J. H. BOBBITT.

THERMO-ELECTRIC FURNACE REGULATOR.

APPLICATION FILED OCT. 7, 1908.

962,884.

Patented June 28, 1910.

6 SHEETS—SHEET 1.

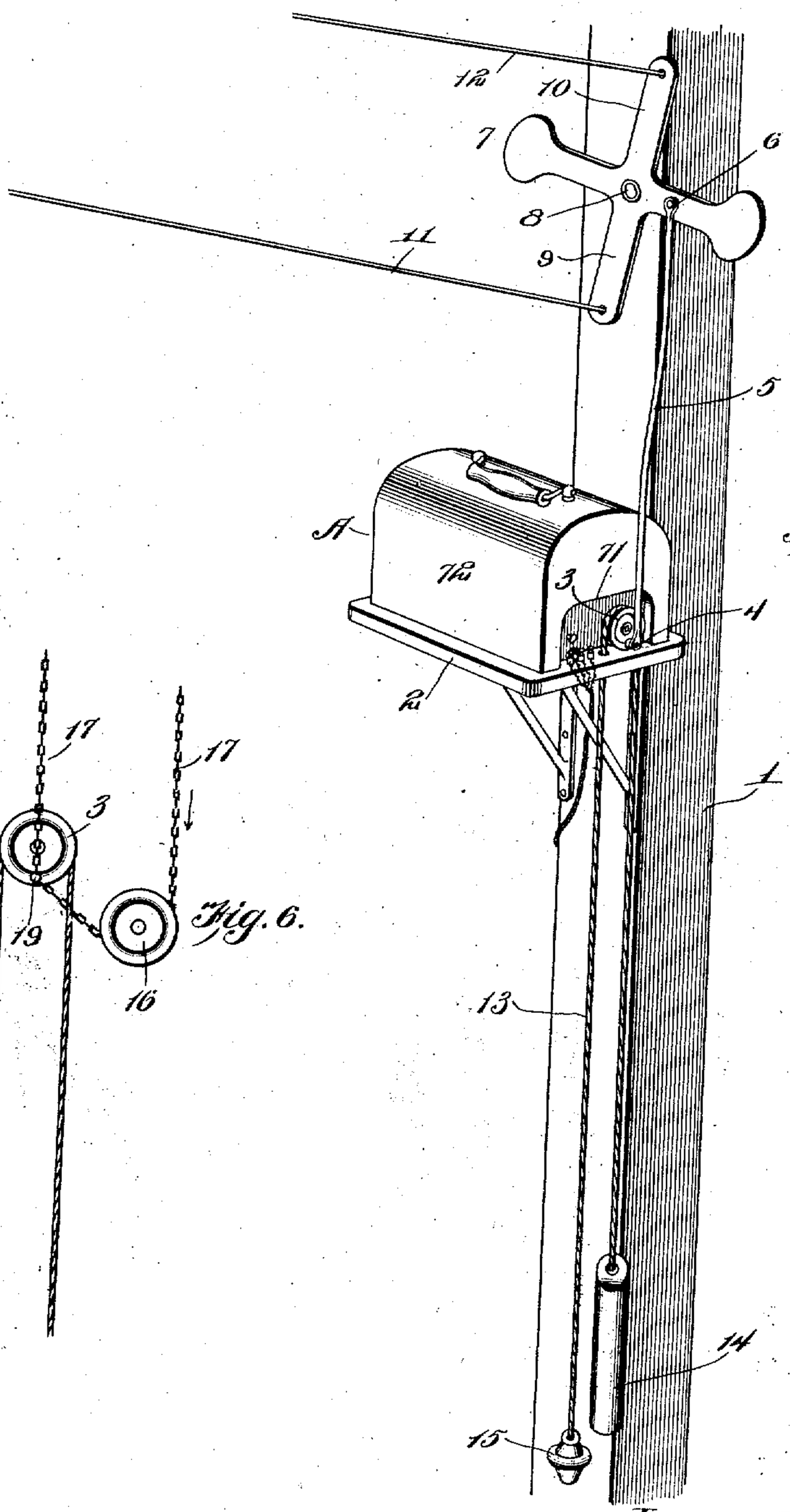

Fig. 1.

Fig. 6.

Witnesses

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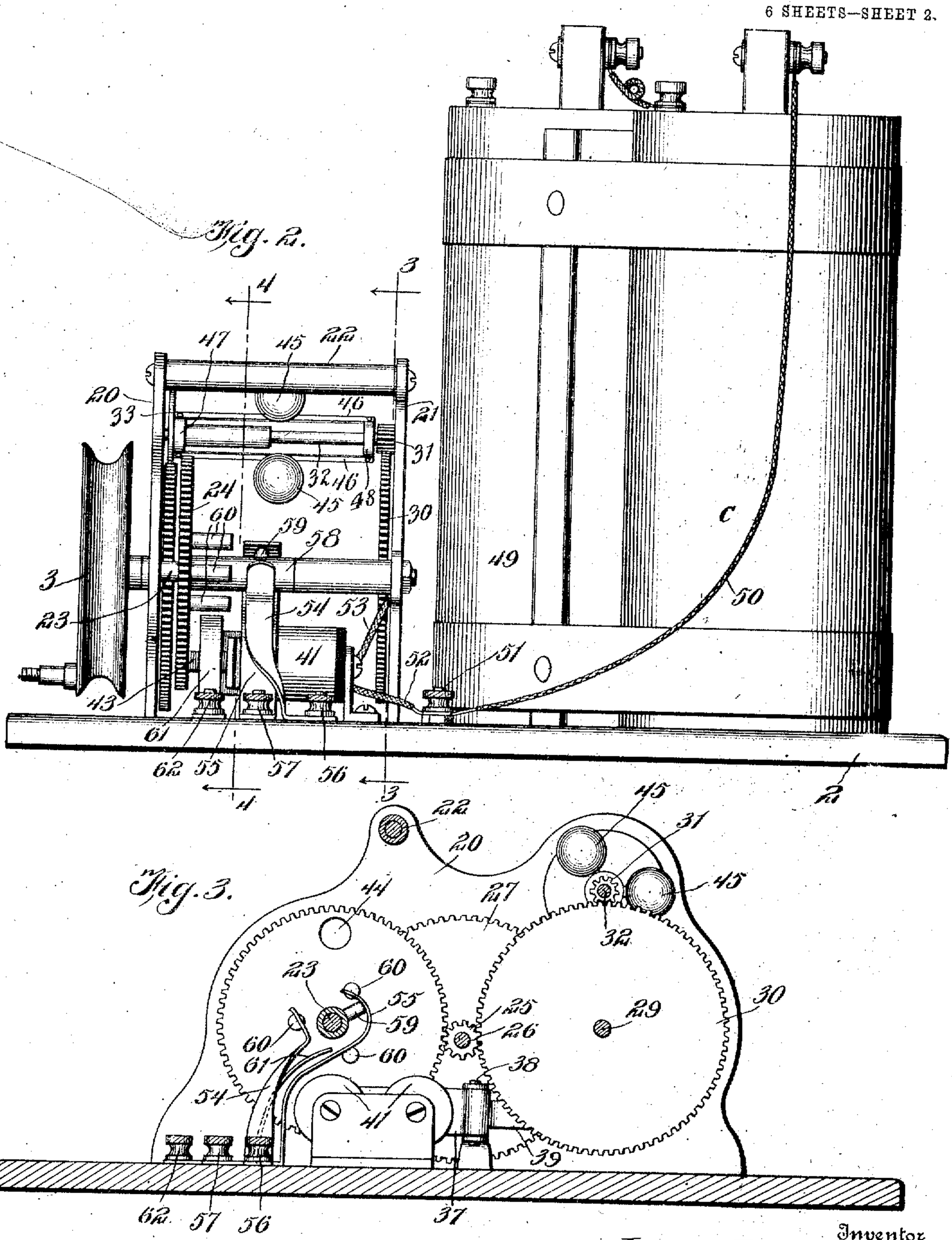
6 SHEETS—SHEET 2.

Fig. 2.



Witnesses

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6 SHEETS—SHEET 3

Fig. 4.

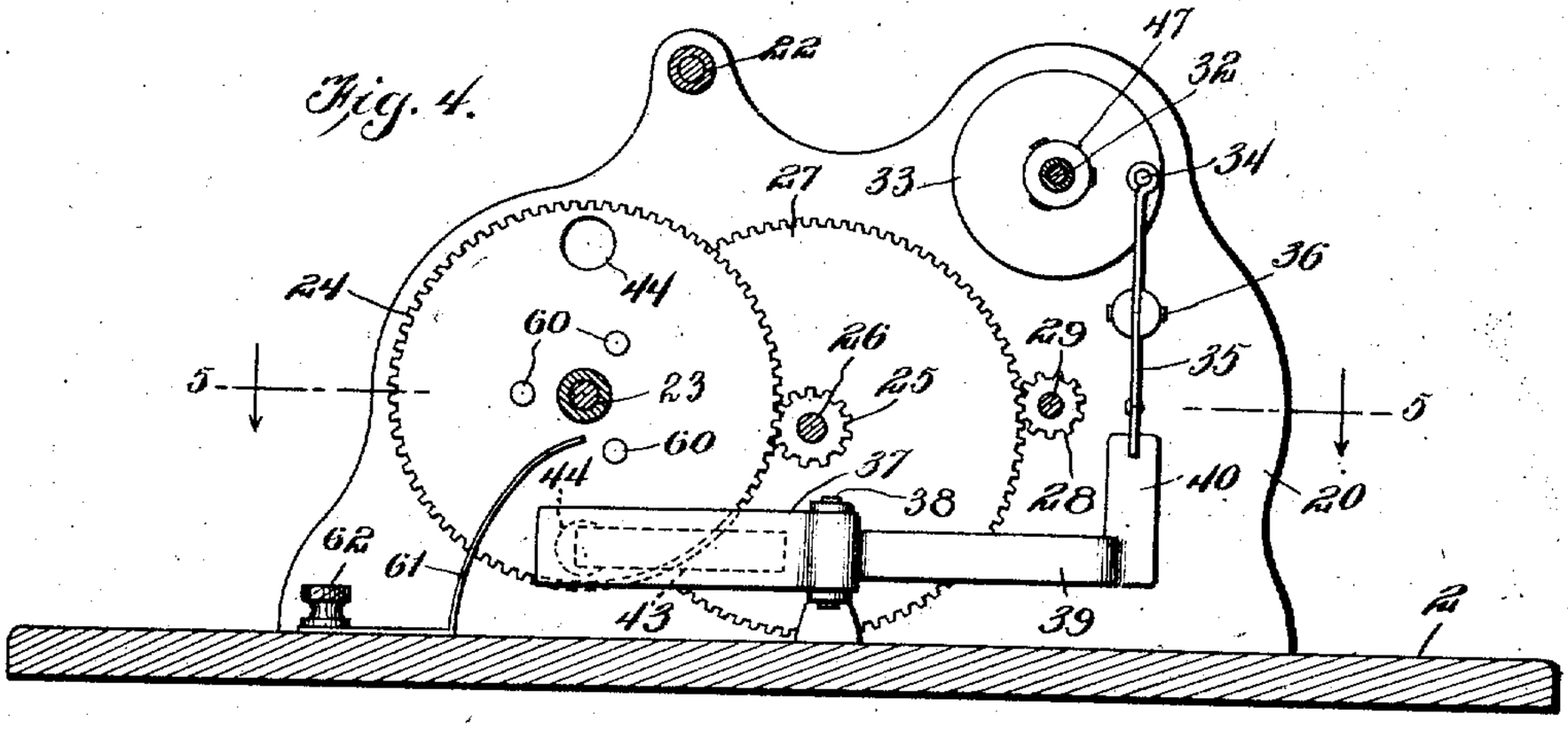

Fig. 5.

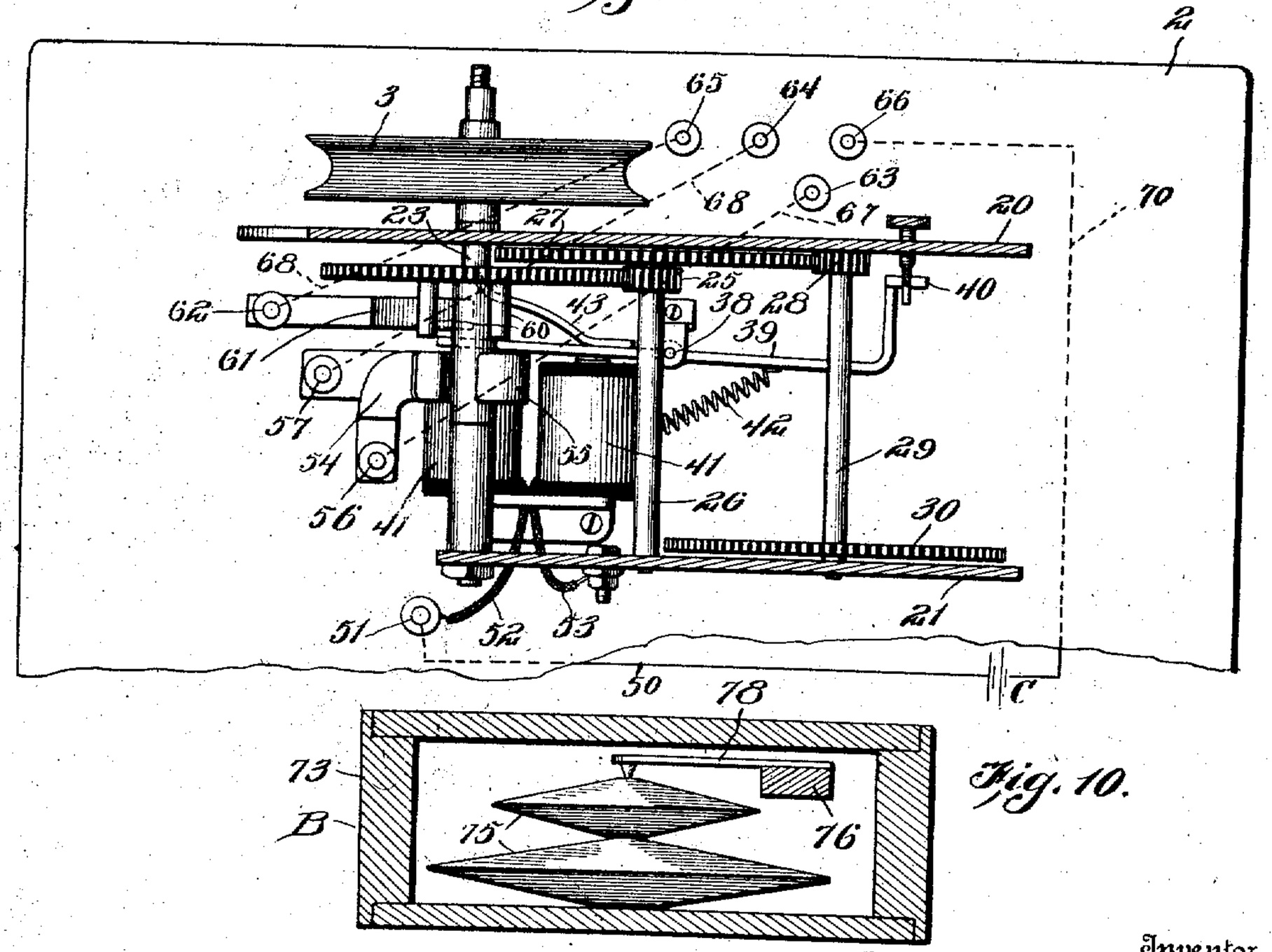

Fig. 10.

Witnesses

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6 SHEETS—SHEET 4.

Fig. 7.

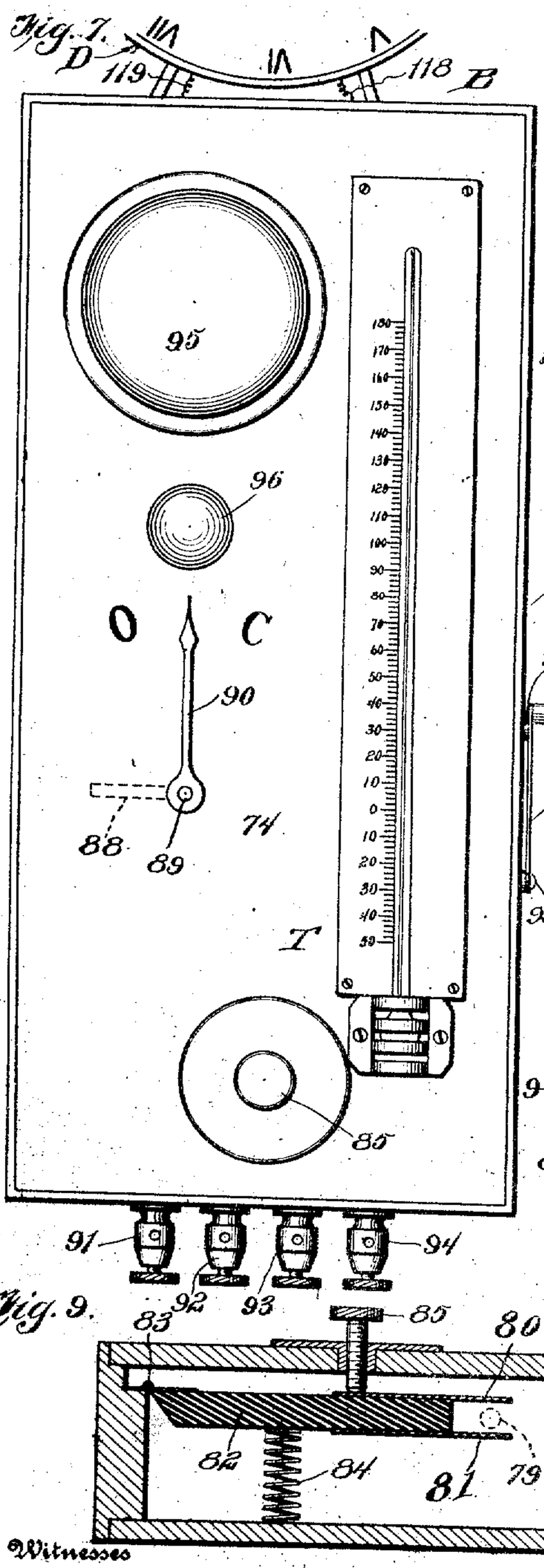

Fig. 8.

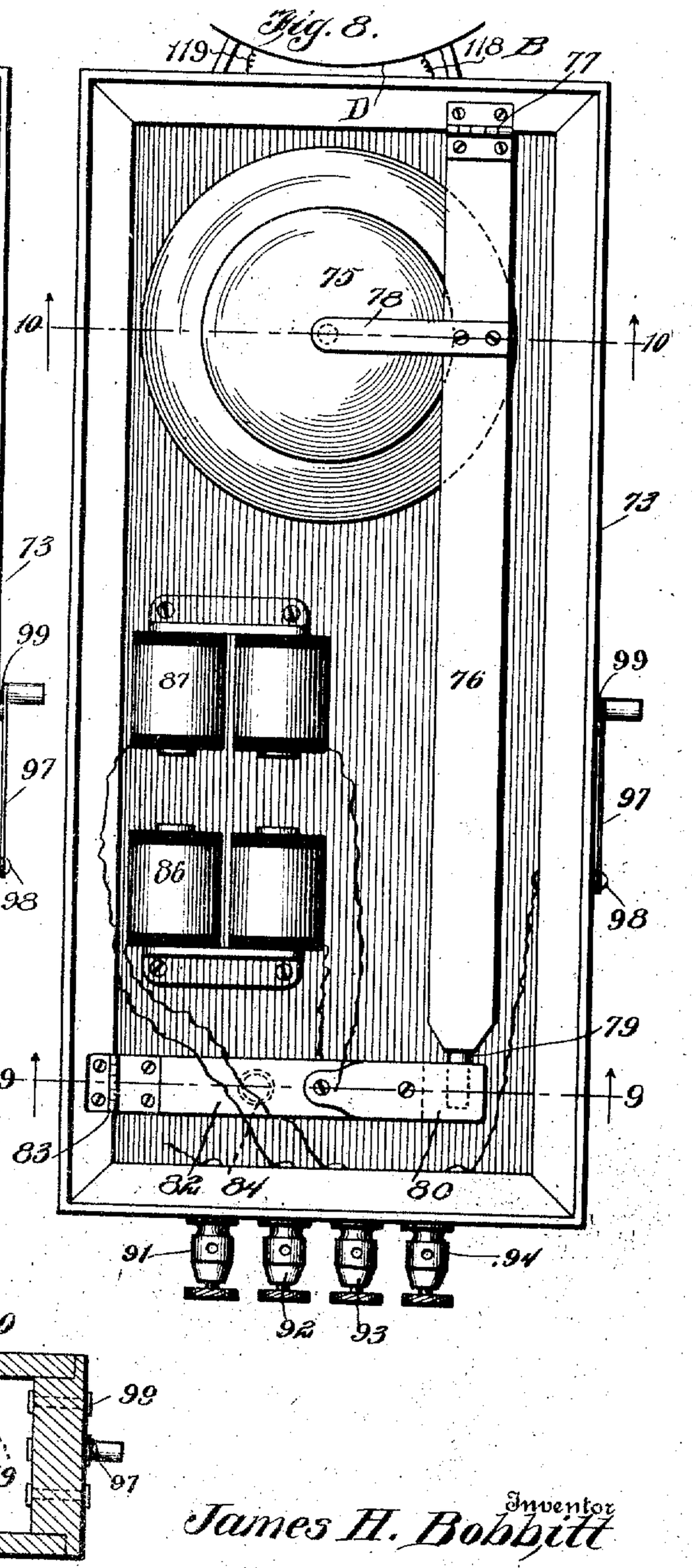

Fig. 9.

Witnesses

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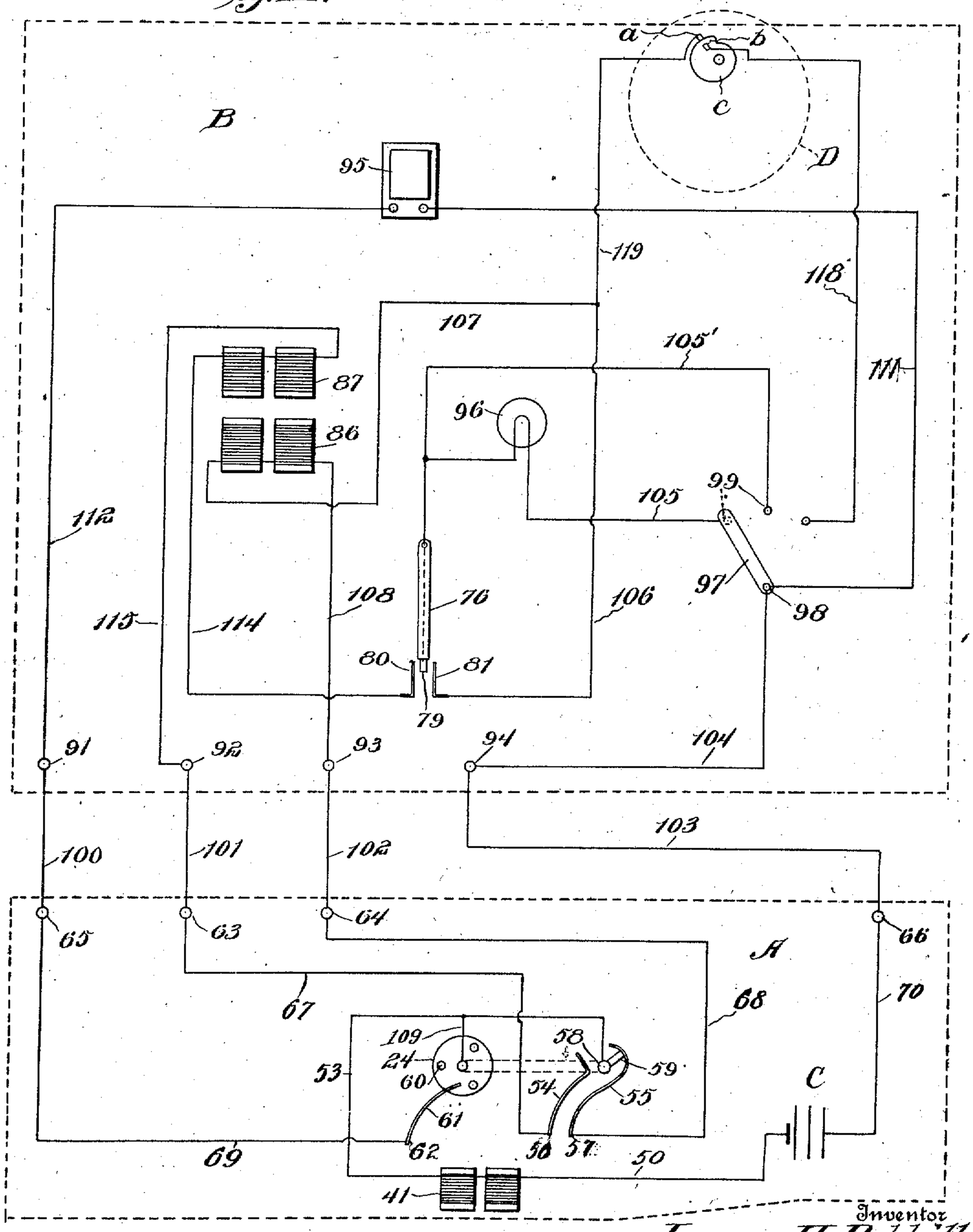
6 SHEETS—SHEET 5.

Fig. 11.



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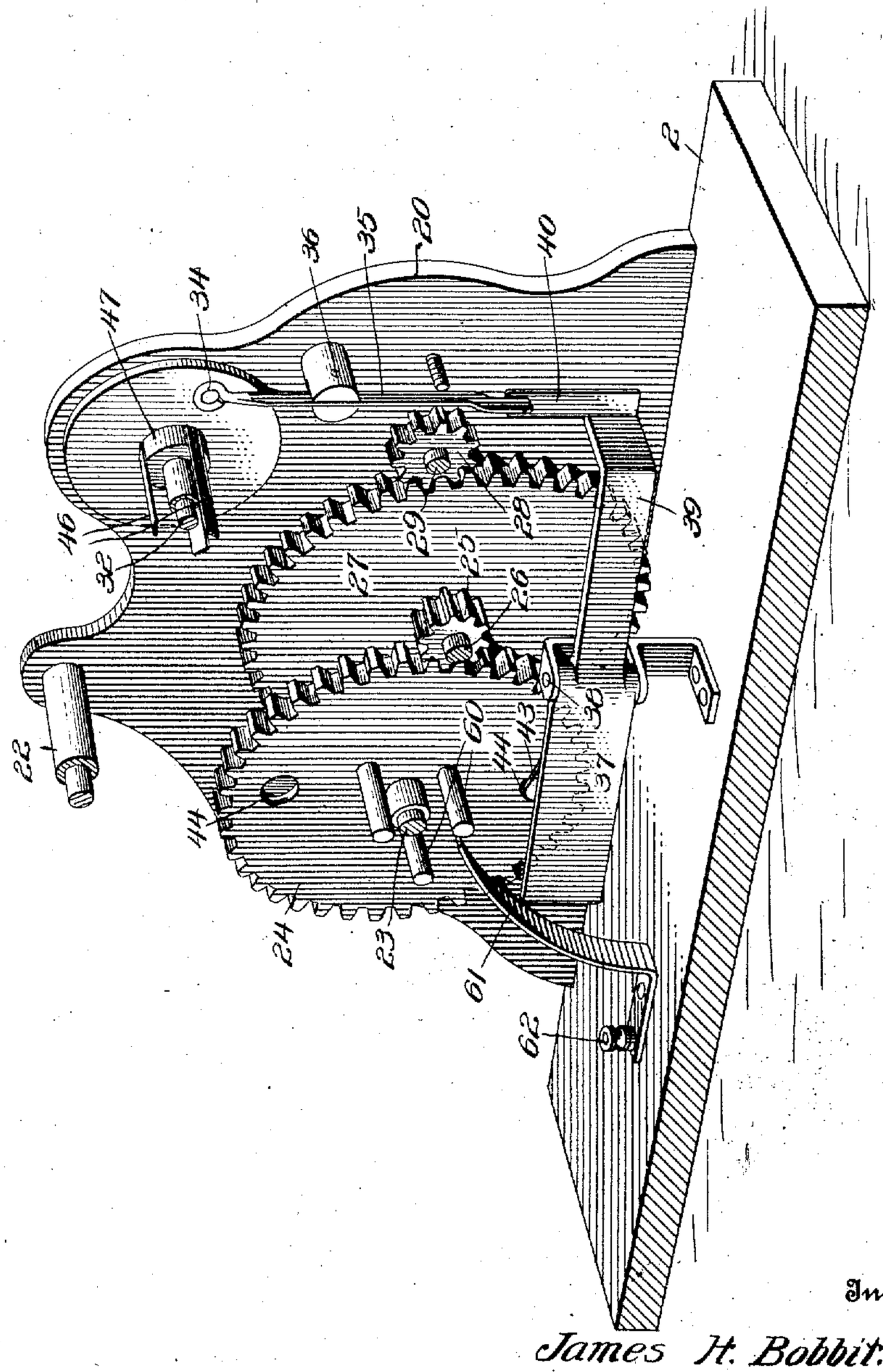
6 SHEETS—SHEET 6.

Fig. 12.



Witnesses

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UNITED STATES PATENT OFFICE.

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THERMO-ELECTRIC FURNACE-REGULATOR.

962,884. Specification of Letters Patent. **Patented June 28, 1910.**

Application filed October 7, 1908. Serial No. 456,548.

To all whom it may concern:

Be it known that I, JAMES H. BOBBITT, a citizen of the United States, residing at Harvard, in the county of Clay and State of Nebraska, have invented new and useful Improvements in Thermo-Electric Furnace-Regulators, of which the following is a specification.

This invention relates to regulating apparatus for furnaces and the like and more particularly to a thermo electric regulator which controls the damper and check of the furnace so that when the temperature rises above a predetermined maximum, the damper will close and the check open, and vice versa, when the temperature falls to a predetermined minimum.

The invention has for one of its objects to improve and simplify the construction and operation of apparatus of this character so as to be comparatively simple and inexpensive to manufacture and install, thoroughly reliable and efficient in use, and readily adjusted for any desired conditions of service.

Another object of the invention is the provision of a motor mechanism mechanically connected with the damper and check of the furnace and controlled by a thermostatically-actuated switch device for making and breaking a circuit to throw the motor mechanism into or out of operation.

A further object is the employment of a signal device whereby the attendant or janitor of a building will be informed as to the operative condition of a furnace, as for instance, when the damper is closed and the check open, a certain signal will be given and when the damper is open and the check closed, another signal will be given.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a perspective view of the motor mechanism for actuating the check and damper of a furnace. Fig. 2 is an end elevation of a motor mechanism with the casing removed. Fig. 3 is a vertical section on line 3—3, Fig. 2. Fig. 4 is a similar section on line 4—4, Fig. 2. Fig. 5 is a horizontal section on line 5—5, Fig. 4. Fig. 6 is a modified form of operative connections between the motor mechanism and the damper and check-actuating lever. Fig. 7 is a front view of the regulator. Fig. 8 is a similar view with the front of the regulator casing removed. Fig. 9 is a horizontal section on line 9—9, Fig. 8. Fig. 10 is a similar section on line 10—10, Fig. 9, showing the thermostat. Fig. 11 is a diagrammatic view of the circuit connections. Fig. 12 is a perspective view of that section of the motor illustrated in elevation in Fig. 4.

Similar reference characters are employed to designate corresponding parts throughout the several views.

In practice, the motor mechanism is preferably located in the cellar or furnace room conveniently close to the furnace so that relatively short connections can be run from the mechanism to the damper and check to thus minimize the power required for their operation and the regulator may be located in any suitable part of the building to be heated by the furnace, such, for instance, as a living room, office or the like where the temperature is to be maintained within certain predetermined limits, there being circuit connections between the regulator and mechanism whereby the latter will be controlled by the variations in the temperature.

Referring to the drawing, 1 designates a supporting structure or post that is provided with a bracket or shelf 2 on which is mounted the motor mechanism A. The motor mechanism includes a wheel 3 which is connected by a crank pin 4 with a connecting rod 5 which is hingedly connected at 6 with a cross-shaped lever 7 which oscillates on a pivot 8 on the post 1 at a point above the mechanism A. The arms 9 and 10 are connected, respectively, by the rods, cords or other elements 11 and 12 with the damper and check of the furnace in such a manner that as the lever is oscillated in one direction, the damper will open and the check close. The wheel 3 is rotated by a cord 13 carrying at one end the actuating weight 14, the cord being lapped around the pulley and maintained in frictional engagement therewith by the lighter weight 15 coöperating with the heavier weight 14.

The control of the motor mechanism will be more fully described hereinafter, but it is to be understood that the wheel 3 turns through one hundred and eighty degrees for

opening the damper and closing the check and then remains stationary until the temperature has reached a predetermined maximum when the motor will continue to revolve through an arc of one hundred and eighty degrees for closing the damper and opening the check and continue to operate in this manner automatically to maintain the temperature substantially even. Fig. 6 shows a modification of the operative connection between the motor mechanism and damper and check-actuating lever. In addition to the wheel 3, the idler pulley 16 is employed and a chain 17 is connected with the two intermediate arms of the lever 7 and the wheel 3 is connected by a pin 19 with the chain. As the wheel 3 turns to the position shown, through one hundred and eighty degrees, the right length of the chain creates a draft on the actuating lever 7 and oscillates the same in one direction and during the succeeding half revolution of the wheel 3, the draft is produced on the lever 7 by the left length of the chain.

The motor mechanism consists of a supporting structure or frame including front and back plates 20 and 21 arranged parallel to each other and spaced apart and suitably secured to the base plate or shelf 2, the plates being rigidly held at the top by a cross rod 22. Mounted on the frame is a driving shaft 23 that projects forwardly from the front plate 2 and to which projecting end is secured the wheel 3. On the shaft and located immediately behind the front plate 20 is a large gear wheel 24 rigidly secured to the shaft to rotate therewith. The wheel 24 meshes with the pinion 25 secured to the shaft 26 that is rotatably mounted on the plates 20, 21, and is provided with a large gear wheel 27 which meshes with a pinion 28 on a third shaft 29. On the shaft 29 is a large gear wheel 30 that meshes with a pinion 31 on a brake-carrying shaft 32, the several gear wheels and pinions constituting a speed-multiplying gear between the driving and brake shafts 23 and 31 so as to rotate the latter at a high speed. The brake comprises a disk 33 secured to the shaft 32 to rotate therewith and the rear side face of the disk is flat to be engaged by a brake shoe 34 arranged on the brake lever 35 fulcrumed at 36 on the front plate of the frame, the said lever being automatically set when the driving wheel 3 has turned half a revolution. The brake lever 35 is actuated by an armature 37 fulcrumed on a pin 38 and provided with an arm 39 that has an upwardly-projecting extension 40 that engages in front of the lower end of the brake lever so that as the armature is drawn rearwardly, the brake shoe will be released from the brake disk 33. Arranged behind the armature is an electro-magnet 41 which attracts the armature rearwardly against the tension of the spring 42 that is connected with the arm 39 of the armature. Secured to the front side of the armature and projecting forwardly therefrom is a spring pawl 43 that is adapted to engage in either of the two openings or recesses 44 of the large gear wheel 24. When the pawl extends into an opening 44, the brake shoe will engage the brake disk and prevent the wheel 3 from turning under the pull of the weight 14 and as soon as the electromagnet is energized, the armature disengages the pawl from the opening 44 and simultaneously releases the brake shoe so that the motor mechanism can operate, and the pawl 43 is adapted to ride on the rear surface of the wheel 24 so as to maintain the brake shoe out of contact with the brake disk while the electro-magnet is deënergized and until the next opening 44 has been reached by the wheel 3 turning through one hundred and eighty degrees, whereupon the pawl will enter the opening 44 and provide movement whereby the brake shoe will again automatically set. The brake device is provided with a governing means which consists of centrifugally-acting weights or balls 45 mounted on springs 46 connected with collars 47 and 48 on the brake shaft 32. In case the speed of the brake-shaft becomes excessive, the balls fly outwardly and draw the brake disk rearwardly into contact with the brake shoe which is held in rearward position by the pawl 43 riding on the rear side of the wheel 24 so that the friction between the brake disk and shoe will be sufficient to slacken the speed.

Mounted on the base plate or shelf 2 are cells C which constitute a battery for supplying current to operate the electro-magnet and signaling devices. One pole of the battery is connected by a wire 50 with a binding post 51 which is, in turn, connected by a wire 52 with the electro-magnet 41 and the electro-magnet is grounded by a wire 53 on the frame of the motor mechanism. On the base plate are spring contacts 54 and 55 secured, respectively, to the binding posts 56 and 57 and arranged with their free ends disposed at opposite sides of the driving shaft 23, and the wheel 24 on such shaft is provided with a tubular extension or hub 58 that carries a contact pin 59 which engages one or the other of the contact springs so that the circuit will be completed by engagement of the contact pin with either contact spring when the thermostatically-actuated switch of the regulator is closed by a rise or fall in the temperature acting on the thermostat of the regulator. On the wheel 24 are contact posts 60 so arranged as to engage a spring contact 61 secured to the base plate 2 by a binding post 62. In the present instance, one post 60 is arranged at one side of a diametrical line passing

through the openings 44 while two other posts 60 are arranged at the opposite sides of such diametrical line. This means that during one half of the revolution of the wheel 24, as, during the closing of the damper, the one post will engage the contact 60 to connect and break a signaling circuit once during such movement of the wheel while during the other half revolution, the remaining two posts will engage the spring and make and break the circuit twice and correspondingly energize the signaling device of the regulator so that the attendant will know what action has taken place. Adjacent the front of the base plate 2 are binding posts 63, 64, 65, 66, that are connected by wires 67, 68, 69, 70, respectively, with the binding posts 56, 57, 62 and the battery of cells C. The binding posts 63, 64, 65 and 66, are exposed through the opening 71, Fig. 1, of the casing 72 of the motor mechanism and afford attachment of the wires between the motor mechanism and the regulator therefor.

The regulator designated generally by B comprises a box-like casing 73 that is adapted to be secured to a wall or other support in the living room, office or other appropriate room of the building heated by the furnace controlled by the motor mechanism, the front face 74 of which is removable for access to the internal mechanism. Arranged within the top part of the casing 73 is a thermostat 75 which is adapted to actuate a swinging member or lever 76 supported from the top of the casing by a hinge 77 and provided with an arm 78 which bears against the thermostat 75. The lower end of the lever has a contact 79 forming a part of a circuit make and break device of which the other parts are metal contact members 80 and 81, clearly shown in Fig. 9. These contact members are attached to a piece of insulation 82 secured within the casing by a hinge 83. Interposed between the insulating piece or lever 82 and the back of the casing is a helical compression spring 84 which urges the lever 82 forwardly, and on the front of the casing is an adjusting screw 85 which bears on the front contact 81 and coöperates with the spring 84 to adjust the contact-carrying member 82 in any desired relation to the contact piece 79 on the lever 76. The contacts 80 and 81 are spaced apart such a distance as to provide a clearance between them and the contact 79 for introducing a time element between the making and breaking of the circuit for effecting the closing of the damper and the making and breaking of the circuit for opening the damper, as will be more fully described hereinafter. Within the casing of the regulator are two oppositely-disposed electro-magnets 86, 87, arranged with their pole pieces spaced apart to act upon a common armature 88, Fig. 7, that is mounted on a pivot 89 extending through the front of the casing and carrying an index 90. The contact 80 is connected with the lower electro-magnet 87, while the contact 81 is connected with the upper electro-magnet 86. On the bottom of the casing are binding posts 91, 92, 93, 94, which are connected with the binding posts of the motor mechanism A, and on the face of the casing on the regulator is a buzzer 95 which constitutes an audible signal and an incandescent lamp 96 which is adapted to be connected in circuit for enabling the apparatus to be set for any desired temperature, as will be hereinafter explained. On the face or front plate of the casing are the letters O and C for designating that when the index 90 is at one or the other, the damper is open or closed, thus enabling the attendant to see at a glance the operative condition of the apparatus.

On the side of the casing of the regulator is a hand-actuated switch consisting of a lever 97 mounted on a pivot 98 which is connected in circuit and the lever is adapted to engage the contact points 99 for opening and closing the several circuits. The operation of the apparatus will be best understood by reference to the diagram of the circuit connections shown in Fig. 11, wherein the binding posts 65, 63, 64, 66, of the motor mechanism A are connected, respectively, to the binding posts 91, 92, 93, 94, of the regulator B by wires 100, 101, 102, 103, that run from the cellar where the motor mechanism is situated to the room where the regulator is placed.

Assuming that the furnace is in operation and the temperature falls, the lever 76 of the thermostat will cause the circuit closer to connect the lower electro-magnet 86 of the regulator in circuit. In other words, the contact point 79 will engage the contact 81 so that the circuit will be closed and the current traverse the following path consisting of a battery C, wires 70, 103, 104, switch lever 97, middle contact point 99, wire 105', contacts 79 and 81 of the circuit closer, wires 106 and 107, lower electro-magnet 86, wires 108, 102, 68, spring contact 55, contact pins 59, the hub 58 of the wheel 24, wires 109 and 53, electro-magnet 41, wire 50 and battery C, the wire 109 being grounded on the metal part or frame of the motor mechanism. This flow of current energizes the electro-magnet 86 and throws the index 90, Fig. 7, to the left to a position opposite the letter O, to indicate that the damper of the furnace is opening. The electro-magnet 41 is also energized so as to attact the armature 39 rearwardly to release the pawl 43 from the wheel 24 and disengage the brake shoe from the brake disk. The weight-carrying cord will consequently actuate the

motor mechanism and cause the furnace damper to open and the check to close. At the same time the contact 59 moves out of engagement with the spring contact 55 to thereby open the circuit so that the electro-magnet 41 will be deënergized and the contact 59 continues to move until it engages with the contact 54 so that the circuit of the electro-magnet 87 will be closed when the temperature rises to the maximum point. During this movement of the contact 59 the armature of the electromagnet 41, however, will be held in rearward position by the engagement of the pawl 43 with the rear side of the wheels 24 so as to hold the brake shoe disengaged and permit the wheel 3 to freely turn under the pull of the weight 14. As the wheel 24 turns, either the single contact 60 on one half of the wheel, or the two contacts 60 on the other half will engage the spring contact 61, so that current will flow from the wire 104 through the wire 111, buzzer 95, wires 112, 100, 69, contact spring 61, contact post 60, on the wheel 24, which is connected with the battery, as before mentioned. The buzzer circuit will be closed once during the movement of the motor mechanism for closing the damper and twice during the movement of the motor mechanism for opening the damper, or vice versa. It will thus be seen that the occupant of the room where the regulator is situated will know by the sounding of the buzzer whether the damper is opening or closing. Assuming now that suitable time has elapsed for the heating system to rise in temperature to maximum owing to the opening of the damper and closing of the check, and assuming that the thermostatically-operated lever 76 has been reversed so as to close the circuit by engagement of the contact 79 with the contact 80, current will flow from the battery through part of the path as hereinbefore described to the contact 79, thence through the contact 80, wire 114, and the upper electro-magnets 87, wires 115, 101, 67, spring contact 54, contact points 59 (which has previously been brought into engagement with such spring contact by the half turn of the wheel 24 during the movement of the wheel 3 for opening the damper) hub 58, wheel 24, wires 109, 53, electro-magnet 41, wire 50. This current energizes the electro-magnets 87 and 41 so as respectively to throw the index 90 to the right to a position opposite the point C for showing that the damper is closing and to release the pawl 43 and brake 34 to permit the motor mechanism to make another half turn to close the damper and open the check. Two or more degrees variation in the temperature will be sufficient to close either circuit for effecting the opening and closing of the damper and the temperature at which the circuits will be opened and closed can be regulated by the adjustment of the screw 85 and by noting the temperature on the thermometer T on the front plate or cover of the regulator casing 74.

In order to set the apparatus to operate within a given range of temperature changes, the draft of the furnace is kept open until the maximum temperature, say 72°, is reached, as ascertained from the thermometer T. The switch 97 is then adjusted to contact with the first contact point 99 to connect the lamp with the battery and the index or adjusting screw 85 is then turned to move the thermostatic lever 76 in a direction to bring the contact 79 into engagement with the contact 80, thereby closing the circuit and causing the lamp to glow, it being understood that the contact 59 of the motor mechanism will be in engagement with the spring contact 54 when the damper is open. The index or adjusting screw 85 is turned just enough to bring the lever into engagement with the contact 80 and the turning of the screws is stopped as soon as the lamp glows. The operator then throws the switch 97 into engagement with the second contact 99 to cut the lamp out of circuit and permit current of sufficient strength to pass through the circuit to energize the electromagnets 87 and 41 for the purpose of actuating the index finger 90 and closing the damper and opening the check of the furnace. The contacts 80 and 81 are so arranged with respect to the contacts 79 that a change of two or more degrees in temperature will cause one circuit or the other to open so that if the temperature falls two degrees or to the point 70° indicated on the thermometer, the contact 79 will engage the contact 81 and close the circuit for opening the damper and closing the check. After thus adjusting the screw 85, the apparatus will continue to operate at the minimum and maximum temperatures of 70° and 72°.

A clock may be employed for automatically controlling the circuit to open the damper and close the check of the furnace at a predetermined time, as for instance, an hour or so before rising in the morning so that the house can be comfortably heated at the rising time. For this purpose, the switch 97 may be moved to the third point 99 to connect in circuit the clock, the switch 97 being thus set at a time when the motor mechanism has closed the damper and opened the check as when the furnace is banked for the night. An ordinary alarm clock is arranged on the top of the casing of the regulator as indicated partially at D, Fig. 7, and within the clock are arranged two contacts *a* and *b* which are maintained separated by the snail wheel *c* that controls the sounding of the gong of the alarm clock, and when the hour has arrived for the alarm, the contacts will engage each other and com-

plete the circuit through the wires 118 and 119 connected, respectively, with the third contact point 99 and with the wire 107. The circuit will thus be closed to connect the electro-magnets 86 and 41 with the battery so that the motor mechanism will be actuated to open the damper and close the check.

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

1. In an apparatus of the class described, the combination of a thermostatically actuated circuit closer responsive to predetermined maximum and minimum temperature conditions, circuits connected with the said closer, draft regulating devices, and a motor mechanism controlled by the said circuit closer for operating the draft devices; said motor mechanism comprising a frame, a shaft mounted thereon, a wheel secured to the shaft, a weight-cord device for turning the wheel, a connecting element between the wheel and the draft devices, a contact finger mounted on the shaft to rotate therewith, spring contacts with which the contact finger is adapted to engage, a brake disk, a shaft supporting the same, a train of gears between the shafts, a governor on the second mentioned shaft, and connected with the brake disk, means for rotating the governor from the first mentioned shaft, a brake shoe arranged to engage the disk, a lever mounted to release the brake shoe, an armature connected with the lever, an electromagnet arranged opposite the armature and adapted to be connected in circuits when the circuit closer is closed and the contact finger is in engagement with either spring contact.

2. In an apparatus of the class described, the combination of a thermostatically actuated circuit closer responsive to predetermined maximum and minimum temperature conditions, circuits connected with the said closer, draft regulating devices, and a motor mechanism controlled by the said circuit closer for operating the draft devices; said motor mechanism comprising a frame, a shaft mounted on the frame, means tending to rotate the shafts, connecting means between the shaft and the draft devices for operating the latter, a wheel on the shaft, a plurality of contact members mounted on the wheel at another part, a spring contact arranged to engage said members as the wheel moves, a signal circuit opened and closed by spring contact and members for indicating the opened or closed condition of the draft, a brake device, a speed responsive means for operating the brake device, an armature for releasing the shoe of the brake device, an electromagnet opposite the armature and adapted to be connected in circuits by the circuit closer, a make and break device included in the said circuit, and a pawl on the armature bearing on the said wheel when the latter turns for holding the brake shoe released when the armature is disengaged, said wheel having means with which the pawl engages to stop the movement of the wheel when the draft devices are fully opened or closed.

3. In an apparatus of the class described, the combination of a furnace-regulating device, a motor mechanism connected therewith, a thermostatically-actuated switch, electrical means controlling the operation of the mechanism and connected in circuit by the switch, oppositely-disposed and spaced electro-magnets independently connected in circuit by the switch, a common index device actuated by the electro-magnets for indicating the draft conditions of the furnace, an audible signal, and a make and break device operated by and connected with the motor mechanism for actuating the audible signal in a predetermined manner during the opening of the draft and in a different manner during the closing of the draft.

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

JAMES H. BOBBITT.

Witnesses:
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R. DE GRAFF.