

942,131.

Fig. 1.

Witnesses:
John H. Parker

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R. Wallace.

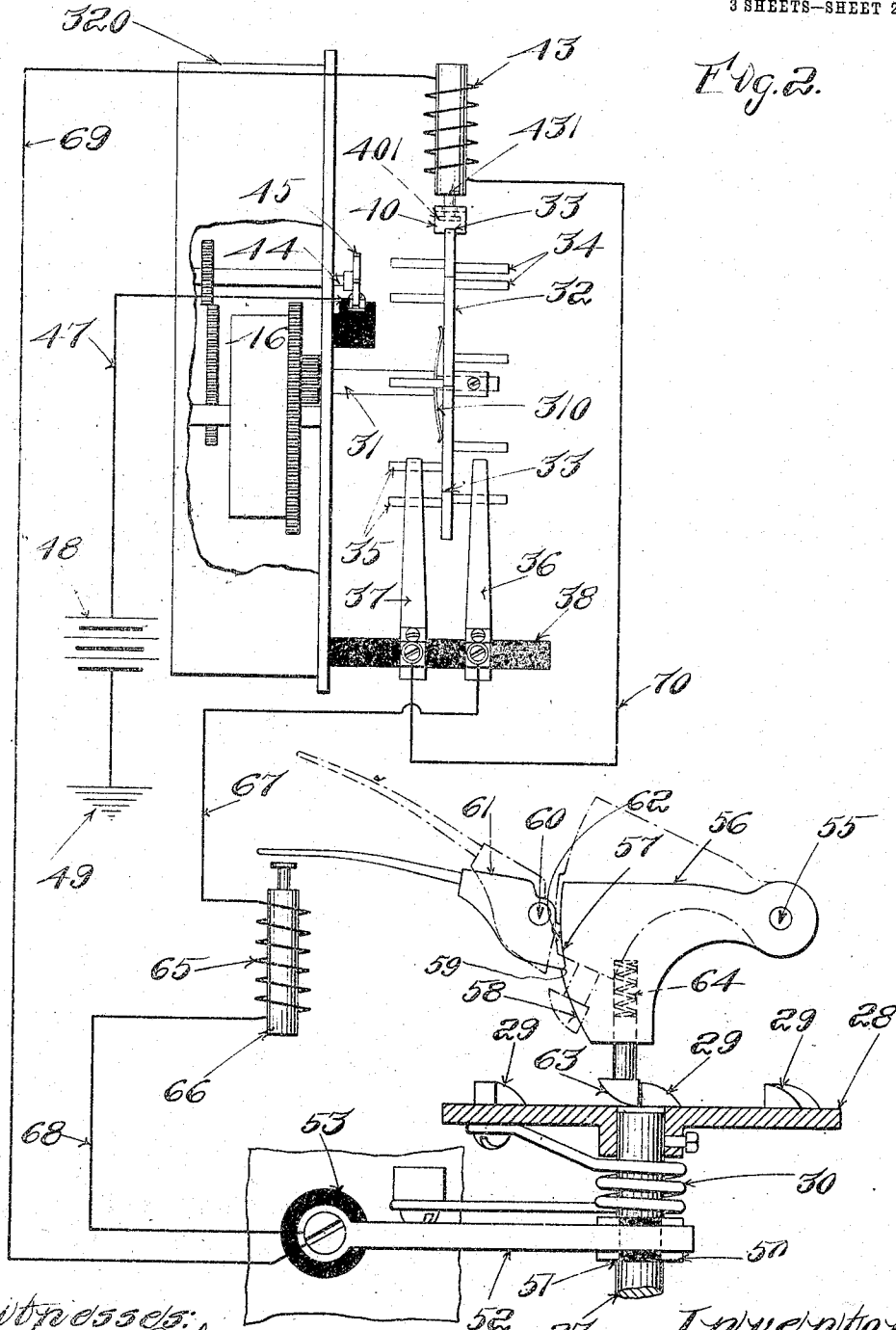
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B. L. AMES.
TIME CONTROLLED SMOKE PREVENTER.
APPLICATION FILED FEB. 28, 1908.

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Patented Dec. 7, 1909

3 SHEETS—SHEET 2.



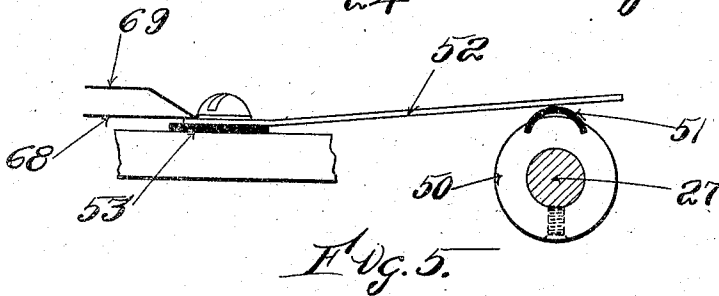
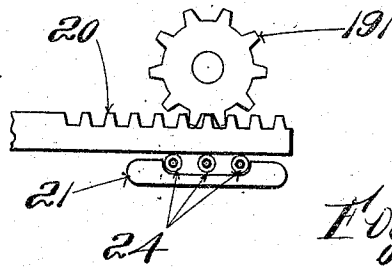
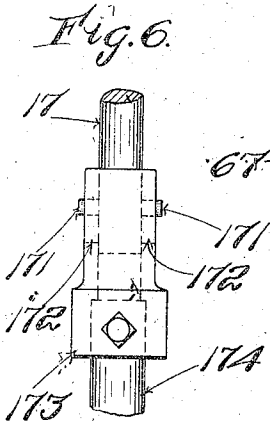
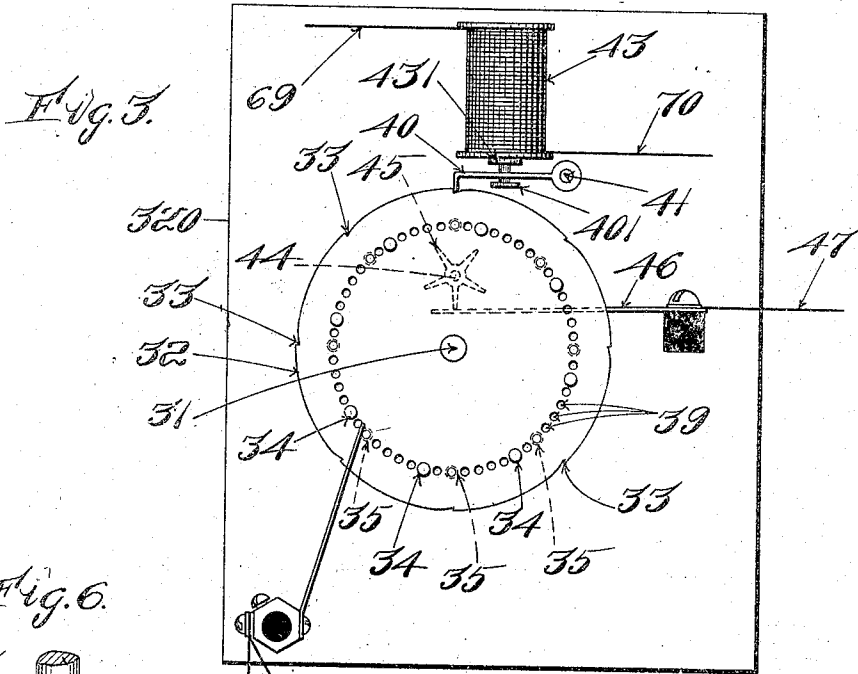
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UNITED STATES PATENT OFFICE.

BRADFORD L. AMES, OF BOSTON, MASSACHUSETTS.

TIME-CONTROLLED SMOKE-PREVENTER.

942,131.

Specification of Letters Patent.

Patented Dec. 7, 1909.

Application filed February 23, 1908. Serial No. 418,210.

To all whom it may concern:

Be it known that I, BRADFORD L. AMES, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented a certain new and useful Improvement in Time-Controlled Smoke-Preventers, of which the following is a specification, reference being had therein to the accompanying drawings.

In the operation of furnaces for boilers, various means of preventing issuance of black smoke from the chimney have been provided. A common means is to introduce air directly over the fire by means of jets of steam from steam nozzles. For the best operation of these devices, the introduction of the air should take place only for a limited period of time immediately after fresh coal has been placed upon the fire, and the supply of air should be stopped after a period of time determined by the conditions in the furnace. To accomplish this, the valve controlling the steam nozzle and the damper controlling the supply of air should both be closed. Heretofore the damper and the steam valve have been opened automatically by the opening of the furnace door, but the closing of the furnace door does not operate to shut off the steam or to close the air damper because it is desirable that the supply of air should be continued for some minutes (under ordinary conditions about five) after fresh coal has been placed upon the fire. Sometimes it has been left to the attention of the fireman to shut the steam valve and close the dampers and sometimes the closing of the valve and dampers is done by automatic apparatus but such apparatus has been clumsy and ineffective. I find in practice that this duty is seldom properly performed by the fireman who frequently allows the steam valve and air dampers to remain open all the time or he closes them immediately after firing, and this carelessness on the part of the fireman results either in uneconomical conditions in the furnace or else in the production of black smoke which is always evidence of imperfect combustion and also is contrary to the ordinances of many cities. For the proper and most economical operation of smoke preventing devices of this kind, it is necessary that the steam valve and air dampers remain open for a certain predetermined length of time only and then be immediately closed.

My invention affords simple and effective

means by which the air blast is turned on by the opening of the door and is shut off at the end of a predetermined period of time which may be varied according to the conditions existing in the furnace.

It consists essentially in door operated mechanism for operating the air dampers and steam valve in one direction, and time-controlled mechanism for releasing at the end of said predetermined period of time the spring which moves the air dampers and steam valve in the other direction, said time-controlled mechanism being arranged to operate the said mechanical parts through electric connections whereby I am enabled to locate the delicate parts of the mechanism at a distance from the furnace so that these parts are not subjected to the injurious conditions prevailing immediately about the furnace.

The device embodying my invention is so constructed that an exceedingly small battery current is required, the only power required being that which is necessary to trip the operating mechanism.

The devices embodying my invention are also constructed so that by a small multiplication of parts it is possible to control independently the smoke preventers attached to several boilers from the same apparatus.

The invention will be fully understood from the following description taken in connection with the accompanying drawings, and the novel features are pointed out and clearly defined in the claims at the close of the specification.

In the drawings:—Figure 1 is a front elevation of a portion of a boiler provided with three smoke preventers operated by a device embodying my invention, certain parts of said device being indicated diagrammatically for convenience of illustration. Fig. 2 is a side view on an enlarged scale, and partly diagrammatic, of the time-controlled mechanism and part of the operating means by which the air dampers and steam valve are operated. Fig. 3 is a front elevation of the time-controlled mechanism shown in Fig. 2. Fig. 4 is a detail of the rack and pinion showing particularly the roller bearing for the rack 20. Fig. 5 is a detail of the contact piece 50 and brush 52. Fig. 6 is a detail of the valve stem.

Referring to the drawings,—there is shown at 11 and 12 the two furnace doors,

the said furnace doors being hinged to swing in opposite directions. At 13, 13, are indicated the air dampers of three smoke preventers supplied by steam through the branch pipes 14 from the main steam pipe 15. The supply of steam to the steam nozzles (not shown) of the three smoke preventers 13 is controlled by the control valve 16 which is a quick acting valve operated by the rotating valve spindle 17. The said air dampers 13, 13, and the said steam valve 16 may together be termed the operating means for the smoke preventers as the smoke preventer is set in operation by opening the said dampers and valve. A pin 19 on an arm 18 on the lower end of said valve spindle 17 engages one of the doors 11, 12, so that the opening of the door turns the said valve spindle 17 and opens the said steam supply valve. The said valve spindle 17 is provided with a pinion 191 which engages a rack 20 carried in brackets 21 across the front of the furnace. The valve spindle 17 is provided with a sliding connection which permits of a slight vertical variation in the position of the said valve with relation to the pinion 191 and rack 20 so that a slight vertical displacement of the valve 16 will not cause the said rack and pinion to bind. This sliding connection consists in a pin 171 (see Fig. 6) on the lower end of the valve spindle 17 and at right angles thereto, said pin being received in two vertical slots 172 in a collar 173 made fast to the lower half of the valve spindle which is numbered 174. Hereafter in this specification the two halves of the valve spindle are referred to collectively as "the valve spindle 17". The rotating air dampers 13 are operated by the longitudinal movement of the rack 20 through a connecting rod 22 and links 23 pivoted at their ends to the said air dampers 13 and sliding connecting rod 22 respectively. In order that said rack 20 may not bind and that it may be more readily slidable, I provide roller bearings 24 in said bracket 21, see more particularly Fig. 4. At the opposite end of the sliding rod 22 I place a second rack 25 operating a pinion 26 mounted on a shaft 27. This rack 25 is behind the said pinion 26. This shaft carries upon its upper end a stop plate 28 provided with projections 29 which will be hereinafter more fully described. About the shaft 27 is placed a spring 30, one end of which is fast to a fixed part and the other end of which is fast to said stop plate 28 and tends to restore the shaft 27, pinion 26, rack 25 and sliding bar 22 to their original position after the opening of the doors.

From the description thus far it will be seen that when either of the furnace doors 11 and 12 is opened, the operating means for the smoke preventers, that is the air dampers and steam valve are actuated by

the movement to the right of the sliding member 22 and that except for the action of the spring 30, said parts will remain in this position until they are restored to their normal position. The restoration of the parts to the normal position is accomplished by the spring 30 which is brought into action by time controlled mechanism operating to release the stop plate 28 at the predetermined time as will be later described.

The stop plate 28 is provided with a series of cam-shaped projections 29, which, if more convenient, be made in the form of notches and the number of said cam-shaped projections is dependent upon the conditions under which said device is to be used. In practice I have found six a convenient number. Above the stop plate 28 and pivoted at 55 is a locking piece 56 provided with a substantially circular surface of two different curvatures as shown at 57 and 58, said two different surfaces being separated by a very small notch 59. At 60 is pivoted a trigger 61 provided with a surface 62 concentric with the said surface 57 and having a point which engages the notch 59 when the parts are in the position shown in Fig. 3. From the lower side of the locking piece 56 projects a pawl 63 provided with an inclined bottom and slidably mounted in the said locking piece 56. The said pawl 63 is yieldingly pressed down upon the stop plate 28 by the spring 64 so that it is allowed to yield upwardly and ride up over the cam pieces 29 as the stop plate is rotated with the shaft 27. When the parts are in the position shown in Fig. 3, the projections 29 are held against the pawl 63 by the spring 30 and the parts remain in the position shown in Fig. 3 until the trigger 61 is moved. When the trigger 61 is moved, the point of the trigger is released from the notch 29 and the pressure upon the pawl 63 causes the locking piece 56 to fly up into the position shown in dotted lines in Fig. 2 and thereby release the stop plate and allow it to rotate under the pressure of the spring 30. The time-controlled means by which the trigger 61 is moved and the locking piece 56 is released will now be described.

Referring now to Figs. 2 and 3 there is indicated at 31 the shaft of a clock-work mechanism 320 and said shaft 31 is caused to revolve by any convenient system of springs and toothed wheels and to make one complete revolution in substantially an hour. I have shown the clock-work somewhat conventionally as such clock-work is old in the art. I prefer to use the movement of an ordinary eight-day clock. To the shaft 31, is fastened a disk or pin-carrier 32 provided with a series of notches 33 on its periphery. The said pin-carrier 32 is mounted loosely upon the shaft 31 and is caused to rotate with the said shaft by means of a spring

clutch 310, but at intervals the said pin-carrier is held from rotating by means of a latch 40 pivoted at 41 the point of said latch engaging one of the notches 33. Arranged upon said wheel and on opposite sides thereof are two series of pins 34 and 35 located in holes drilled in the pin-carrier 32 and the said pins 34 and 35 make contact at intervals determined by their position on the said pin-carrier 32 with a pair of brushes 36 and 37 mounted on an insulating support 38. The pins 35 are in the embodiment shown in the drawing, set in the face of the pin-carrier 32 opposite to each notch 33 in the periphery, of said pin-carrier 32, but the pins 34 on the right hand side of the pin-carrier as seen in Fig. 3 are set at convenient intervals, the distance of any pin 34 from the preceding notch 33 determining the length of time during which the valve and air dampers remain open. As shown in the drawings, this time is five minutes, but if a longer time is desired, the pins 34 are set farther apart by means of additional holes 39 drilled in the said pin-carrier 32 or if a shorter time is desired, each of said pins is set nearer to the notch 33 to which it corresponds. In practice I find it convenient to have the said holes 39 drilled in the pin-carrier at minute intervals. The pins 35 serve to operate the devices by means of which the pin-carrier is released and allowed to revolve. Above the said pin-carrier is a solenoid 43 which is energized at certain intervals to lift its core 431 and to cause the lower headed end 401 of said core to strike the said latch 40 a blow and thereby lift it and release the pin-carrier 42 so that the pin-carrier may rotate with the shaft 31. On the second-hand shaft 44 of the clock movement is located a star-wheel 45 which rotates with the said shaft once a minute and beneath the said star-wheel is a brush 46 which contacts at intervals with the points of the said star-wheel. This brush is connected by the wire 47 with the battery 48, and the other side of said battery being grounded at 49. It will, therefore, be seen that the star-wheel 45 makes contact five times for each revolution; that is, five times in each minute, but the said contacts are very short, being not more than two or three seconds at a time. In this way the battery current is greatly conserved without affecting the operation of the machine. When the brush 46 is in contact with the star wheel 45, the electric current from the battery passes through the wire 47, the brush 46 and the star wheel 45 to the frame work of the clock movement and thence to the shaft 31, since the parts are of metal and the brush 46, as previously stated, is insulated from the frame of the clock movement.

On the shaft 27 of the stop plate 28 is

located a circular contact piece 50 provided with an insulating sector 51 (see Fig. 5.) A brush 52 mounted on some convenient fixed portion and insulated therefrom at 53 bears upon the said circular piece 50 and makes contact therewith except when it is upon the insulating sector 51 when the said contact is broken.

Beneath the end of the trigger 61 is located a solenoid 65 provided with a core 66, and this solenoid is connected at one end with the brush 36 by means of the wire 67, and at the other end with the brush 52 by means of the wire 68. The said brush 52 is connected with the solenoid 43 by wire 69 and the other end of said solenoid 43 is connected with the brush 37 by means of the wire 70. As previously stated, brush 46, which contacts with the star-wheel 45, is connected with the main circuit of the battery 48 by means of the wire 47, the other side of said battery being connected with the ground 49.

The operation of the devices shown and described herein are as follows: When the fireman opens the door to put coal upon the fire, the sliding bar or connecting rod 22 is moved to the right in Fig. 1 by means of the arm 18, rack 20 and pinion 191. The movement of the sliding bar 22 to the right causes the shaft 27 and the stop plate 28 mounted thereon to rotate by means of the rack 26 and pinion 25. This rotation of the shaft 27 causes the brush 52 to contact with the non-insulated portion of the contact piece 50 and as the shaft is grounded, permits current to flow from the battery through the solenoid 43 in the following path, thereby energizing the solenoid 43. The current from the battery flows through the wire 47 to the brush which contacts five times a minute with the star-wheel 45. When one of the points of the star-wheel contacts with the brush 46, the current passes from the battery into the clock work and from one of the pins 35 which is then in contact with the brush 37 (at this time the brush 36 is not in contact with any of the pins 34) through the wire 70 to the solenoid 43, thereby energizing it. From the solenoid 43, the current passes through the wire 69 to the brush 52 and thence to the ground through the shaft 27. Prior to this time, the pin-carrier 32 has been stationary, being allowed to slip on the shaft 31 by means of the clutch. When the solenoid 43 is energized, the latch 40 is lifted so that its point is free from the notch 33 in which it rests, thereby releasing the pin-carrier 32 and allowing it to rotate with the shaft 31. The rotation of the pin-carrier 32 then carries the pin 35 out of contact with the brush 37, breaking the circuit through the solenoid 43, and allowing the latch 40 to drop again onto the periphery of the pin-carrier 32. Further rotation of the pin-car-

rier brings one of the pins 34 in contact with the brush 36 so that the next time the star-wheel 45 contacts with the brush 46, the circuit in which is placed the solenoid 65 is energized and the core of the said solenoid is caused to move upward and strike the trigger 61, thereby releasing the locking piece 56 and allowing the stop plate 28 to be rotated by the spring 30. This rotation of the shaft 27 by the spring 30 closes the air dampers 13 and the steam valve 16 and restores the parts to the original condition, bringing the brush 52 on the insulating sector of the contact piece 50. The brush 36 is of such a length that it remains on each of the pins 34 for a relatively long time and the circuit in which the solenoid 65 is located is closed during this time, whenever the star-wheel 45 contacts with the brush 46. By this means, the certainty of action of the device is materially increased for the armature 66 of the solenoid strikes the trigger 61 a number of blows if the first one is not sufficient to move the trigger and release the parts, but this action only takes place in case the first blow of the armature failed to release the trigger. The rotation of the pin-carrier 32 continues after the brush 36 has broken contact with the pin 34 until the latch 40 drops into the next notch 33 in the pin-carrier 32. At this time the brush 37 is on the pin 35 and the circuit from the star-wheel 45, through the solenoid 43 which operates the latch 40, is again in condition to be closed when the furnace door is opened and the brush 52 makes contact with the contact piece 50.

By supplying the shaft 31 with a second pin-carrier 32 and with corresponding brushes 36, 37 and solenoid 43 the smoke preventers on a second boiler may be operated by a single clock-work, and if desired the number of boilers may be increased by a corresponding duplication of parts.

I claim as my invention,—

1. In a smoke-preventer and in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for actuating it in the other direction, a ratchet and pawl to hold the spring after the movement in the first direction, and releasing means for said pawl comprising a clock-train, an electric circuit normally open, a solenoid in said circuit to act on said pawl, and a contact device actuated by the clock-train to close the circuit at the end of a predetermined period of time.

2. In a smoke preventer and in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for actuating said operating means in the other direction, a stop plate and pawl for said spring, a solenoid to move the pawl and release the stop plate and spring, time-controlled mechanism,

and electric connections between said time controlled mechanism and said solenoid.

3. In a smoke-preventer and in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for actuating it in the other direction, a ratchet and pawl to hold the spring after the movement in the first direction, and releasing means for said pawl comprising a clock-train, an electric circuit normally open, a solenoid in said circuit to act on said pawl, a contact device rotatable with said clock-train to close the circuit at the end of a predetermined period of time after said contact begins to rotate, a latch to keep the contact from rotating, a solenoid to operate said latch, a second circuit through said solenoid and a contact operated by the door-operated means to close the last mentioned circuit, lift the latch, and allow the first mentioned contact to begin to rotate when the door operated means is moved in the first direction.

4. In a smoke preventer and in combination with the doors of a furnace, the air-damper and the steam valve actuated in one direction by the door of the furnace, a source of electric energy, a clock movement, a pin-carrier on shaft thereof, a clutch to cause said pin-carrier to turn with said shaft, a latch to hold the pin-carrier from rotation, actuating means operated by a movement of a furnace door to move the latch and set the pin-carrier in motion, pins on said pin-carrier, and a brush making contact with one of said pins after a predetermined interval to close a circuit and actuate the said air damper and steam valve in the opposite direction.

5. In a smoke preventer and in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for actuating said operating means in the other direction, a stop plate and pawl for said spring, a solenoid to move the pawl and release the stop plate and spring, a source of electric energy, a clock movement, a pin-carrier on a shaft thereof, pins on said pin-carrier, and a brush making contact with said pins at predetermined intervals to close a circuit through the said solenoid and release the said spring.

6. In a smoke preventer in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for operating said actuating means in the other direction, a rotating stop plate, and pawl for said spring, a solenoid to move the pawl and release the stop plate and spring, a source of electric energy, a clock movement, a pin-carrier on a shaft thereof and having notches in its periphery, a latch engaging

the notches in the periphery of the said pin-carrier, a solenoid operating said latch, an electric circuit through the said solenoid, two sets of pins on said pin-carrier, two brushes, one for each set of pins, one brush making contact with one set of pins to close the circuit through the said solenoid and release the said stop plate and pawl, and the other brush contacting with the other set of pins to close the circuit through the said last mentioned solenoid and lift the said latch to allow the said pin-carrier to move.

7. In a smoke preventer, in combination with operating means therefor, door-operated means for actuating said operating means in one direction, a spring for operating said actuating means in the other direction, a rotating stop plate and pawl for said spring, a solenoid to move the pawl and release the stop plate and spring, a source of electric energy, a clock movement, a pin-carrier on a shaft thereof, having notches in its periphery, a latch engaging the notches in the periphery of the said pin-carrier, a

solenoid operating said latch, a circuit 25 through the said solenoid, a rotating contact rotating with the said stop plate and having a portion thereof insulated, a brush contacting with the said rotating contact to ground a circuit, two sets of pins on said pin-carrier, 30 two brushes, one for each set of pins, one brush making contact with one set of pins to close the circuit through the said solenoid and release the pawl and stop plate, and the other brush contacting with the other set of 35 pins to close the circuit through the last mentioned solenoid and to lift the said latch to allow the pin-carrier to move, the said last mentioned brush being in electric connection with the brush contacting with the said ro- 40 tating contact to make connection with the ground and close the circuit.

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

BRADFORD L. AMES.

Witnesses:

GEORGE P. DIKE,
ALICE H. MORRISON.