990,237.

R. J. DAVIS.

DAMPER REGULATOR.

APPLICATION FILED JAN. 3, 1910.

Patented Apr. 25, 1911.

4 SHEETS—SHEET 1.

Witnesses:

Ira D. Perry

J. H. Jochum, Jr.

Inventor:

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By Brown Hopkins

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4 SHEETS—SHEET 2.

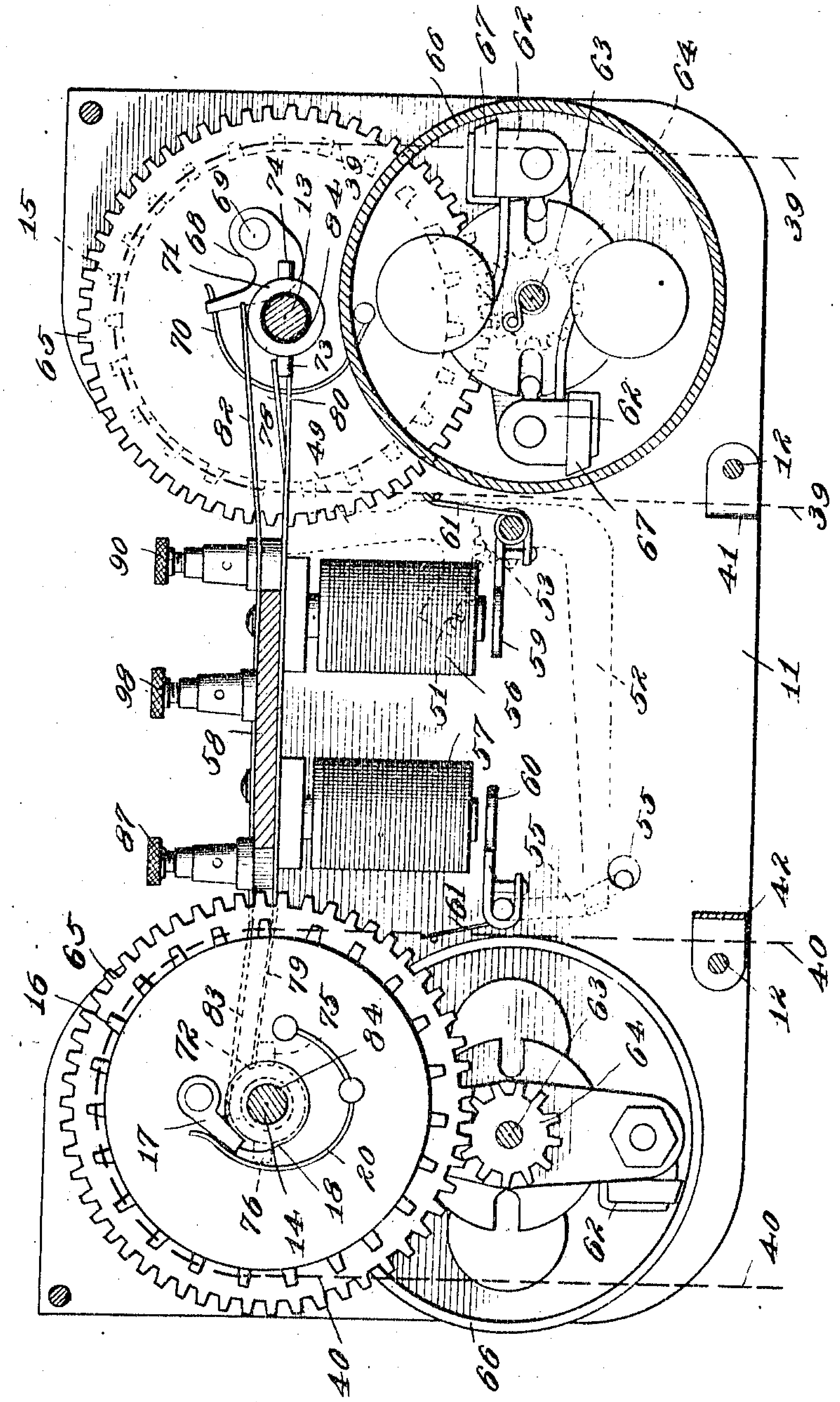

Fig. 3.

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Fig. 4.

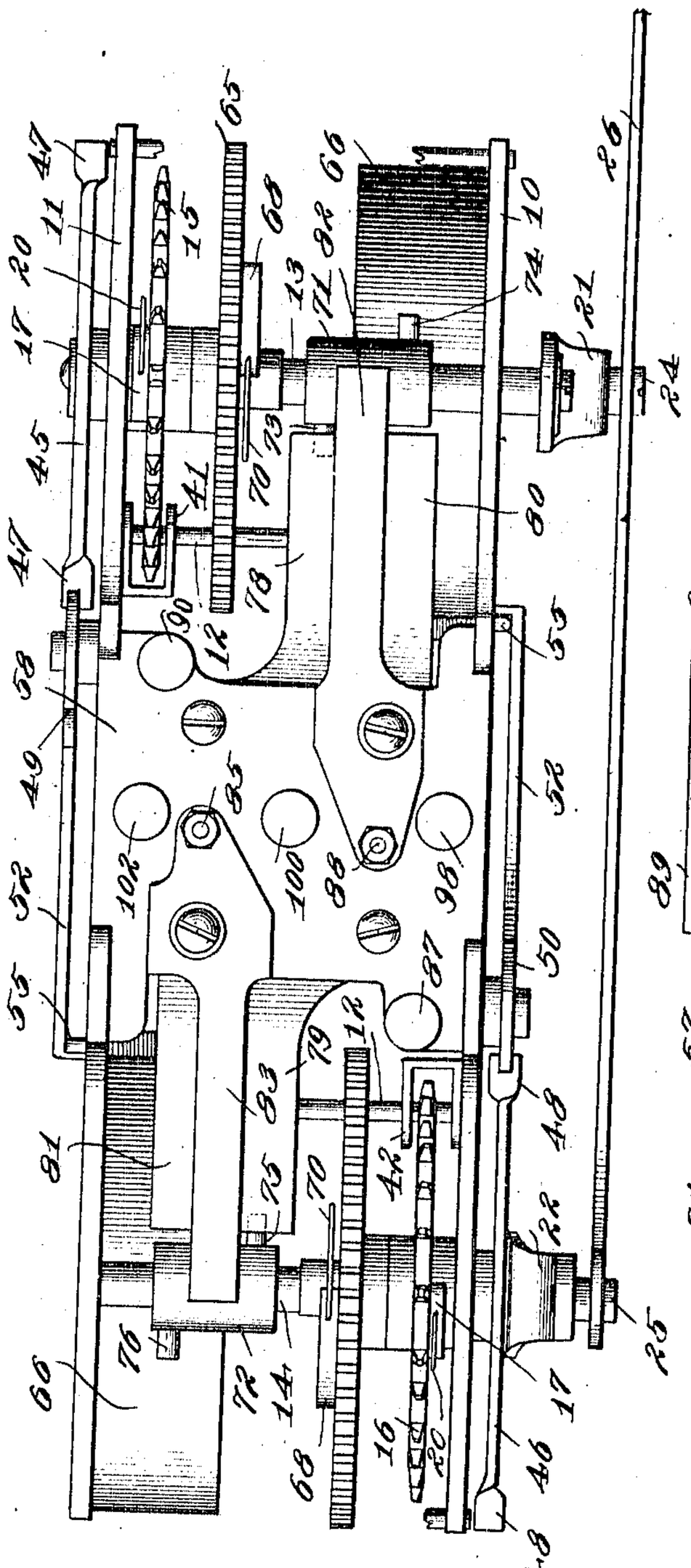
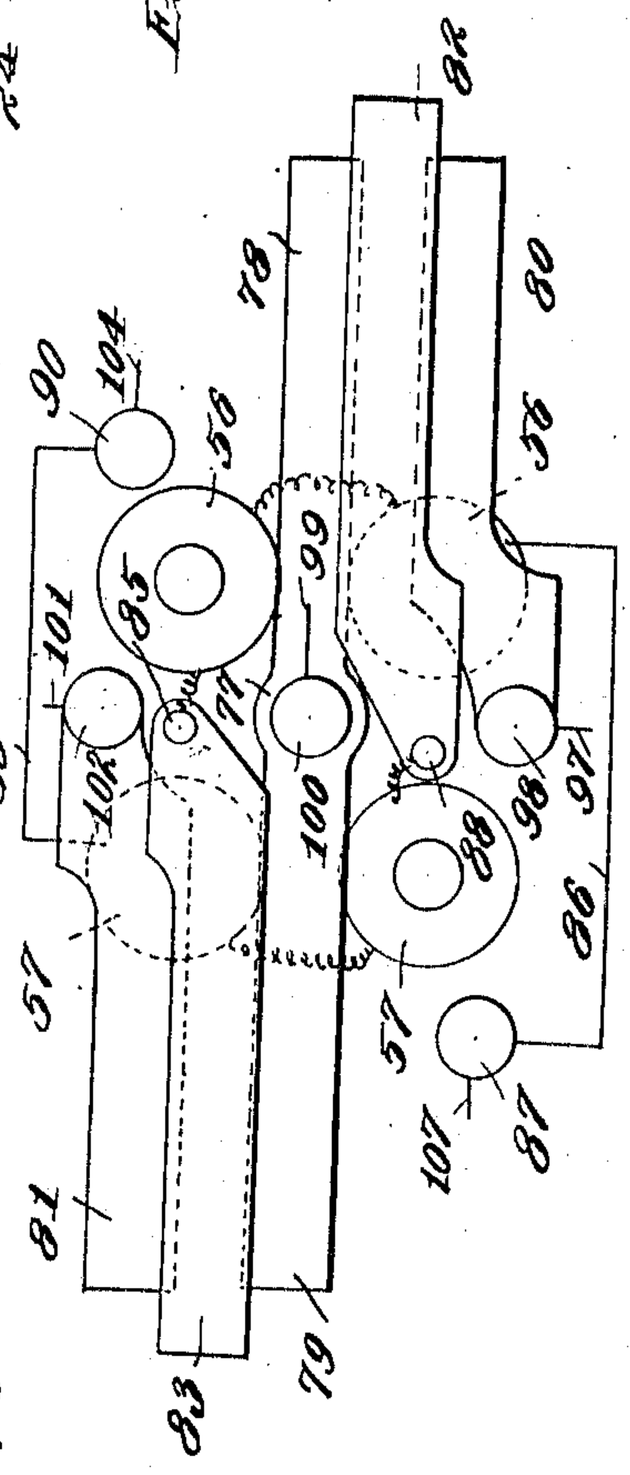


Fig. 5.



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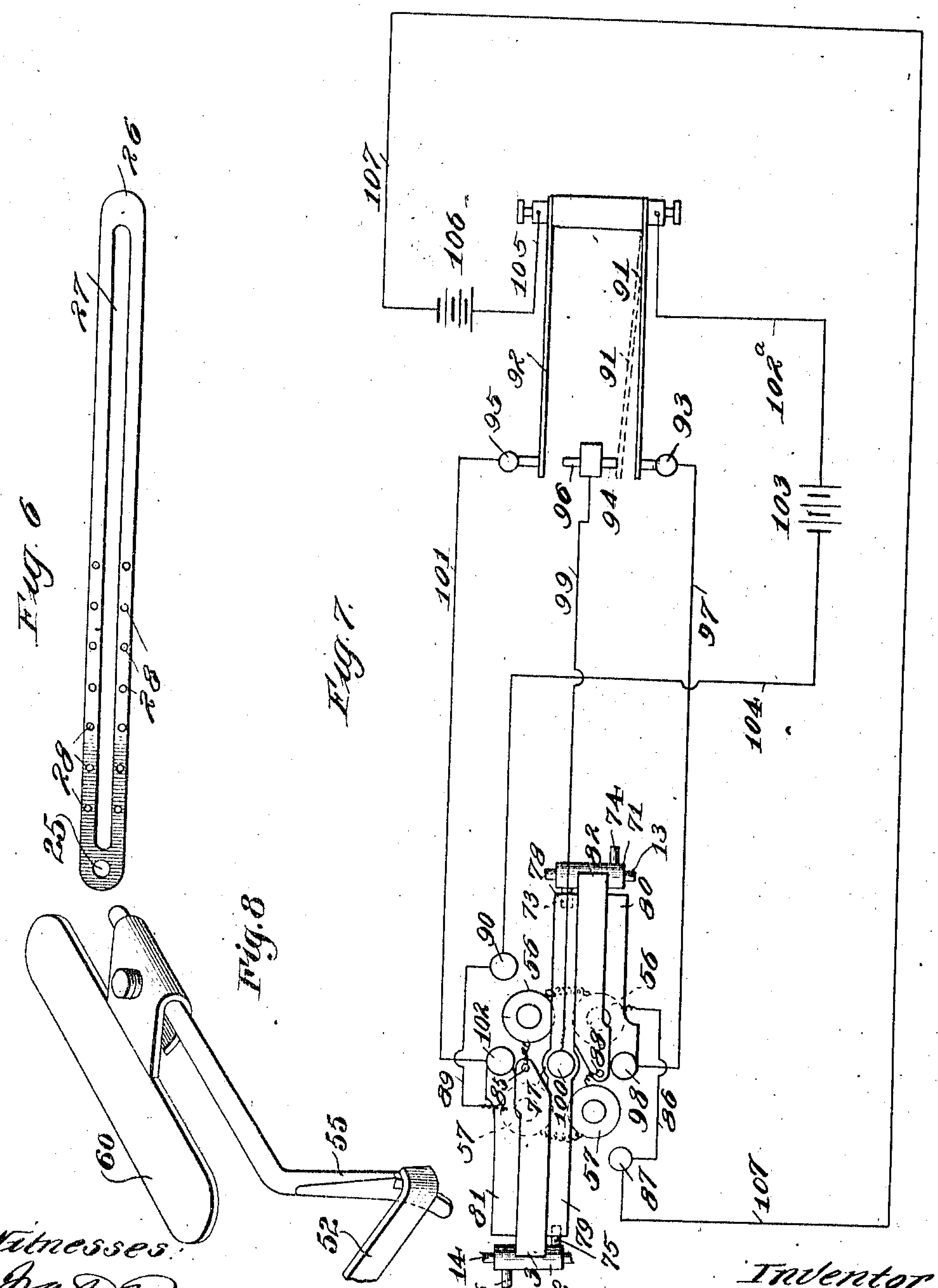

Witnesses:

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UNITED STATES PATENT OFFICE.

ROBERT J. DAVIS, OF CHICAGO, ILLINOIS.

DAMPER-REGULATOR.

990,237. Specification of Letters Patent. Patented Apr. 25, 1911.

Application filed January 3, 1910. Serial No. 535,945.

To all whom it may concern:

Be it known that I, ROBERT J. DAVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Damper-Regulators, of which the following is a specification.

This invention relates more particularly but not necessarily to improvements upon the damper regulator of the particular type shown and described in my application for United States Letters Patent, Serial No. 450,882, filed April 29, 1908, to which reference may be had for an understanding of any feature common to the two devices which are shown herein but not described in detail, and the primary object of the present invention is to provide improved means whereby varying degrees of adjustment of the damper may be obtained and the damper maintained in its adjusted positions.

A further object is to provide an improved device of this character which will be simple, durable and cheap in construction and effective and efficient in operation.

To the attainment of these ends and the accomplishment of other new and useful objects, as will appear, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawings illustrating an embodiment of the invention and in which—

Figure 1 is a side elevation, partly in section, of an improved apparatus of this character constructed in accordance with the principles of this invention and showing the damper adjusting means in one position in full lines and in another position in dotted lines. Fig. 2 is a detail elevation of a portion of the apparatus showing the same in two positions, one in full lines and the other in dotted lines. Fig. 3 is an enlarged detail sectional view on line 3—3 of Fig. 4. Fig. 4 is a top plan view of Fig. 3. Fig. 5 is a diagrammatic view showing the contacts and the electro-responsive devices. Fig. 6 is a view of the regulating lever. Fig. 7 is a diagrammatic view showing the circuits. Fig. 8 is a detail perspective view of one of the armatures and catches which are controlled by the electro-responsive devices.

Referring more particularly to the drawings and in the present exemplification of the invention, the support for the operating mechanism preferably comprises two spaced plates 10 and 11, which are held spaced from each other in any desired or suitable manner, preferably by means of spacing members 12 arranged at convenient points between the plates and which are connected by their extremities to the plates in any suitable manner. Journaled adjacent each extremity of these plates or supports and extending transversely thereacross are shafts 13, 14, to which are respectively secured sprockets 15, 16, by means of suitable ratchet mechanism comprising a dog 17 which cooperates with a shouldered portion 18 on the shaft and which dogs are held in position to engage the shoulders by means of suitable elastic members 20, such as springs or the like. This ratchet mechanism will permit the respective sprockets 15, 16, to rotate freely about the respective shafts 13, 14 in one direction but when the sprockets are rotated in the opposite direction, the ratchet mechanism will lock the sprockets to the shafts so that the shafts will be rotated by the sprockets.

The shafts 13, 14, are of a length to project beyond one of the plates or supports comprising the frame, preferably the front plate or support 10, as shown more clearly in Figs. 1 and 4, and secured respectively to the projecting extremities of those shafts are arms 21, 22 and these arms are provided with a slot 23 through which the extremity of the respective shafts project and a fastening device is secured to the end of the shafts for preventing displacement of the arms. The slots 23 permit the arms to be adjusted laterally with respect to the shafts so as to vary the movement of the dampers in a manner which will be presently set forth. The arms are respectively provided with laterally projecting pins or extensions 24, 25. Pivotally supported by one of the projections, preferably the projection 25, on the arm 22 is an operating lever 26, the body portion of which is provided with an elongated slot 27, which extends substantially the entire length of the lever. The other projection 24 on the arm 21 extends into the slot 27 so that the lever 26 may be freely moved longitudinally with respect to the pin or projection 24 when the arm 22 is rotated, so that the projection 24 will serve as a fulcrum by

which the lever is rocked. When the arm 21 is rotated, the pivotal connection or projection 25 will form the fulcrum about which the lever 26 is rocked under the influence of the arm 21.

The body portion of the lever 26 is provided with a series of apertures 28 and connected to one side of the lever 26, preferably by means of the apertures 28 and a hooked extremity, is a flexible member 29 preferably in the form of a chain or the like.

The apparatus thus far described is preferably supported from an overhead support 30 such as the ceiling of a room by means of suitable hangers 31. The other extremity of the flexible member 29 is connected to the door or damper 32 of the furnace 33. A similar flexible member 34 is connected by one extremity to the lever 26 by engaging in any one of the apertures on the opposite side of the lever. This flexible member 34 is preferably arranged so as to pass over overhead pulleys 35 preferably secured to the support 30 and the free extremity of the flexible member is connected to a damper 36 of the furnace.

From the above it is thought that this improved construction will be clearly understood, and with the mechanism thus far described it is thought, that the operation will also be clearly understood but briefly stated it is as follows: Assuming the parts to be in the position shown in full lines in Fig. 1, and motion is imparted to the shaft 13 to rotate the latter, the arm 21 will be rotated and will raise the lever 26 from the position shown in full lines to that shown in dotted lines. During this raising movement, the lever will rock about its point of connection 25 with the arm 22 as a fulcrum, and it will draw up on the flexible member 29 to further open the door or damper 32. At the same time tension will be released on the flexible member 34, which will permit the damper 36 to close by the weight of the damper and the portion of the flexible member between the damper and one of the pulleys 35. Assuming the parts to be in the position shown in full lines in Figs. 1 and 2, the operation will be the same with this exception, that if motion is imparted to the arm 22 instead of the arm 21 the lateral projection 24 on the arm 21 will serve as a fulcrum for the lever 26 and when the arm 22 is rotated, the lever will be moved about the fulcrum 24 to rock the lever from the position shown in full lines in Fig. 2 to that shown in dotted lines in the same figure. This movement of the lever will release the tension on the flexible member 29 and permit the damper or door 32 to close by the weight thereof and at the same time will draw upon the flexible member 34 to open the damper 36. It will therefore be apparent that the dampers 32, 36, may be adjusted to varying degrees and maintained in their adjusted positions according to which of the arms 21, 22 is rotated. The rotation of these arms 21, 22 is controlled entirely by the temperature of the room to be heated and in a manner as will be clearly set forth.

The arms 21, 22 may be rotated in any suitable manner but are preferably rotated and operate in a manner similar to the operation of a gravity motor and for this purpose weights 37, 38, are provided, one for each of the sprockets 15, 16, and these weights are operatively connected with the respective sprockets by means of flexible members 39, 40, preferably in the form of chains or the like, one extremity of each of which is secured to one of the weights and the body portions of the chains or flexible members pass over the respective sprockets 15, 16, as shown diagrammatically in Fig. 3. The chains also pass respectively through guides 41, 42, which are preferably held in position between the supports 10 and 11 by means of the connecting members 12, as shown more clearly in Fig. 3 and secured to the flexible members are stops 43, 44, preferably in the form of rings or the like. These stops 43, 44 are adapted to respectively engage the guides 41, 42, when the weights 37, 38 are respectively adjacent the limit of their downward movements so as to stop the shafts 13, 14, at predetermined positions to prevent the completion of the current through the electro-responsive devices to prevent the operation of the motors and in this manner the stops 43, 44 serve as circuit breakers in the manner which will be set forth.

The shafts 13, 14 may be controlled in any desired or suitable manner, so that the weights will impart intermittent rotation thereto and for this purpose arms 45, 46 are secured respectively to the shafts 13, 14. Each of the arms is secured to the respective shafts intermediate its extremities and its extremities are preferably flattened as at 47, 48, shown more clearly in Figs. 1 and 4. Locking dogs 49, 50 are respectively provided for the arms 45, 46, and are pivotally supported on the main supporting members of the mechanism. One of these arms 45, 46, and their respective locking dogs 49, 50, is arranged adjacent the outer face of each of the supports 10, 11, so that the mechanism may be compactly arranged and at the same time means may be provided for controlling the rotation of the respective shafts. Each of the dogs 49, 50 is provided with a toothed portion 51, as shown more clearly in Figs. 1 and 3, which portions are preferably in the form of segments and an arm 52 provided with a toothed portion 53 is pivotally supported as at 54 so that the toothed portion 53 thereof will engage the respective

toothed portions 51 of the arms. These arms 52 are provided for controlling the movement of the locking dogs 49, 50, and a catch 55 is provided for each of the arms 52 and is so arranged that when the respective locking dogs 49, 50 are in engagement with the respective arms 45, 46, the free extremities of the arms will be engaged by the respective catches 55 to lock the respective shafts 13, 14 against rotation. When the catches 55 are shifted to release the arms 52 the tendency of the respective weights 37, 38 will be to rotate the respective shafts 13, 14, which in turn tend to move the arms 45, 46 against the tension of the dogs 50 and the dogs 50 will in turn move the arms 52 through the medium of the connections 51, 53, so that the shaft will rotate the movement of the dogs permitting the arms to escape. As soon as the dogs 50 move out of engagement with the respective arms 45, 46, the dogs will be immediately returned to their normal positions after the ends of the arms have passed out of engagement therewith by the weight of the arms 52 and in positions to be engaged and retained by the catches 55.

Any suitable means may be provided for controlling or shifting the catches 55 and for this purpose electro-responsive devices 56, 57, are provided. These electro-responsive devices are preferably in the form of magnets, as shown more clearly in Fig. 3 and are arranged in pairs and supported in any desired or suitable manner, preferably by means of insulating material 58 held in position by means of the supports 10 and 11 and in such a position that the electro-responsive devices will stand between the shafts 13 and 14 so that the mechanism may be compactly arranged. Coöperating with these electro-responsive devices are armatures 59, 60, to which the catches 55 are respectively connected, so that when one or the other pair of electro-responsive devices is energized, the respective armature will be attracted and this movement of the armatures will rock the catches or shift them to release the arms 52. The armatures and the catches 55 may be returned to their normal positions when the electro-responsive devices are deënergized in any suitable manner, preferably by means of elastic members 61 in the form of springs. The electro-responsive devices may be deënergized before the arms 52 reach their normal position or positioned to hold the dogs 50 in operative positions with relation to their respective arms 45, 46, in which event, the catches 55 will yield to the arms 52 as the latter reach positions to be engaged and held by the catches, this yielding movement being permitted by means of the elastic members 61.

The speed of rotation of the shafts 13, 14, is controlled by means of suitable governors which preferably comprise weighted members 62 which are secured for pivotal movement to shafts 63, one adjacent each of the shafts 13, 14, and these shafts 63 are connected to the respective shafts 13, 14 for rotation therewith by means of a gear 64 supported for rotation with the shaft 63 and which gear meshes with a gear 65 secured for rotation with each of the shafts 13, 14. The weighted members 62 are supported for rotation within a housing 66 which forms an annular wall and the weighted members are provided with gripping surfaces 67 which are thrown out into engagement with the wall 66 by centrifugal force, as will be clearly understood. The gears 65 are preferably mounted loosely upon the respective shafts 13, 14, and in order to permit the free rotation of the gears with relation to their respective shafts in one direction and to lock the gears to the shafts when the gears are rotated in the opposite direction, suitable locking mechanism may be provided, preferably in the form of a dog or cam 68, which is pivotally supported as at 69 upon the gear 65 and is adapted to be forced into engagement with a portion of the respective shafts 13, 14, preferably by means of an elastic member 70 in the form of a spring. This independent motion of the gear 65 is provided in order that the mechanism will not be jarred by suddenly arresting the descent of the weights 37, 38, and also permits the governor to gradually stop as the momentum of the governor tends to rotate the gear 65 after the shaft 13 has been stopped.

Secured to each of the shafts 13, 14, is a sleeve 71, 72. The sleeve 71 is provided with laterally projecting pins 73, 74, and the sleeve 72 is provided with corresponding pins or projections 75, 76. Supported by the support 58 is a common contact 77, shown more clearly in the diagrammatic view in Fig. 5. This contact 77 projects beyond each side of the support 58 and its extremities 78, 79, terminate respectively adjacent the sleeves 71, 72, and in such positions that when the respective shafts 13, 14, are rotated a sufficient distance, the respective projections 73, 75, will engage the extremities 78, 79, of the contact 77. These extremities of the contact are preferably flexible so as to yield to permit the pins or projections to pass but are sufficiently stiff to form a good contact for the circuit. Secured also to the supports 58 are contacts 80, 81, one of which projects beyond each side of the support and are respectively parallel with and located preferably in the same plane with the extremities 78, 79 of the contact 77. These contacts 80, 81 also terminate respectively adjacent the sleeves 71, 72, so as to be engaged respectively by

the pins or projections 74, 76 on the sleeves 71, 72, when the shafts are rotated a sufficient distance. The pins or projections on the respective sleeves are preferably arranged so as to be disposed in opposite directions from each other, that is, so that when one of the pins on the sleeves is in engagement with its respective contact, the other pin on the same sleeve will be out of engagement with its contact. Contacts 82, 83 are also secured to the support 58 and are arranged to project beyond opposite sides thereof. These contacts are preferably spaced above or arranged in a higher plane from the plane of the contacts 78, 80, and 79, 81, and are preferably slightly longer than the adjacent contacts. The extremity of the respective contacts 82, 83 engage and rest upon the respective sleeves 71, 72, which latter are insulated by suitable insulating material 84 from the respective shafts 13, 14.

The electro-responsive devices 56 are connected in series and one end of the winding is connected as at 85 to the contact 83 and the other end of the winding is connected as at 86 to a binding post 87. The electro-responsive devices 57 are also connected in series and one end of the winding is connected as at 88 to the contact 82. The other end of the winding is connected as at 89 to a binding post 90.

These electro-responsive devices 56, 57 are controlled by means of thermostatic bars 91, 92 which are secured together to operate in unison and the free extremity of these bars are adapted to move respectively between contacts 93, 94 and 95, 96. One of the contacts, preferably the contact 93 of the thermostatic bar 91 is connected by means of a conductor 97 to a binding post 98 which in turn has connection with the contact 80. The contacts 94, 96 are electrically connected and are in turn connected by means of a conductor 99 to a binding post 100, which latter has connection with a contact 77 and the ends 78, 79 thereof. The other contact 95 of the thermostat is connected by means of a conductor 101 to a binding post 102, which in turn is electrically connected with the contact 81. The thermostatic bar 91 has connection by means of a conductor 102ª to one side of a battery cell 103 and the binding post 90 is connected to the other side of the cell by means of a conductor 104. The other thermostatic bar 92 is connected by means of a conductor 105 to one side of a battery cell 106 and the binding post 87 is connected by means of a conductor 107 to the other side of the battery cell 106. The specific construction and operation, however, of these thermostatic bars 91, 92, forms no part of the subject matter of the present invention, but the subject matter of my application Serial No. 495,902, filed May 4, 1909. Suffice it to say that when the temperature in the room to be heated increases or decreases, the thermostatic bars will move respectively into and out of engagement of its coöperating contact points to energize the corresponding electro-responsive devices 56, 57. These thermostatic bars are set so as to operate on slightly different temperatures and are arranged preferably within a casing 108 (see Fig. 1) which is secured or supported by means of the wall 109 of the room so that the conductors may be located within the wall in the ordinary and usual manner.

Assuming the thermostatic bars as shown in diagram in Fig. 7 to be in the position as shown in full lines, the pin 73 on the sleeve 71 in engagement with the contact 78 and the weights 37, 38 elevated to the full line position as shown in Fig. 1, and a variation of the temperature of the room occurs the operation will be as follows: If the temperature of the room decreases, the thermostatic bar 91 will move from the position shown in full lines in diagram in Fig. 7 to the position shown in dotted lines which will complete the circuit through the electro-responsive devices 57 by means of the following path; from one side of the battery cell 103 through the conductor 102ª, thermostatic bar 91, contact 94, conductor 99, binding post 100, contact 78, pin 73, sleeve 71, contact 82, conductor 88, through the electro-responsive devices 57, conductor 89, binding post 90, conductor 104, back to the other side of the battery cell 103. As soon as the circuit is completed in this manner, the electro-responsive devices 57 will be energized and will attract the armature 60, thereby shifting the catch 55 and releasing the arm 52. When the arm 52 is thus released, the weight 37 will also be released and will start to descend. As the weight descends, the shaft 13 will be rotated as in the manner already set forth. The instant the shaft 13 starts to rotate, the arm 45 which is secured thereto and which has been released will pass out of engagement with the dog 49 and the moment the extremity of the arm passes the dog, the gravity of the arm 52 will move the dog 49 into the path of movement of the other extremity 47 of the arm 45 so as to be engaged by the arm to arrest the movement of the shaft 13. Just as soon as the shaft 13 commences to rotate, the pin 73 will pass out of engagement with the contact 78 and thereby break the circuit through the electro-responsive devices 57 which will deënergize the latter. The elastic member 61 will then move the armature 60 to its normal position to set the catch 55 to lock the arm 52 and consequently the dog 49. This operation takes place before the other extremity of the arm 45 reaches a position to engage the dog 49. This will stop the rotation of the shaft

13 and arrest the descent of the weight 37, the jar caused by the sudden arresting of the weight being taken up by means of the governor and the loose connection between the gear 65 and the shaft 13 in the manner already fully explained. Assuming the parts to be in the initial position as above set forth and if the temperature of the room increases the thermostatic bar 92 will move into engagement with contact 96 to control the circuit from the battery 106 through the electro-responsive devices 56 in a similar manner.

The pins 73, 74, on the sleeve 71 and also the pins 75, 76, on the sleeve 72 are so arranged with respect to each other and with respect to the arms 45, 46, that when one of the pins moves away from its contact, the other pin will be in engagement with its respective contact when the movement of the shaft is arrested, so that when the temperature in the room varies to such an extent as to cause the thermostatic bar 91 to move into engagement with the contact 93, the circuit will be again completed through the electro-responsive devices 57 to still further adjust the dampers.

The operation just above described applies equally as well to the thermostatic bar 92 and the electro-responsive devices 56.

In order to break the circuit through the mechanism and to render the mechanism inoperative when the weights 37, 38 approach the limit of their descending movements, the stops 43 and 44 are provided. These stops are so arranged that just as the weights reach their limits, they will engage the guides or stops 41, 42, and thereby stop the rotation of the shafts 13, 14. These stops 43, 44, are also so arranged that when the respective shafts 13, 14, are arrested by the engagement of the stops with the guides 41, 42, the pins 73, 74, on the sleeve 71, and the pins 75, 76 on the sleeve 72 will be held out of engagement with the contacts 78, 80, and 79, 81, so that in the event of the operation of the thermostatic bars 91, 92, with the parts in the position above described, the energization of the electro-responsive devices would not set the mechanism in operation and the parts will thereby be protected.

The point of attachment of the flexible connections from drafts 32, 36, to lever 26 may be made at any one of the series of points 28 along lever 26 so as to render the drafts more or less open when in the intermediate position in order that sufficient air may be admitted to the fire to maintain a comparatively even temperature and thus avoid a frequent change of the drafts to either of the other positions.

In order that the invention might be fully understood, the details of the foregoing embodiment thereof have been thus specifically described, but

What is claimed as new is—

1. In a damper regulator, the combination of a regulating lever, a plurality of shiftable fulcrums with which the lever has engagement, a connection between the lever and the door or damper of a heater, mechanism for shifting either of the fulcrum points to rock the lever about the other fulcrum point for adjusting the door or damper, and means operatively related to the said mechanisms for rendering one of the mechanisms active and for maintaining the other of said mechanisms inactive.

2. In a damper regulator, the combination of a regulating lever, a plurality of shiftable fulcrums with which the lever has engagement, a connection between the lever and a door or damper of a heater, mechanism for shifting either of the fulcrum points to rock the lever about the other fulcrum point for adjusting the door or damper, and electro-responsive means operatively related to the said mechanisms for rendering one of the mechanisms active and for maintaining the other of said mechanisms inactive.

3. In a damper regulator, the combination of a regulating lever, a plurality of shiftable fulcrums with which the lever has engagement, a connection between the lever and a door or damper of a heater, mechanism for shifting either of the fulcrum points to rock the lever about the other fulcrum point for adjusting the door or damper, and means controlled by the temperature of the room and operatively related to the said mechanisms for rendering one of the mechanisms active and for maintaining the other of said mechanisms inactive.

4. In a damper regulator, the combination of a regulating lever, a plurality of shiftable fulcrums with which the lever has engagement, a connection between the lever and the door or damper of a heater, mechanism for shifting either of the fulcrum points to rock the lever about the other fulcrum point for adjusting the door or damper, and means operatively connected with said mechanisms for automatically rendering one of the said mechanisms active and for maintaining the other of said mechanisms inactive.

5. In a damper regulator, the combination of a regulating lever, changeable fulcrums for the lever, a connection between the lever and a heater damper or door, mechanism individual to each of the fulcrums for shifting one of the fulcrums with respect to the other to rock the lever about the said other fulcrum for varying the adjustment of the door or damper, and means common to said mechanisms for controlling the operation of the latter.

6. In a damper regulator, the combination of a regulating lever, changeable fulcrums

for the lever, a connection between the lever and a heater damper or door, mechanism individual to each of the fulcrums for shifting one of the fulcrums with respect to the other to rock the lever about the said other fulcrum for varying the adjustment of the door or damper, and means common to said mechanisms and controlled by the temperature of the room for controlling the operation of the latter.

7. In a damper regulator, the combination of a regulating lever, a movable support to which the lever is pivotally connected, a second support for the lever and with which the lever has a sliding connection, a connection between the lever and a door or damper of a heater, actuating mechanism individual to the supports for moving one of the latter to rock the lever about the other support as a fulcrum, and means for controlling the operation of the said actuating mechanism.

8. In a damper regulator, the combination of a regulating lever, a movable support to which the lever is pivotally connected, said lever being provided with a slot in its body, a second support for the lever having a portion projecting into the slot to form a sliding connection with the lever, mechanism for rotating either of the supports to rock the lever about the other as a fulcrum, a connection between the lever and a door or damper of a heater, and means controlled by the temperature of the room for actuating said mechanism to adjust the said door or damper.

9. In a damper regulator, the combination of a regulator lever, a movable support to which the lever is pivotally connected, a second support for the lever and with which the lever has a sliding connection, mechanism individual to the supports for moving one of the respective supports to rock the lever about the other as a fulcrum, a flexible member connected with a door or damper of a heater and also with the lever intermediate its points of support, whereby the operation of the lever will adjust the door or damper, means whereby the point of connection of the flexible member with the lever may be varied, and means for controlling the said operating mechanisms.

10. In a damper regulator, the combination of a regulating lever, a movable support to which the lever is pivotally connected, a second movable support for the lever and with which the lever has a sliding connection, a connection between the lever and a door or damper of a heater, actuating mechanism individual to the supports for moving one of the respective supports to rock the lever about the other support as a fulcrum, means for controlling the operation of the said actuating mechanisms, means for locking the lever in any of its adjusted positions, and means for releasing the lever.

11. In a damper regulator, the combination of a pair of shafts, a crank on each of said shafts, a connection between the cranks, said connection permitting a free and independent movement of each shaft and crank, a connection between the first said connection and a door or damper of a heater, mechanism for moving each crank to adjust the door or damper and means for controlling the operation of said mechanism.

12. In a damper regulator, the combination of a pair of shafts, a crank on each of said shafts, a connection between the cranks, said connection permitting a free and independent movement of each shaft and crank with respect to the other shaft and crank, a connection adjustably secured to the first said connection and arranged between said connection and the door or damper of a heater, mechanism for moving each crank to adjust the door or damper, and means for controlling the operation of said mechanism.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 30th day of December A. D. 1909.

ROBERT J. DAVIS.

Witnesses:
J. H. Jochum, Jr.,
C. H. Seem.