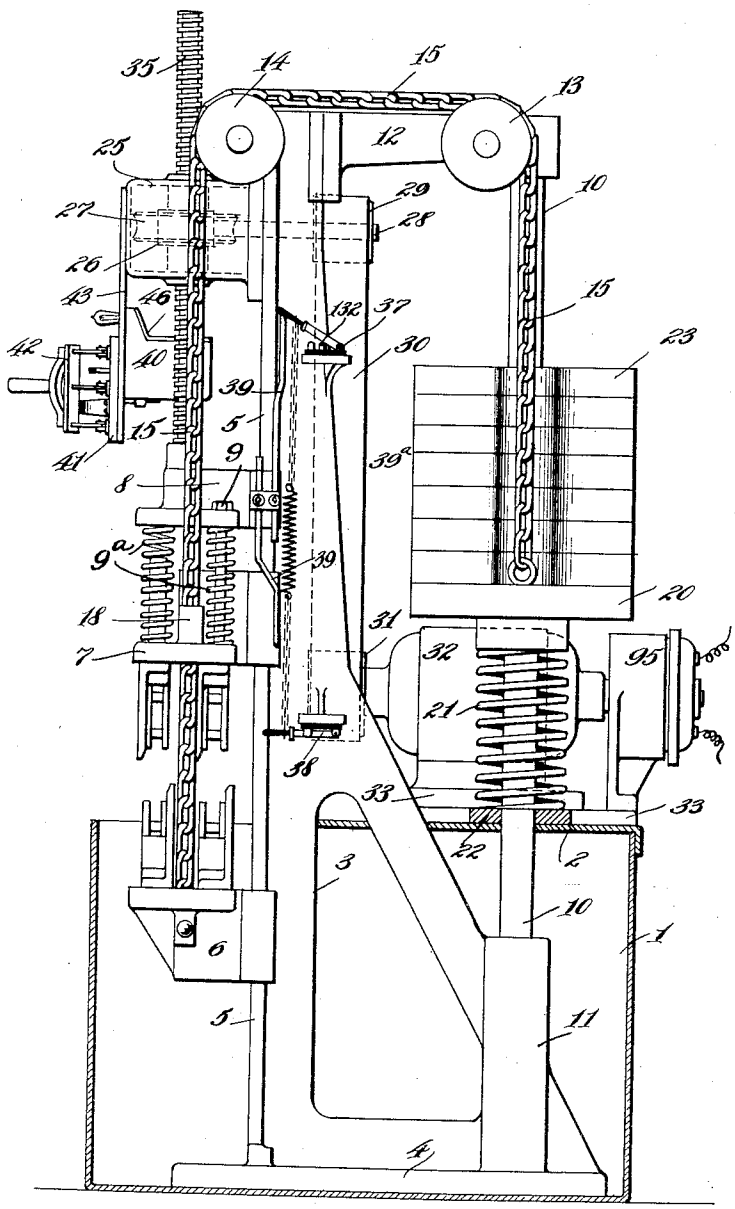


Fig. 1.

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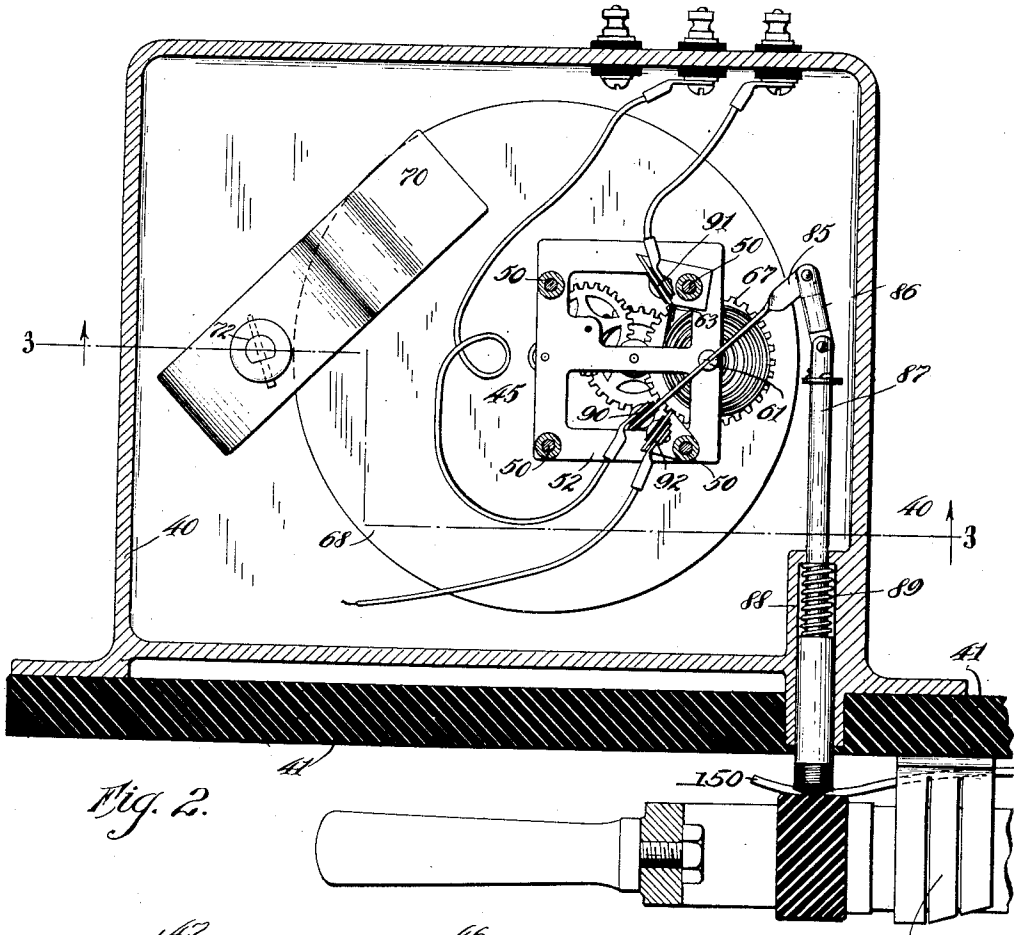


Fig. 2.

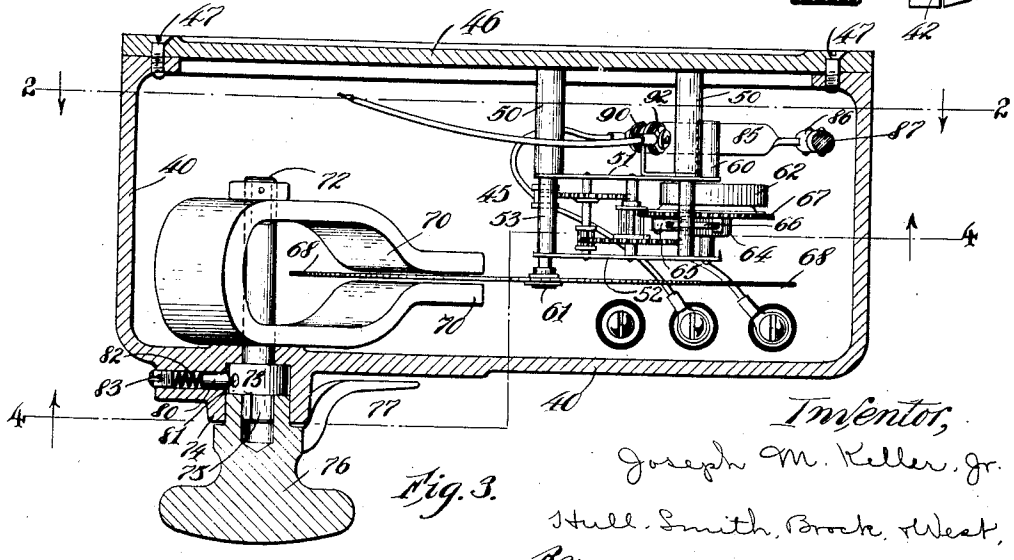


Fig. 3.

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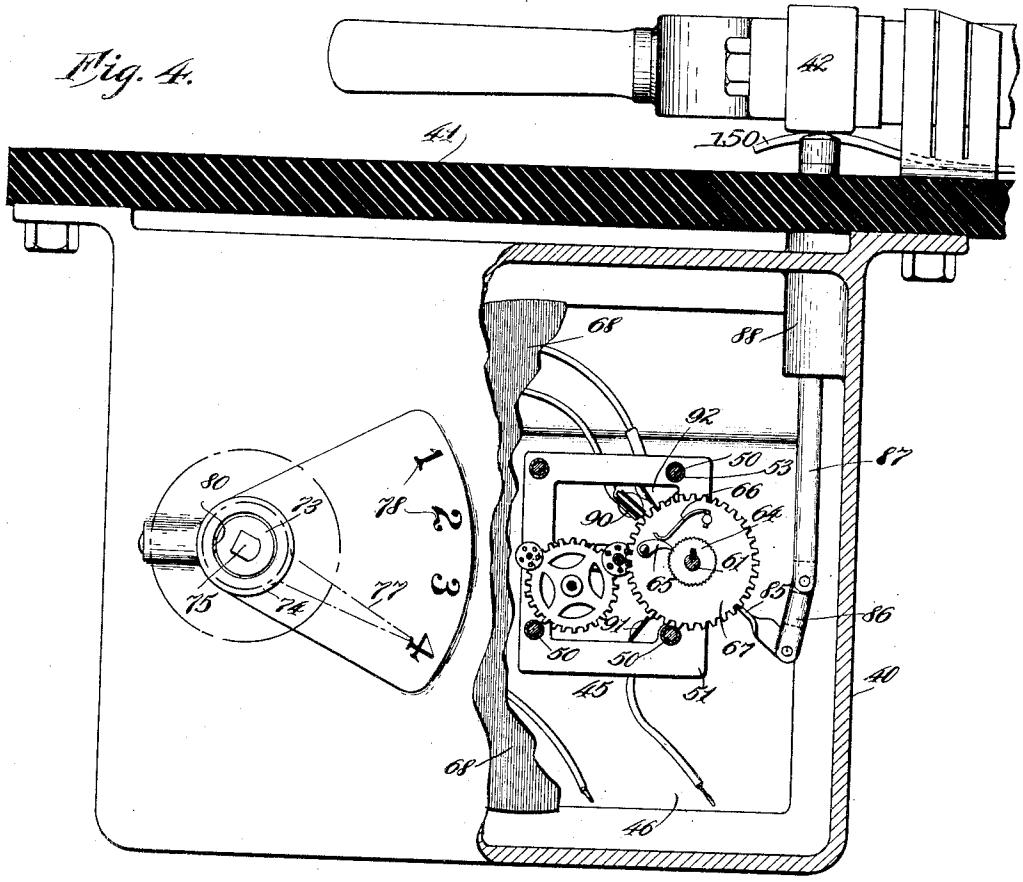
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4 SHEETS—SHEET 3.

Fig. 4.



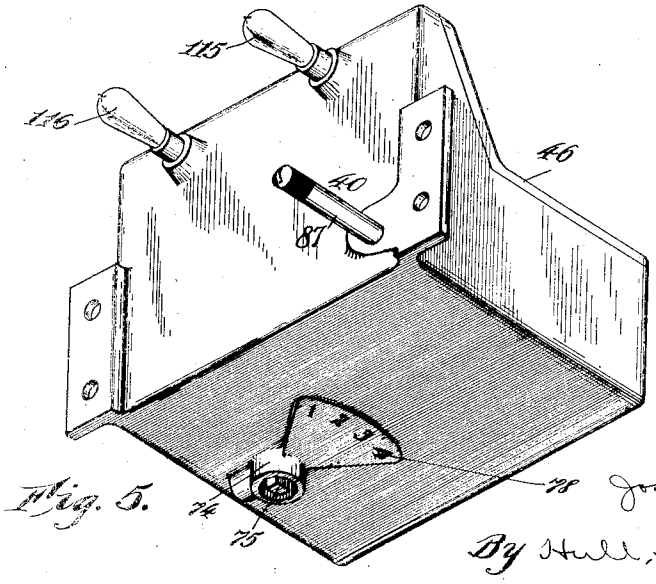
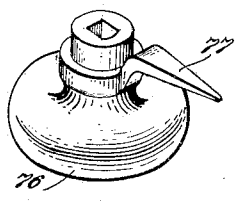


Fig. 5.

Fig. 6.



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4 SHEETS—SHEET 4.

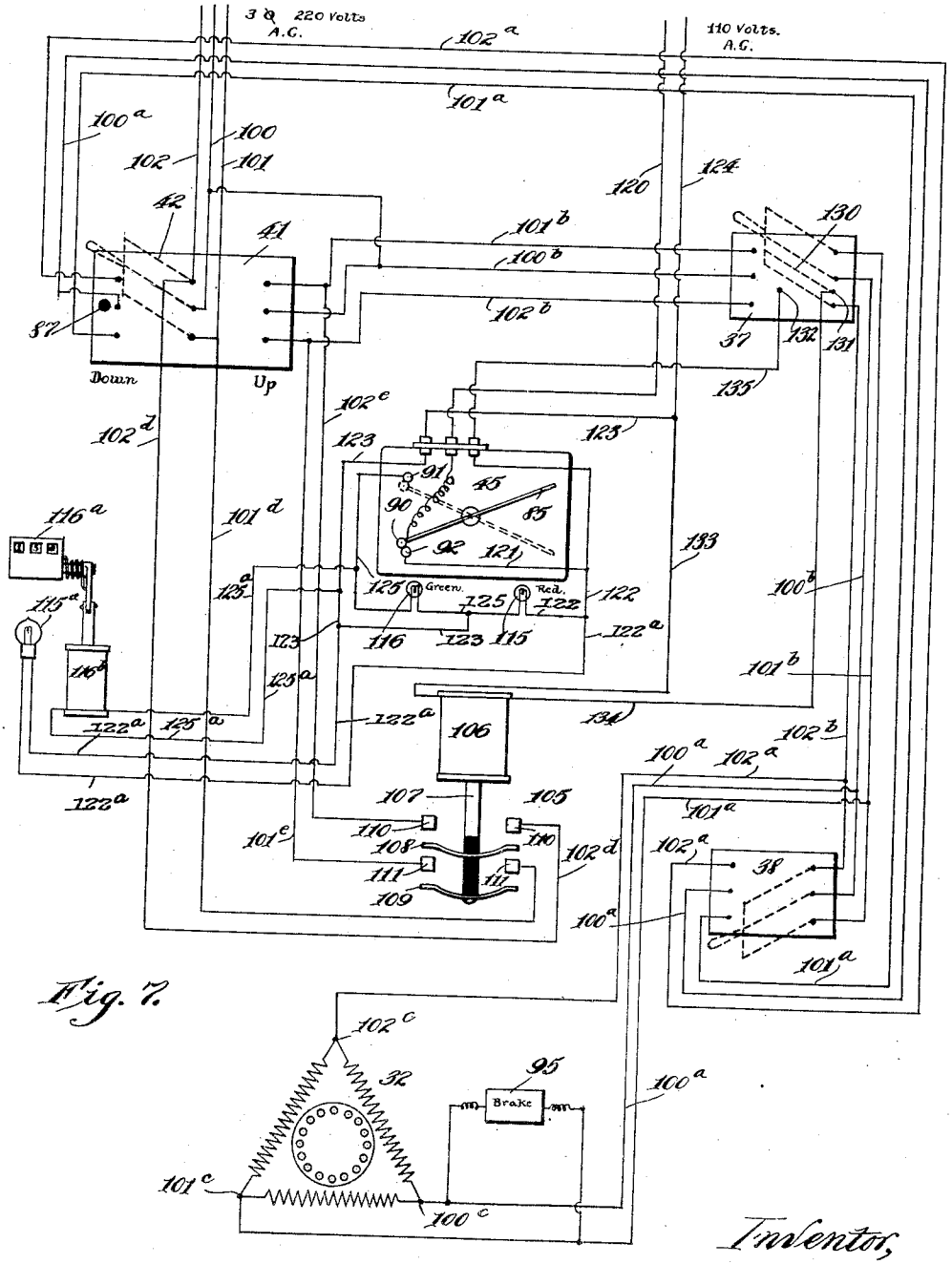


Fig. 7.

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UNITED STATES PATENT OFFICE.

JOSEPH M. KELLER, JR., OF CLEVELAND, OHIO.

TIMING MECHANISM AND APPARATUS INVOLVING THE SAME.

1,215,166. Specification of Letters Patent. Patented Feb. 6, 1917.

Application filed March 13, 1916. Serial No. 83,782.

To all whom it may concern:

Be it known that I, JOSEPH M. KELLER, Jr., a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Timing Mechanism and Apparatus Involving the Same, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to timing mechanism, and more particularly to a timing mechanism that is especially suitable for use with certain classes of machines or apparatus wherein a dwell of a definite period of time is required in their operation for the purposes of accomplishing a given result in the most satisfactory manner, and of realizing the results of their utmost capacity by preventing the consumption of more time than is actually required for such dwell.

While the timing mechanism of my invention may be used in numerous connections, as, for instance, wherever it is necessary to time the throwing of a switch, the operation of an actuating device, such as a clutch, etc., the same is peculiarly adaptable to spring cambering and tempering machines, and for this reason I have elected to show it herein in such connection, selecting for this purpose a spring cambering and tempering machine of the type disclosed in the application of Thomas J. Fay, Serial No. 857,522, filed August 19, 1914.

It may be briefly explained that in the use of these machines, they are associated with furnaces wherein the spring leaves or plates are heated before being placed in the cambering machine for forming and tempering. As will be more fully set forth hereinafter, a heated leaf or plate is placed upon a templet or form that is supported upon a movable table of the machine with which cooperates a complementary form or templet that is carried by a movable head, the templets and table being depressible into a vat of tempering solution where the spring leaf is held for a given length of time dependent upon the quality and thickness or cross-section of the spring, and upon the results desired. It is needless to say that the length of time the spring is submerged is important to the attainment of satisfactory and uniform results.

Now, when it is explained that one operator is required to handle a number of these machines, passing from one to the other while the springs are held submerged, it will be seen that unless some means is provided for accurately timing the submersion and then automatically actuating the machine to withdraw the spring from the tempering solution and for indicating when such operation is completed, not only unsatisfactory results in the tempering of the spring are obtained, but a material loss of time results from the fact that the springs are left in the machines longer than necessary and the full capacity of the machines is not realized. Also, indicating devices to show when the machines are idle will induce the workman to give the machines the required attention, and will indicate to the general overseer or foreman of the work any negligence on the part of the workman.

The objects of my invention are to provide a timing mechanism that may be conveniently attached to or incorporated in apparatus of the kind referred to, and which will accurately control the same as aforesaid; to provide an adjustment for the timing mechanism whereby the effective period thereof may be varied; to provide a safe guard against such adjustment being tampered with by unauthorized persons; and to provide a timing mechanism of the above character that is comparatively simple of construction; durable; convenient of operation and adjustment; that does not easily get out of order; to provide mechanism of this nature that can be incorporated in an apparatus of the sort above discussed without interfering with the usual manual control thereof; and wherewith visual indicators and recording devices may be employed to show the operations and status of the apparatus.

In the accompanying drawings I have shown the timing mechanism attached to a spring cambering and tempering machine of the kind above mentioned, and while I will proceed to describe it in such connection and in detail, I wish to be understood as not limiting myself to this particular use of the mechanism, or to the structural details of the embodiment illustrated, further than required by the terms of the annexed claims and rendered necessary by the state of the prior art.

In the drawings, Figure 1 is a sectional side elevation of a spring cambering and tempering machine to which is attached the

timing mechanism of my invention; Fig. 2 is a horizontal section through the mechanism and a portion of the main switch plate of the cambering machine to which the mechanism is attached; and Fig. 3 is a section on the line 3—3 of Fig. 2; Fig. 4 is a composite bottom plan and horizontal sectional view of the timing mechanism and a portion of the main switch plate and switch, the various planes of the view being indicated by line 4—4 of Fig. 3; Fig. 5 is a perspective view of the timing mechanism detached from the machine; Fig. 6 is a similar view of the operating handle used for regulating or adjusting the timing mechanism; and Fig. 7 is a diagram of the electric circuits and elements involved in the cambering machine and timing mechanism.

The spring cambering and tempering machine comprises, generally, a tank or vat 1 having all but its forward top portion closed by a cover 2, and from the bottom of which rises a frame 3, having a base 4, and a vertical guide 5 whereon a table 6, a head 7, and an auxiliary head 8 are reciprocable. The heads 7 and 8 are connected by bolts 9 which pass freely through the latter and are threaded into the former, thus permitting the heads to move to a limited extent with respect to each other; and compression springs 9^a, interposed between the heads, tend to maintain them separated to the extent permitted by the bolts 9. A post 10 rises from a boss 11 of the base 4, and helps to support, at its upper end, a bracket 12 that is attached to and extends rearwardly from the upper end of the frame 3. A pair of guide pulleys 13 and 14 are supported on each side of the upper end of the machine, and chains 15, having one end of each attached to the table 6, pass upward through tubular bosses 18 of the head 7, over the pulleys 14 and 13, and have their opposite ends secured to a plate 20 that is guided upon the post 10, and is normally supported by a cushion spring 21, that surrounds said post and bears upon a plate 22, mounted on the cover 2 of the tank 1. A series of weights 23 are carried by the plate 20 and serve to hold the table 6 suspended in normal position. While it is possible to show but one chain 15 and pair of pulleys 13 and 14 in the side elevation of Fig. 1, it will be understood that they are duplicated on the opposite side of the machine.

A casing 25 is attached to and projects forward of the upper end of the frame 3, and a worm 26 and worm wheel 27 (both shown in dotted lines) are contained within the casing, and the worm shaft 28 extends rearwardly therefrom and has attached to it a pulley 29. An endless belt 30 is trained over the pulley 29 and a similar pulley 31 that is attached to the shaft of a motor 32, mounted upon a bed 33, that is supported by the tank or vat 1. While I have specified a belt and pulleys as the transmitting mechanism between the motor and the worm, it will be understood that the same may constitute what is commonly known as a noiseless chain and coöperating gears, or any other satisfactory equivalent thereof.

A threaded shaft 35 is guided through the casing 25 and has its lower end secured to the auxiliary head 8. The hub of the worm wheel 27 constitutes a nut through which the shaft 35 extends, and as the worm wheel is rotated, therefore, the shaft will be raised or lowered according to the inclination of the threads and direction in which the worm wheel is turned, to move the head 7 and auxiliary head 8 along the guide 5.

When the electric circuits of the machine are described in connection with Fig. 7, it will be seen that the motor 32 is reversible and that, when it is driven in one direction, it will lower the head, and when in the other direction, will elevate the same through the gearing above described.

What will be referred to as a top limit switch 37, and a bottom limit switch 38 are supported upon suitable brackets which extend from the side of the frame 3 and support the switches 37 and 38 in such a position that their handles are engaged by the ends of rods 39 that are shown as adjustably supported by the auxiliary head 8.

The casing 40 of my timing mechanism is shown as supported from the rear of the plate 41 of the main switch 42 of the cambering machine, and the switch plate is suspended from the casing 25, by bars 43. A clock work mechanism, shown generally at 45, in Figs. 2, 3, 4, and diagrammatically in Fig. 7, is suspended from a cover 46 of the casing, such cover being held to the casing by screws 47.

Posts 50 depend from the cover, and to the lower end of these posts is attached a frame that is made up of side plates 51 and 52, and spacers 53. The clock work mechanism may be of any approved type, for numerous well known styles would be adaptable to the purpose, and it is deemed sufficient to state that the same comprises, generally, a spring arbor 60, and a governor shaft 61, between which a train of transmission gearing is interposed. It will be understood, of course, that such gearing includes the spring 62, having one of its ends attached to the arbor 60 and its opposite end to a part of the frame, as shown at 63. A ratchet 64 is secured to the spring arbor and coöperates with a pawl 65, that is held in engagement with the ratchet, by a spring 66, to drive the gear 67 when the arbor is rotated by the unwinding of the spring, the gear 67 being rotatably mounted upon the arbor and carrying the pawl 65.

Beyond the lower plate 52 of the clock work frame, the shaft 61 has fastened to it

an aluminum disk 68 which rotates between the poles of a permanent magnet 70, that is secured to a shaft 72, journaled within the bottom of the casing, and having an enlargement 73 therebeyond which occupies a hollow boss 74 of the casing. Beyond the enlargement 73 the shaft is shown as having three right angle flattened sides to give the end of the shaft a peculiar formation, such part being designated 75. The end of the shaft is so shaped for the application of the socketed end of a key or operating handle 76, the end of the handle being of a size to conveniently fit within the hollow boss 74. The operating handle has an indicating finger 77 for coöperation with a series of indications 78, inscribed upon the bottom of the casing. Upon the application of the handle to the extension 75 of the shaft 72, the magnet 70 may be adjusted angularly, and the same is held in any of its adjusted positions by a plunger 80 which has a tapered end for coöperation with a series of depressions 81, in the enlargement 73 of the shaft, the plunger 80 being guided within a bore that is formed in a latter extension of the boss 74 and wherein there is confined a spring 82 between the plunger and the end of a plug 83 which closes the outer end of the bore.

The aluminum disk 68 and magnet 70 constitute a very satisfactory dampener or governor of a well known type, and by adjusting the faces of the magnet inward and outward between the center of the disk and its periphery, the speed of the disk may be changed, it being understood that the speed is reduced as the magnet approaches the periphery of the disk, and vice versa.

An arm 85 is rigidly secured to the spring arbor 60, and one of its ends is connected by a link 86, to the rear end of a push rod 87 that is guided within a hollow cylindrical boss 88, shown as formed in the forward right hand corner of the casing 40. The switch plate 41 is provided with an aperture through which the push rod extends in a position to be engaged by the bridge of the main switch 42. It will be observed that the rear end of the push rod 87 is reduced in diameter, and a spring 89 is interposed between the shoulder thus formed and the end wall of the hollow boss 88. This spring tends to push the rod outward, although the same is sufficiently weak not to affect the action of the clock work mechanism. The end of the arm 85, opposite the end which has connection with the push rod 87, carries a two-faced contact member 90, that is shown as insulated from the arm. The opposed faces of the contact member 90 are arranged to coöperate with contacts 91 and 92 that are carried by the frame of the clock work mechanism. The effect of the engagement of the contact member 90 with the contacts 91 and 92 will be described in connection with the circuit diagram.

The momentum of the motor 32 is overcome by a brake 95 that is magnetically released, the brake involving means for setting it when the magnet of the brake is deenergized. Brakes of this nature are common, and a more detailed description of it is deemed unnecessary.

By referring to the diagram of Fig. 7, I will first describe the main actuating circuit of the machine, or that which is incorporated in the apparatus independently of my timing mechanism; and I will then explain the auxiliary circuit in which my timing mechanism and the magnet switch controlled thereby, are included.

The diagrammatic representations of the various mechanical elements of the apparatus, such as motor, brake, switches, etc., have the same reference numerals applied to them in Fig. 7, as are used to designate them in other figures of the drawings, and to expedite the reading of the diagram, the names of some of the elements have been applied thereto.

A three-phase circuit of 220 volts, alternating current is employed for driving the motor represented at 32. It has already been stated that the motor is reversible, and such reversal is accomplished by changing the relation of the branches of the circuit, and this is attained, ordinarily, through the main switch 42, having two sets of contact points with either of which the blades of the switch may be engaged. When the switch blades are thrown into engagement with one set of contact points, the motor will be driven in one direction, and reversed, when the blades are thrown into engagement with the other set. Where the three branches of the circuit lead to the main switch, they are numbered, respectively, 100, 101, and 102. The central branch 100 has connection with the corresponding blade of the switch, and when the switch is thrown to the left to drive the motor in a direction to depress the head and table of the machine, the aforesaid branch of the circuit is continued through the wire designated 100^a. Likewise, the branches 101 and 102 continue through the wires 101^a and 102^a, respectively. These wires lead ultimately to the three points or binding posts 100^c, 101^c and 102^c, respectively, of the motor, through what has been referred to as the bottom limit switch 38. This is all very clearly shown in the diagram.

When the blades of the main switch are thrown into engagement with the other set of contact points, to drive the motor in the reverse direction and elevate the head and table of the machine, what has been conveniently referred to as the central branch 100 of the circuit, continues on through

wire 100^b, through the top limit switch 37, to where it connects with that branch of the wire 100^a that leads direct to the binding post 100^c of the motor. It will be observed, however, that the corresponding branches of the wires 101^a and 102^a—or those which lead directly to the respective binding posts 101^c and 102^c of the motor—connect, the first with a wire 101^b which leads, through the top limit switch 37, to the upper contact point of the set now under consideration, while the other wire 102^a has connection with a wire 102^b which leads, through the top limit switch, to the bottom contact point of the main switch. It will be seen from this that the branch 101 of the circuit, which originally had connection with the binding post 101^c of the motor now has connection, through the wire 102^b, with the binding post 102^c, the third binding post 100^c of the motor remaining constantly connected with the central branch 100, through the adjacent portion of the wire 100^a, the wire 100^b, and the central contact point of the switch.

Considering the operation of the machine as controlled through the main switch, it will be seen that when the switch is thrown to the left (the side designated "down"), the motor will be energized and will drive the head and table of the machine downward until the lower end of one of the rods 39 engages the operating handle of the bottom limit switch 38 and opens such switch, thus breaking the motor circuit. It will be remembered that as the upper end of the other rod 39 leaves the operating handle of the top limit switch 37, such switch is closed through the influence of the spring 39^a, which has connection with and tends to draw toward each other the operating handles of the limit switches 37 and 38. The parts will now remain at rest until the main switch is thrown in the opposite direction, (or to the side designated "up"), when the circuit will be established through the top limit switch, to drive the motor in a reverse direction and elevate the head and table of the machine, the upper end of the last mentioned rod 39 engaging the operating handle of the top limit switch 37 and opening such switch, thereby breaking the driving circuit.

The motor brake 95 bridges between the constant branch of the motor circuit and both of the other branches, and is therefore energized at all times the motor is in operation, the brake becoming effective upon the opening of either of the last mentioned branches.

Now the object of including my timing mechanism is to render automatic the closing of the circuit which drives the motor in a direction to elevate the head and table of the machine. For this reason, when my timing mechanism is employed, the operator is concerned only with the closing of the main switch in a direction to drive the aforesaid parts of the machine downward. It may be said, therefore, that the other side of the main switch has substituted for it a magnetic switch shown generally at 105, in Fig. 7. This may constitute, for the purpose of illustration, a solenoid 106 having a core 107 which carries a pair of contact plates 108 and 109, the former bridging the gap between the contact points 110, and the latter, the gap between the contact points 111. In making the substitution of the magnetic switch for the "up" side of the main switch, the branch 102 of the actuating circuit is continued on through the wire 102^d, to one of the contact points 110, and, when the magnetic switch is closed, through the plate 108, opposite contact point 110, wire 102^e to the wire 101^b, where it finally leads to the motor through a course already described. The branch 101 of the actuating circuit continues on through wire 101^d to the contact point 111, plate 109, opposite contact point 111, and wire 101^e, to the wire 102^b.

My timing mechanism is used to control the magnetic switch 105. As previously mentioned, the timing mechanism includes visual indicators, the same being in the form of electric lamps 115 and 116, and, for convenience, the respective lamps 115 and 116 are designated, in the drawing, "Red" and "Green."

It may be explained at this time that in some connections in which my invention is used, it may be advantageous to incorporate an annunciator or recorder which may be located at some remote point with respect to the machine whereon the timing mechanism is used, as in the office of the plant, or in the foreman's or inspector's booth, to indicate to the person having general oversight of the work, the number of times the machine is operated, and also when the machine is idle. I very simply make provision for this by placing an electric lamp 115^a in multiple with the former electric lamp 115, and a recorder or counter 116^a of any approved form, that is shown as actuated by a solenoid 116^b, that is in multiple with the lamp 116, as will be seen from an inspection of the diagram of Fig. 7 and from the following description of the wiring.

For obvious economic reasons I prefer to employ a 110-volt alternating current circuit for the actuation of the magnetic switch 105, the illumination of the electric lamps 115, 115^a, 116, and the energization of the solenoid 116^b. One leg of the 110-volt circuit is represented by the wire 120, and leads to the contact member 90, carried by the arm 85, and when the parts are in normal position or at rest, as shown in full lines

in Fig. 7, the contact member is in engagement with the contact 92, from which wires 121 and the respective wires 122 and 122ª lead, through the lamps 115 and 115ª, to the wire 123, which has connection with the wire 124, that represents the opposite side of the circuit. Therefore, when the machine is not in operation, the red lamp 115 and the lamp 115ª will remain illuminated. When the operating handle of the main switch is depressed to cause the motor to drive the head of the machine downward, the bridge of the switch engages the push rod 87 of the timing mechanism, as previously described, and forces it inward to swing the arm 85 to the position shown in full lines in Fig. 2, and in dotted lines in Fig. 7. In such position, the contact member 90 is in engagement with the contact 91, and the current will now flow from the wire 120 through the respective wires 125 and 125ª, to the solenoid 116ᵇ and the "green" lamp 116, and return through the wire 123, to the opposite side of the circuit. The main switch being held closed during the downward travel of the head of the machine, the "green" lamp remains lighted; but as soon as the head reaches the lower limit of its movement, the bottom limit switch 38 is opened by the engagement of the previously mentioned rod 39 with the operating handle of said switch, and the circuit to the motor is broken, deënergizing the motor and its brake 95, and allowing the brake 95 to arrest the momentum of the motor. A leaf spring 150 (see Figs. 2 and 4) is preferably employed for opening the main switch, the same having one of its ends fastened to the plate 41 and its other or free end engaging the bridge of the switch and exerting an outward thrust thereon when the switch is closed. The main switch may now be released, allowing the leaf spring 150 to open the switch, thus releasing the push rod 87, so that the arm 85 may be swung to its normal position, under the influence of the spring 62. The speed with which the arm will return to its normal position is governed, as has already been explained, by the dampener or governor constituting the magnet 70 and disk 68.

It will be remembered that, immediately after the start of the head of the machine downward, the rod 39 is withdrawn from the operating handle of the top limit switch, allowing such switch to close, thus placing the "up" circuit in readiness for closing through the operation of the magnetic switch 105. A fourth plate, designated 130, is incorporated in the top limit switch and serves to bridge the contacts 131 and 132, when such switch is closed.

I may explain at this time that it is preferable to have the circuit including the blade 130 of the top limit switch remain closed an instant longer than that established through the other blades of the switch, for a reason that will presently become apparent. This result is conveniently accomplished by setting the elements constituting the contact 132, and which are of practically the same length as those with which the other blades of the switch coöperate, as shown in Fig. 1, nearer the pivoted ends of the blades, so that as the switch is opened, its blade 130 will linger between the elements of its contact for an instant after the other blades have withdrawn from their contacts.

It will be observed that the side of the circuit represented by the wire 124 leads, through the wire 133, to the coil of the solenoid 106 of the magnetic switch 105, the opposite side of such coil having connection, through the wire 134, with the contact 131. The opposite contact point 132 leads through the wires 135 and 121 to the contact 92 of the timing mechanism. Therefore, when the timing mechanism, under control of the dampener or governor above referred to, returns to normal position, the circuit including the foregoing elements, is completed through the contact member 90 and the wire 120. From this it will be seen that, when the time determined by the adjustment of the magnet 70 has expired, a circuit is established through the solenoid 106 of the magnetic switch 105, actuating such switch and bridging the pairs of contacts 110 and 111, completing a circuit already described in detail and through which the motor 32 is reversed from the direction given it by the circuit established through the "down" side of the main switch 41. The magnetic switch 105 remains closed, and the circuit established thereby intact, until the operating handle of the top limit switch is engaged by the rod 39 and opened, whereupon the magnetic switch is deënergized and the "up" side of the main (or 220-volt) circuit is consequently opened to stop the operation of the machine.

By reason of the difference in time, as above explained, between the opening of the circuit controlled by the blade 130 of the top limit switch and including the coil of the magnetic switch 105, and the opening of the motor actuating circuit which flows through the other blades of the top limit switch and through the contact elements of the magnetic switch, the magnetic switch will remain closed for an instant after the motor actuating circuit is opened, so that when the magnetic switch is allowed to open, its contact elements will separate without the possibility of an arc, thus preserving it indefinitely against injury.

It will be seen from the foregoing that by the use of my invention the control of apparatus embodying the same, so far as the

time during which it remains effective is concerned, is placed beyond the will of the operator and into the hands of the person primarily responsible for the work, assuring the most satisfactory results in the quality of the products, and in quantity, also, by inducing the operator to work the apparatus to its full capacity by notifying him, as well as the person in general charge, when the apparatus has completed an operation and is ready for another.

Having thus described my invention, what I claim is:—

1. The combination with apparatus involving means for actuating the same to inaugurate a process, and means independent of the first for actuating the apparatus to terminate such process, of timing mechanism that is set in action by the operation of the first mentioned means and actuates the second mentioned means upon the completion of the action of said timing mechanism, and means for regulating the duration of such action.

2. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electro-magnetic device for operating the second means, timing mechanism that is set in action by the operation of the first means and comprising contact members that are brought into engagement thereby after a predetermined period of time, and an electric circuit including the electromagnetic device and the aforesaid contact members.

3. The combination with apparatus involving means for actuating the same to inaugurate a process, an electric circuit for actuating the apparatus to terminate such process, a switch for closing said circuit, timing mechanism that is set in action by and upon the actuation of the first mentioned means and which closes the aforesaid switch upon the termination of its action, and means for regulating the duration of the action of said timing mechanism.

4. The combination with apparatus involving means for actuating the same to inaugurate a process, an electric circuit for actuating the apparatus to terminate such process, a switch for closing said circuit, timing mechanism that is set in action by and upon the actuation of the first mentioned means and which closes the aforesaid switch.

5. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and said movable member for moving the member in the first direction when said means is operated, a contact member wherewith the movable member engages when said movable member assumes normal position, and an electric circuit including the electromagnetic device, the aforesaid contact member, and the movable member.

6. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and said movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the movable member engages when in normal position and with the other of which said movable member engages when at the limit of its movement from such normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned of the aforesaid contact members, and the movable member, and a second electric circuit including the aforesaid electromagnetic device, the other of said contact members, and the movable vibratory member.

7. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and said movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the movable member engages when in normal position and with the other of which said movable member engages when at the limit of its movement from such normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned of the aforesaid contact members, and the movable member, a second

electrical indicating device, and a second electric circuit including the aforesaid electromagnetic device, the second indicating device, the other of said contact members, and the movable member.

8. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and said movable member for moving the member in the first direction when said means is operated, a contact member wherewith the movable member engages when said movable member assumes normal position, an electric circuit including the electromagnetic device, the aforesaid contact member, and the movable member, and a governing device for regulating the speed with which the movable member is permitted to return to normal position.

9. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and said movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the movable member engages when in normal position and with the other of which said movable member engages when at the limit of its movement from such normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned of the aforesaid contact members, and the movable member, a second electric circuit including the aforesaid electromagnetic device, the other of said contact members, and the movable member, and a governing device for regulating the speed with which the movable member is permitted to return to normal position.

10. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and the movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the aforesaid movable member engages when in normal position and with the other one of which the movable member engages when at the limit of its movement from normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned contact member, and the movable member, a second electric circuit including the other contact member, the movable member, and the aforesaid electromagnetic device, gearing that is operated by the power storing element when moving the movable member to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of said disk is arranged to rotate, and means for adjusting the poles of the magnet between the center and periphery of the disk.

11. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and the movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the aforesaid movable member engages when in normal position and with the other one of which the movable member engages when at the limit of its movement from normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned contact member, and the movable member, a second electric circuit including the other contact member, the movable member, and the aforesaid electromagnetic device, gearing that is operated by the power storing element when moving the movable member to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of said disk is arranged to rotate.

12. The combination with apparatus involving means for actuating the same to inaugurate a process, and further means for actuating the apparatus to terminate such process, of an electromagnetic device for operating the second means, timing

mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, operative connections between the first mentioned means and the movable member for moving the member in the first direction when said means is operated, a pair of contact members with one of which the aforesaid movable member engages when in normal position and with the other one of which the movable member engages when at the limit of its movement from normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned contact member, and the movable member, a second electric circuit including the other contact member, the movable member, and the aforesaid electromagnetic device, gearing that is operated by the power storing element when moving the movable member to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of said disk is arranged to rotate, means for adjusting the poles of the magnet between the center and periphery of the disk, and means for indicating the adjustment of the magnet.

13. The combination with apparatus having an element movable into a position to inaugurate a process, an electric circuit including a motor for moving said element, a switch for closing said circuit, a circuit breaker for opening said circuit, said circuit breaker being actuated by a part of said movable element when said element has reached substantially the limit of its movement, a second electric circuit for returning the element to normal position, and a magnetic switch for closing said second circuit, of timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction to normal position, operative connections between the aforesaid switch and said movable member for moving the movable member in the first direction when said switch is closed, a contact member wherewith the movable member engages when the latter is in normal position, an electric circuit including the contact member, the movable member and the electromagnet winding of the aforesaid magnetic switch, and a circuit breaker for opening the second mentioned circuit of the apparatus, said circuit breaker being actuated by the aforesaid element as it approaches normal position.

14. The combination with apparatus having an element movable into a position to inaugurate a process, an electric circuit including a motor for moving said element, a switch for closing said circuit, a circuit breaker for opening said circuit, said circuit breaker being actuated by a part of said element when said element has reached substantially the limit of its movement, a second electric circuit for returning the element to normal position, and a magnetic switch for closing said second circuit, of timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction to normal position, operative connections between the aforesaid switch and said movable member for moving the movable member in the first direction when said switch is closed, a contact member wherewith the movable member engages when the latter is in normal position, an electric circuit including the contact member, the movable member, and the electromagnet winding of the aforesaid magnetic switch, a circuit breaker for opening the second mentioned circuit of the apparatus, said circuit breaker being actuated by the movable element as it approaches normal position, and means for regulating the duration of movement of the movable member.

15. The combination with apparatus to be actuated, of an electromagnetic device for actuating the same, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, means for moving the member in the first direction, a pair of contact members with one of which the movable member engages when in normal position and with the other of which said movable member engages when at the limit of its movement from such normal position, an electrical indicating device, an electric circuit including said indicating device, the last mentioned of the aforesaid contact members, and the movable member, a second electric circuit including the aforesaid electromagnetic device, the other of said contact members and the movable member, and a governing device for regulating the speed with which the movable member is permitted to return to normal position.

16. The combination with apparatus to be actuated, of an electromagnetic device for actuating the same, timing mechanism comprising a power storing element, and a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction, means for moving the member in the first direction, a contact member with which the aforesaid movable member engages when in normal position, an electric circuit including the contact member, the movable member, and the aforesaid

electromagnetic device, gearing that is operated by the power storing element when moving the movable member to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of said disk is arranged to rotate, means for adjusting the poles of the magnet between the center and periphery of the disk, and means for indicating the adjustment of the magnet.

17. In timing mechanism of the character set forth, the combination of a power storing element, a movable member operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction to normal position, means for moving the member in the first direction, a pair of contact members, a contact member carried by the movable member for engagement with one of the pair of contact members when in normal position and for contact with the other when at the extreme limit of its movement from such normal position, and means for regulating the duration of movement of the movable member.

18. In timing mechanism of the character set forth, the combination of a power storing element, a movable actuator operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction to normal position, means for moving the actuator in the first direction, gearing operated by the power storing element when moving the actuator to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of the disk is arranged to travel, a casing inclosing the aforesaid parts, and a shaft to which the magnet is secured, said shaft extending through and journaled within one wall of the casing, the protruding end of the shaft being formed for the application of a shaft turning device, the casing having a series of indications and the shaft turning device a pointer for coöperation with the indications to indicate the adjustment of the magnet.

19. In timing mechanism of the character set forth, the combination of a power storing element, a movable actuator operatively connected thereto for movement in one direction to store power in the element and movable thereby in the opposite direction to normal position, means for moving the actuator in the first direction, gearing operated by the power storing element when moving the actuator to normal position, a disk rotated by said gearing, a magnet between the poles of which a portion of the disk is arranged to travel, a casing inclosing the foregoing parts, means outside the casing and operatively connected to the magnet for adjusting the poles of said magnet between the center and periphery of the disk, and further means for indicating the various positions of the magnet.

20. The combination with apparatus having an element movable into a position to inaugurate a process, an electric circuit including a motor for moving said element, a switch for closing said circuit, a circuit breaker for opening said circuit, said circuit breaker being actuated by a part of said movable element when said element has reached substantially the limit of its movement, a second electric circuit for returning the element to normal position, and a magnetic switch for closing said second circuit, of a time switch mechanism for controlling the supply of current to the magnetic switch, and a circuit breaker for opening the second mentioned circuit of the apparatus, said circuit breaker being actuated by the aforesaid element as it approaches normal position.

21. The combination with apparatus having an element movable into a position to inaugurate a process, an electric circuit including a motor for moving said element, a main switch for closing said circuit, a circuit breaker for opening said circuit, said circuit breaker being actuated by a part of said movable element when said element has reached substantially the limit of its movement, a second electric circuit for returning the element to normal position, and a magnetic switch for closing said second circuit, of a time switch mechanism for controlling the supply of current to the magnetic switch, said mechanism being set in operation by and upon the operation of the main switch, and a circuit breaker for opening the second mentioned circuit of the apparatus, said circuit breaker being actuated by the aforesaid element as it approaches normal position.

22. The combination with apparatus having an element movable into a position to inaugurate a process, an electric circuit including a motor for moving said element, a switch for closing said circuit, means for opening said circuit when said element has reached substantially the limit of its movement, a second electric circuit for returning the element to normal position, and a switch for closing said second circuit, of timing mechanism for controlling the last mentioned switch.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

JOSEPH M. KELLER, Jr.

Witnesses:
R. L. Bruck,
H. B. McGill.