E. A. LOWE.

THERMALLY CONTROLLED RELEASING MECHANISM FOR FIRE DOORS AND THE LIKE.

APPLICATION FILED MAY 12, 1915.

1,208,177.

Patented Dec. 12, 1916.

3 SHEETS—SHEET 1.

Fig. 1.

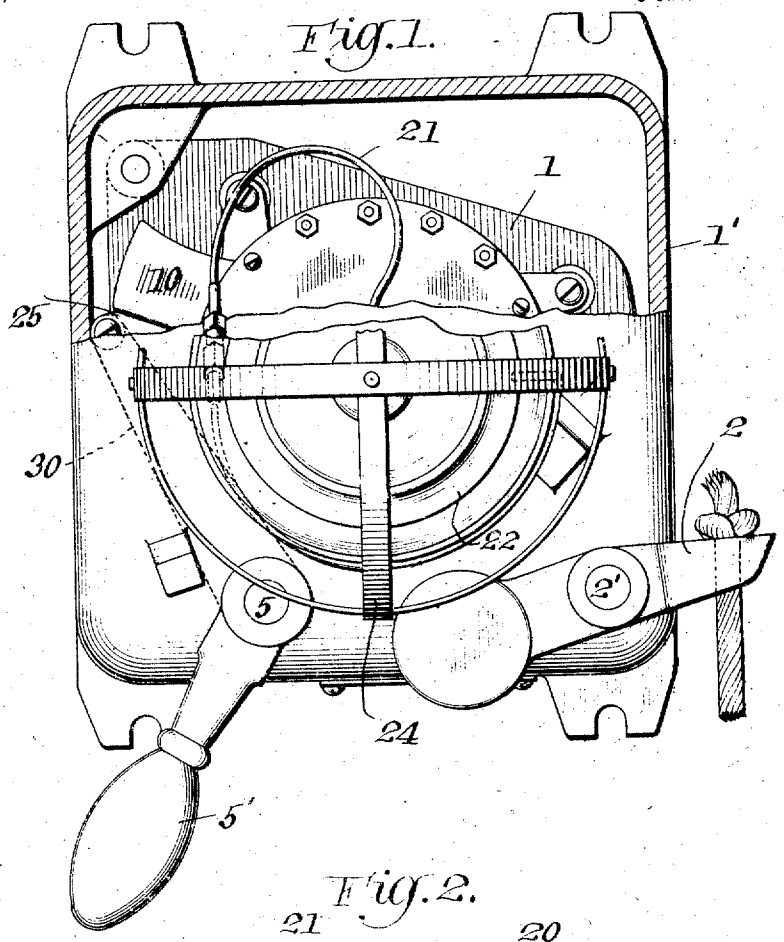
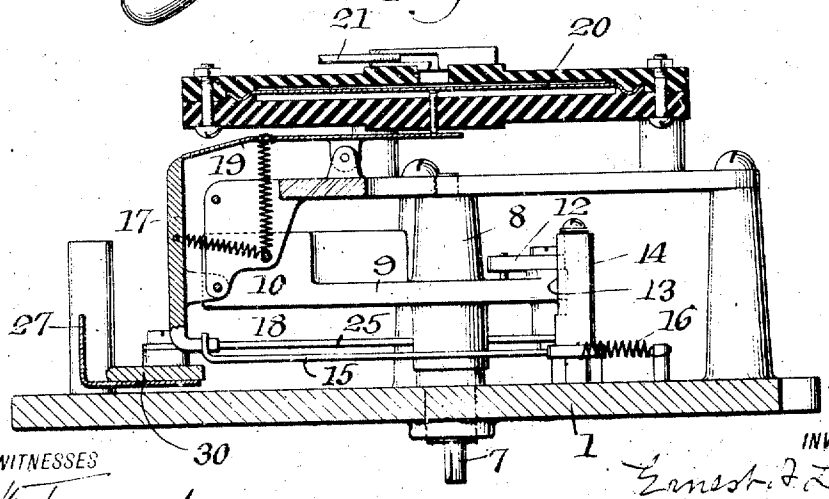


Fig. 2.



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Fig. 3.

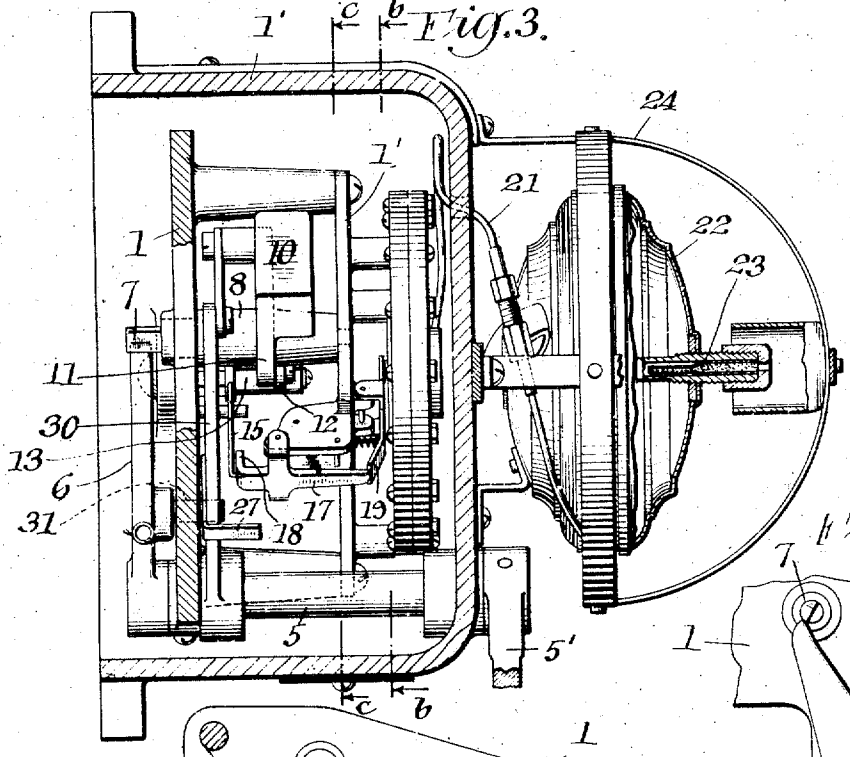


Fig. 5.

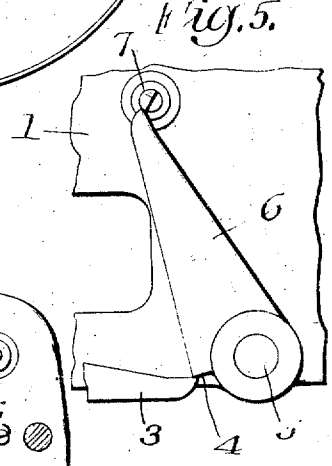
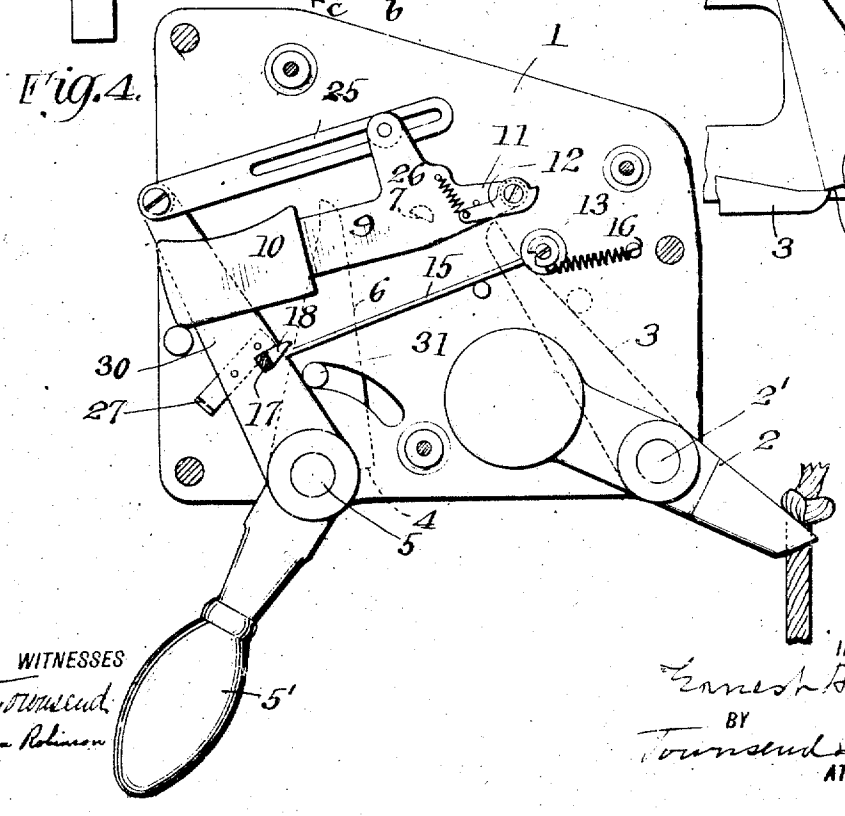


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 6.

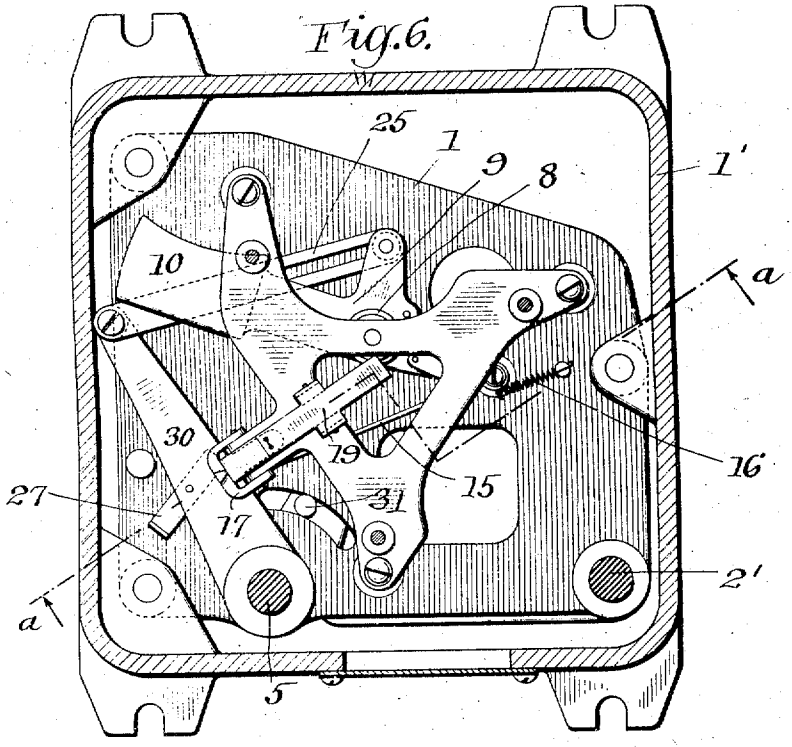
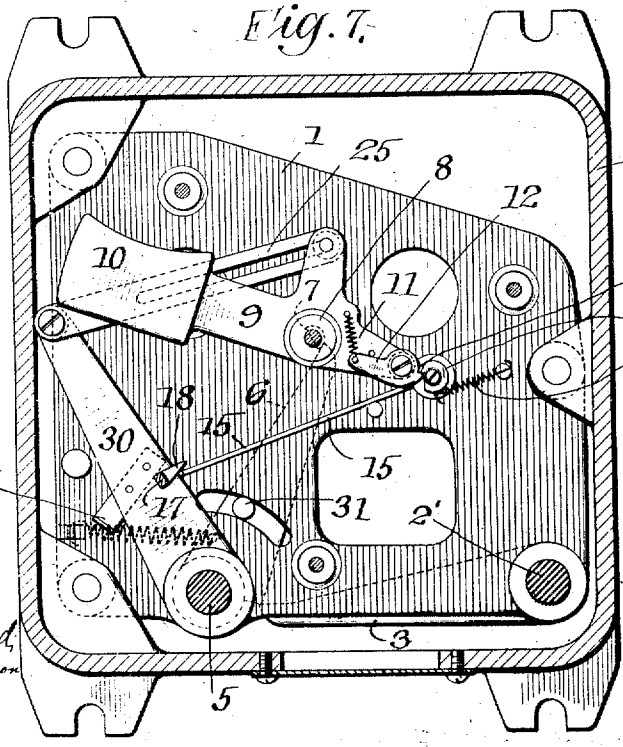


Fig. 7.



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THERMALLY-CONTROLLED RELEASING MECHANISM FOR FIRE-DOORS AND THE LIKE.

1,208,177. Specification of Letters Patent. Patented Dec. 12, 1916.

Original application filed June 17, 1913, Serial No. 774,101. Divided and this application filed May 12, 1915. Serial No. 27,485.

To all whom it may concern:

Be it known that I, ERNEST A. LOWE, a citizen of the United States, and a resident of Plainfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Thermally-Controlled Releasing Mechanism for Fire-Doors and the like, of which the following is a specification.

My invention relates to thermally controlled releasing mechanism for fire doors and the like and is an improvement upon the apparatus for the same general purpose which is shown and described in my prior application for patent filed June 17th 1913, Serial No. 774,101.

The object of my present invention is to secure greater strength and simplicity in the apparatus while at the same time adding to the sensitiveness thereof in responding to any abnormal rate of rise of temperature requiring the fire door or the like to be opened or closed.

Owing to the weight of fire doors and the size of the mechanism by which their operation is necessarily governed the practice has been, prior to my original invention, to employ a fusible link interposed in the connection of the cord that normally sustains a counter-weight opposing the weight which tends to close the door, but in some cases, in place of the fusible link, it has been proposed to employ a detent or releasing mechanism, a thermostat, an electro-magnet and battery, the thermostat acting to close the circuit of the battery and release the mechanism when a certain absolute temperature has been reached and irrespective of the rate of rise of temperature, the action of the thermostat in the combination being then to call into action the force of a battery and magnet to operate the detent releasing mechanism.

The aim of my original invention, as well as of the improvement thereon, is to overcome the objections incident to the previously employed apparatus by making the operation of the door depend upon the rate of rise of temperature instead of upon the attainment of an absolute temperature without regard to the rate of rise and at the same time to bring about the action of the release mechanism by the force of expansion due to heat, instead of using said force of expansion to bring into action a battery and magnet; and to likewise produce a device which shall be more sensitive in its operation or action than can possibly be the case when a fusible link is employed that ordinarily requires to be subjected to the direct action of the flame.

In my original application before referred to I have described an apparatus constructed specially with reference to the use of a thermostat operating on the principle of a determinate rate of rise of temperature for bringing about the opening or closing of the door, and the rate of rise thermostat described is one in which a confined body of air is employed and the rate of rise at which the device shall respond to effect the closing of the door is determined by the rate at which air, when expanded by the heat, may be allowed to escape from its inclosure. The force of expansion of the air is used as a force for directly affecting or operating the latch or catch for the releasing mechanism mechanically instead of through the intervention of a battery and magnet and the device will not become effective unless the rate of expansion of the air and consequent mechanical force exerted thereby exceeds the rate of compensation due to the escape of the expanding air through a minute or restricted passage-way.

In my original application I describe the use of a release mechanism having a master shaft and a spring which is wound up by the master shaft and is used by means of a pawl connected to the master shaft to actuate a clock-work train having the usual clock-work escapement and a releasing detent operated by the thermostat.

To secure a more sensitive and positive control of the mechanism for effecting the release of the door than is possible by the mechanism set forth in my original application is the special object of my present invention and for the purpose of making my present invention clear I have shown in the accompanying drawings an apparatus similar in construction to that shown in my original application, excepting as respects the use of the before-mentioned clock train.

In the drawings: Figure 1 is a front elevation of the apparatus with a portion of the casing removed. Fig. 2 is an inverted plan of a portion of the apparatus, a part

being shown in horizontal section on the line *a*—*a* Fig. 6. Fig. 3 is an edge view of the apparatus, the casing or working mechanism being shown in section. Fig. 4 is an elevation of a portion of the detent mechanism detached from the other parts. Fig. 5 shows in detail a part of the detent devices. Fig. 6 is a vertical section on the line *b*—*b* Fig. 3. Fig. 7 is a vertical section on the line *c*—*c* Fig. 3.

1 is any suitable framework for supporting the shafts and other mechanism herein described, all inclosed in a suitable casing 1′ exterior to which may be located the thermostat constructed on the principle before referred to and modified somewhat in form from that described in my original application. No claim is herein made to this type of thermostat *per se* inasmuch as the same forms the subject of claims in my original application and will be made the subject of a divisional patent.

2 indicates what may be, for convenience, described as the primary release arm of the apparatus inasmuch as this is the arm which, in the preferred manner of application of my device to releasing fire doors, is in the form of a hook adapted to receive the knotted end of a cord sustaining a counter-weight, the construction being such that when the shaft 2′ carrying said arm 2 is released, the said arm may turn and allow the cord to slip from the hook thereby throwing the counter-weight out of action and permitting the door to close by its own weight.

3 is a detent arm projecting from the shaft 2′ mounted preferably as a rock shaft and 4 is a detaining shoulder or catch for arm 3.

6 is a secondary detent arm provided with the shoulder or catch 4 and mounted to turn freely or independently of the shaft 5, which is the re-setting shaft and for that purpose is provided with the operating handle 5′ and an arm 30 carrying slotted link 25 and hook or projection 27, as will be presently described. Upon the detent arm 6 is the pin 31 adapted to be engaged by the re-setting arm 30.

The shaft 8 adapted to rock in suitable bearings is the main or master shaft of the apparatus which in my prior application is normally under the bias of a coiled spring tending to turn the shaft so as to release the arm 6 and acting also, through a pawl carried by the shaft, upon the train of clockwork. The detent 7 is formed in a manner described in my prior application, by simply milling the end of the shaft so that when the shaft turns from the position shown in Fig. 5 the arm 6 will be released. The primary release arm and detent therefor together with the secondary detent and master shaft are practically constructed and combined as shown in my prior application.

9 is a weighted arm of the rock shaft 8 and 10 the weight therefor giving the shaft a bias tending to turn it in a direction to release the secondary detent arm 6.

11 is a detent arm projecting from the master shaft and carrying a pivoted latch or catch 12 normally engaged with a detent 13.

15 is a secondary detent arm for the master shaft carried by the shaft 14, while 16 is a spring acting on the shaft 14 in a manner to restore it to normal position after the automatic action of the apparatus. The secondary detent arm 15 is normally detained by a pivoted detent lever or catch 17 having a toe or dog 18 with which the secondary detent arm 15 directly engages and by which it is normally locked from turning.

As will be seen, the dog-carrying lever or catch 17 is so pivoted or arranged with relation to the detent arm 15 and its shaft that the arm 15 is effectually locked and exerts no tendency to turn the catch 17 and release itself. As will also be seen, the members of the detaining devices directly associated with the rock shaft and forming the first element of the train of detent mechanisms by which the shaft is held against movement under the bias given to it by the weight are so formed and engaged that the detaining member 14 thereof tends to move or has a bias under the influence of the detained member 13 in a direction such that if it is freed and allowed to move it will release the engaging member and thus bring about the release of the shaft by which the detained member is carried. This self-releasing tendency of the detent devices due to the bias given to the detaining element is however effectually resisted or controlled by means of the secondary detent arm 15 which is locked by the dog 18 lying normally over the secondary detent arm 15. The same self-releasing tendency due to the action of the detained member upon the detaining member and due to the form of the members and the disposition of the shafts carrying them also exists in the case of the detent devices for the shaft 2′ and shaft 5, as will be readily seen by reference to Figs. 4 and 5. A suitable spring applied as shown more fully in Fig. 2 serves, however, to move the lever or catch 17 in a manner to carry the dog or toe 18 away from the position of engagement by the secondary detent arm 15. The said catch or lever 17, however, is locked or restrained from turning by suitable means which, being thermally actuated on change of temperature, will release said catch in any suitable manner as for instance by the devices to be now described.

19 is a thermally actuated latch or releasing device normally restraining the detent lever or catch 17 from turning to free the detent arm 17. The latch or catch 19 suitably mounted on the frame of the apparatus, as shown, is mechanically actuated by the

force of expansion of the confined air of the thermostat when the rate of its rise of temperature is such that the air may not escape from the inclosure of the thermostat fast enough to prevent the mechanical force of expansion from being exerted upon a suitable diaphragm 20 shown in Fig. 2. Said diaphragm is mounted within a suitable case and carries a pin operating on the latch 19. The casing, sealed at the edges of the diaphragm, is connected by a pipe 21 with the interior of a metallic chamber or inclosure 22 mounted on the front of the apparatus in a frame 24 and containing the air which, being heated, exerts its expansive force upon the diaphragm 20 in case the rate of rise of temperature is such that it cannot be compensated for by the escape of the air through the vent pipe 23, whose interior end is crimped or compressed to form a restricted passage for the air, limiting the rate of escape of air when the temperature rises. Said vent pipe is shown as packed with air filtering material in the same way as is described in my original application.

Fig. 7 shows the relation of the parts in normal position and prior to release thereof to free the primary release arm 2. When the temperature rises at such rate that the air expands within the chamber at so fast a rate that its expansive force will operate the diaphragm 20 and actuate the latch 19, the detent lever 17 is freed from the position shown in Fig. 2 and under the influence of a suitable spring, as clearly shown in Fig. 2, turns in a direction to free the secondary detent arm 15 controlling the movement of the master shaft by normally locking the detent arm 11 for said master shaft. When this action takes place the master shaft turns under the influence of its weight 10 and frees the train of detents between the same and the primary release arm, thus bringing about the closure of the door or other device. As soon as this takes place the shaft 2′ provided with a suitable weight, as shown, returns to its normal position ready for the latching up of the train of detents between it and the master shaft. The detent mechanism and the master shaft itself are restored to normal position by the operation of the shaft 5 provided with a suitable handle as already described and which, through arm 30 and slotted link 25 working on a pin carried by the arm 26 projecting from the master shaft, turns the same back to restore it to normal position where it will be locked by the detent 13. As the arm 30 turns to re-set the master shaft and before the latch or catch 12 is brought into engagement with the detent 13, the hook or projection 27 thereon engages the catch lever 17 and moves the dog 18 over into position above the secondary detent arm 15, which at such time is in the position shown in Fig. 4, being under the influence of the spring 16. Hence the detent devices directly associated with the master shaft and which, as before described, have a self-releasing tendency, will be prevented from freeing themselves when engaged by the action of the link 25 since at such time the secondary detent arm 15 will have been securely locked by the forward movement of the arm 30 and latch 17. As will be seen, the moment the latch 17 is moved to throw the dog forward into locking position for the secondary detent arm 15, it will be itself held up in such position by reason of the fact that the end of the catch lever will pass over the end of the latch 19 which, by the action of its own spring, is thrown into locking position indicated in Fig. 2.

In the re-setting operation described, the arm 30 by engaging the pin 31 on the secondary detent arm 6, throws the same into position where the detent 4 will lie over the end of the detent arm 3 as shown in Figs. 5 and 7 and the end of the secondary detent arm 6 will be locked by the unmutilated portion of the shaft 8, itself constituting a detent, as described in my prior application before referred to, it being understood that the restoration of the arm 6 to this position occurs before the shaft has been turned back by the arm 30 to such position as to obstruct the free backward movement of the arm 6. The parts having been thus restored to position, the arm 6 is locked positively by the master shaft and the self-freeing tendency of the detent for the latter is checked by the action of the locking dog 18 upon the secondary detent arm 15 until said secondary arm is freed by the movement of the catch lever 17 occurring when the temperature rises at a rate predetermined by the rate at which the air is permitted to escape through the restricted passage leading from the chamber of the thermostat.

What I claim as my invention is:—

1. In an apparatus of the character described, the combination of a primary release arm and train of detents normally holding the same out of action, a weighted master shaft having a detent normally holding said train from action, a detent arm also carried by said shaft and normally holding the same from rotation under the influence of the weight, a secondary detent and detent arm normally restraining said rock shaft and detent arm and means for freeing said secondary detent arm upon increase of temperature at an abnormal rate.

2. In an apparatus of the character described, the combination with the master rock shaft and primary release arm provided with means controlled by a detent on the master shaft for normally detaining said arm of a detent arm carried by the master

shaft, a pivoted latch or catch sustained thereby, a shaft provided with a lock for said latch and having a secondary detent arm, a detent lever having a dog normally engaged by the secondary detent arm and a latch for the dog-carrying lever operatively connected with means responsive to abnormal rate of rise of temperature.

3. In an apparatus of the character described, the combination with the master rock shaft and means controlled thereby for normally holding a primary release arm out of action, of means responsive to an abnormal rate of rise of temperature, a weight tending to turn said master shaft in a direction to free the primary release arm and an independent train of detents normally holding the master shaft from turning and operatively connected with the devices responsive to abnormal rate of rise of temperature and actuated by the latter through the direct force of air when expanded by the heat of said abnormal rate of rise.

4. In an apparatus of the character described, the combination of a weighted master rock shaft having a detent arm projecting from said shaft, a detent shaft provided with a detent normally holding the detent arm and master shaft from turning, a secondary detent arm, a pivoted dog-carrying lever or latch normally restraining said secondary detent arm, a catch for holding the dog in position to normally lock the secondary detent arm, a diaphragm operatively connected with the catch and serving to free the secondary arm from the dog and a connection from the diaphragm chamber to an air chamber having a vent adapted to allow air to escape at a predetermined rate to render the device responsive only when the temperature of the air rises at a predetermined rate as and for the purpose described.

5. In an apparatus of the character described, the combination of a weighted master rock shaft and detent devices therefor comprising a detained member carried by said rock shaft and a detaining member engaged thereby and having a bias under the influence of the weighted rock shaft tending to move it in a direction to release said shaft, a secondary detent arm connected to said detaining member, a catch locking said arm against movement so as to hold the detent devices for the rock shaft in check, means responsive to change of temperature for freeing the secondary arm from the locking action of said catch and means for turning the master shaft back to normal position and restoring said catch to position for locking the secondary detent arm prior to the restoration of the detained member of the rock shaft detent devices to position for engaging with its detaining member.

6. In an apparatus of the character described, the combination of the weighted master rock shaft, mechanism released by the motion of said shaft under the influence of its weight when said shaft is permitted to turn, detent devices normally holding said shaft against turning and comprising a detained member connected to the rock shaft and a detaining member engaged thereby and having a self-releasing tendency due to the action of the weight exerted on the detaining member through the detained member, a secondary detent arm holding said self-releasing tendency in check and a thermally controlled latch or catch having a toe or dog engaged by and locking the secondary detent arm.

7. In an apparatus of the character described, the combination of the biased master rock shaft, mechanism released by the motion of said shaft under the influence of its weight when said shaft is permitted to turn, detent devices normally holding said shaft against turning and comprising a detained member connected to the rock shaft and a detaining member engaged thereby and having a self-releasing tendency due to the action of the weight exerted on the detaining member through the detained member, a secondary detent arm and catch locking said arm whereby the self-releasing tendency is held in check, a spring acting on said catch and tending to withdraw the toe or dog from locking position and a latch or catch normally holding the first-named latch or catch in locking position and itself mechanically actuated by the force of expansion of confined air on rise of atmospheric temperature.

8. In an apparatus of the character described, the combination substantially as described of a weighted main or master rock shaft carrying a detent and mechanism normally restrained thereby but freed by the action of the detent on said shaft when the shaft is permitted to turn, independent detent devices normally holding the shaft from turning under the bias given thereto by said weight, a secondary detent arm holding said independent detent devices in normally engaged position, a dog for locking the secondary detent arm and a re-setting device acting as described to restore the dog to position to lock the secondary detent arm and then turn the master shaft into position to cause said detent devices therefor to become engaged.

9. In an apparatus of the character described, the combination of a biased master shaft carrying a detent, and mechanism normally restrained thereby but freed by the action of the detent on the shaft when the same is permitted to turn and independent detent devices normally holding the shaft from turning, said detent devices embracing a detent arm on the master shaft, a detained

detent member mounted on said arm and a detaining member engaged thereby and having a bias imparted to it in a direction to cause it to release the detained member, a secondary detent arm, a latch normally restraining said secondary detent arm and means responsive to a change of temperature at a predetermined rate for controlling the action of the latch whereby the shaft may be released and in turn may free the normally restrained mechanism.

Signed at New York in the county of New York and State of New York this 11th day of May A. D. 1915.

ERNEST A. LOWE.

Witnesses:
W. R. WARNER,
F. B. TOWNSEND.