

M. H. HART.
DOOR OPENING AND CLOSING DEVICE.
APPLICATION FILED DEC. 16, 1910.

988,265.

Patented Mar. 28, 1911.

3 SHEETS—SHEET 1.

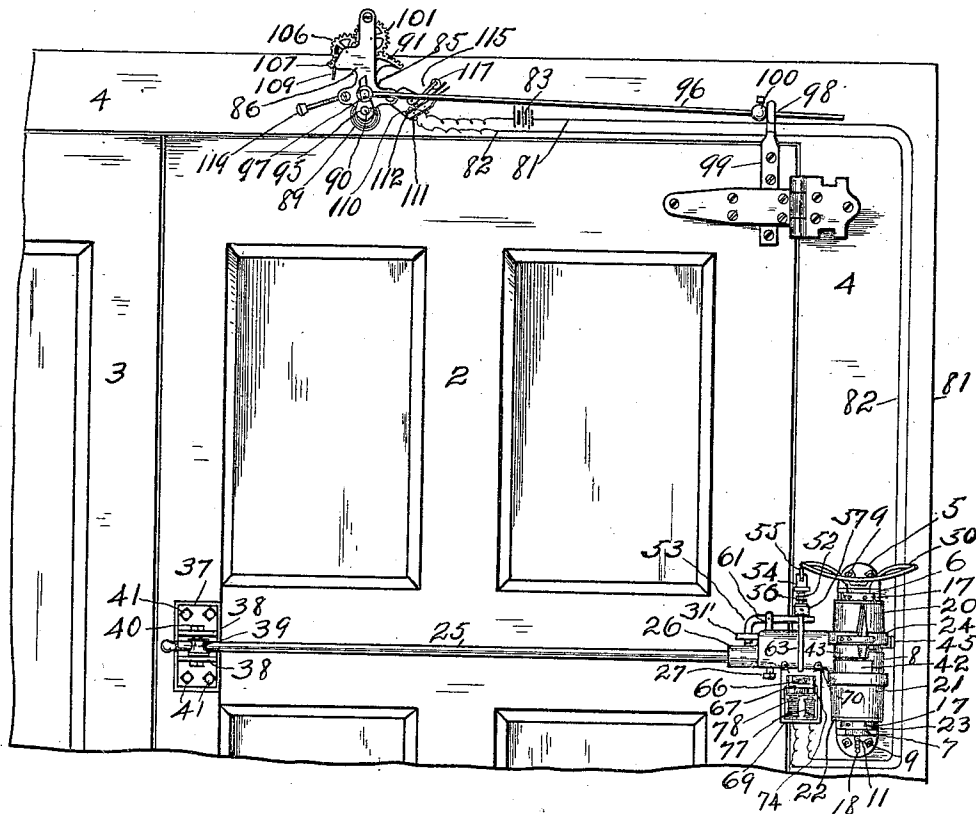


Fig. 1.

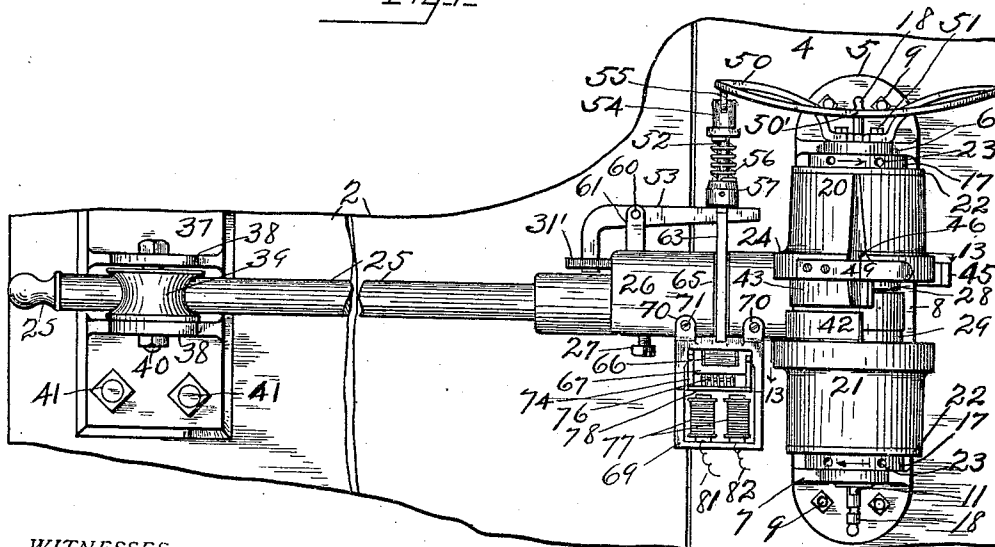


Fig. 2.

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3 SHEETS—SHEET 2.

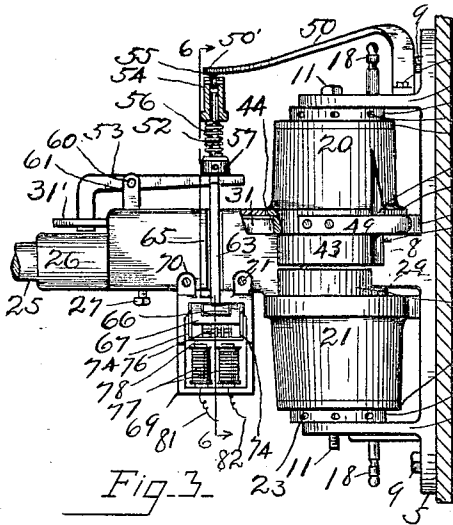


Fig. 3.

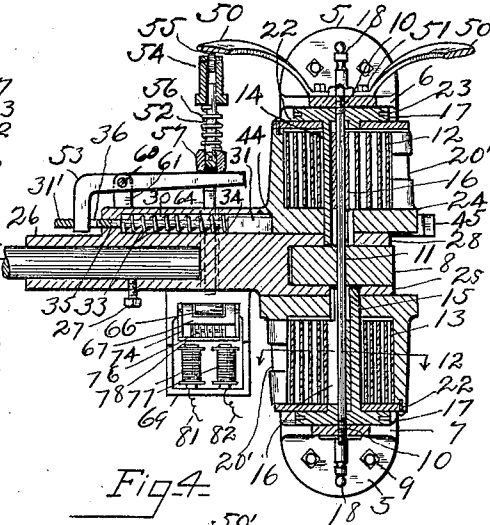


Fig. 4.

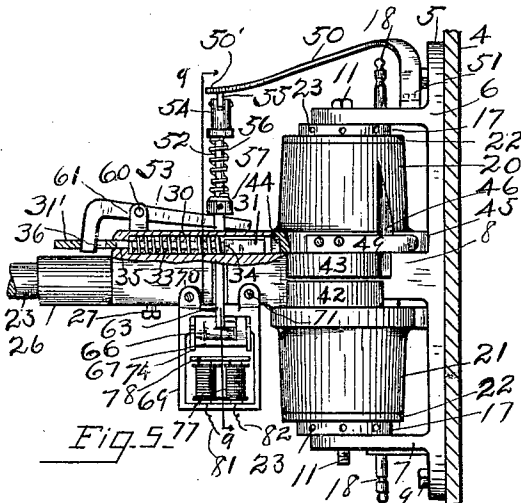


Fig. 5.

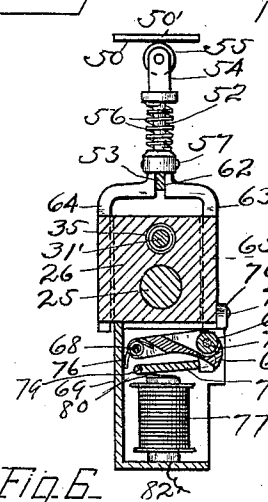


Fig. 6.

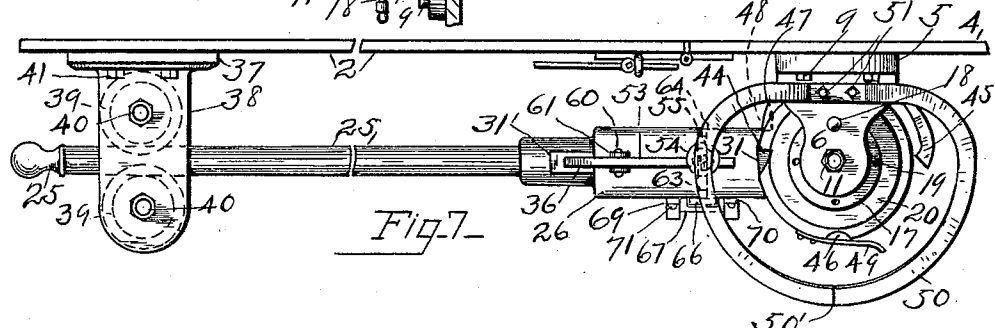


Fig. 7.

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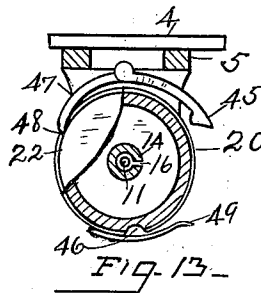
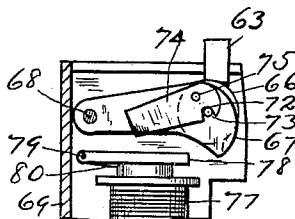
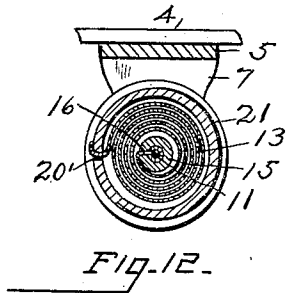
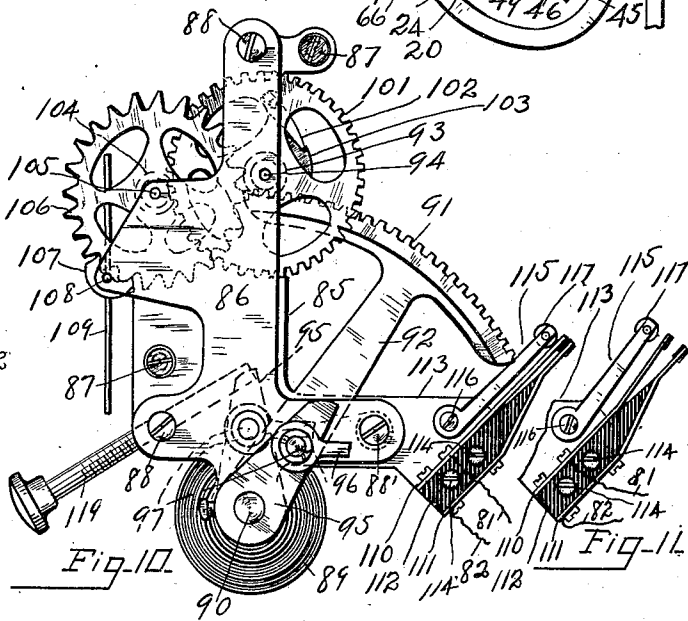
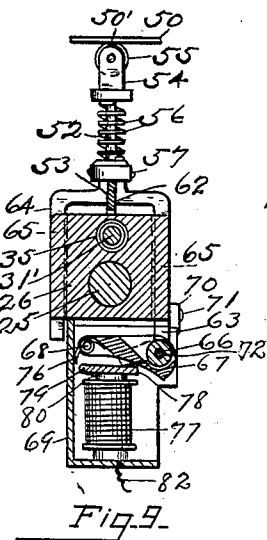
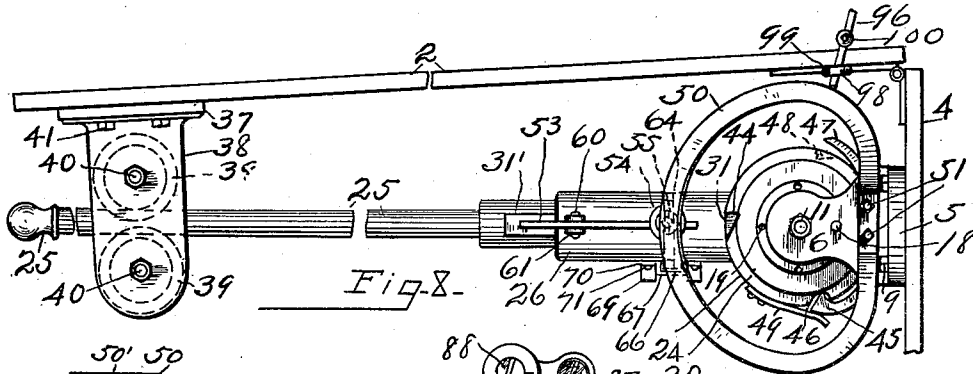
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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

MILTON H. HART, OF AKRON, OHIO, ASSIGNOR OF ONE-HALF TO ROBERT MANY, OF CHICAGO, ILLINOIS.

DOOR OPENING AND CLOSING DEVICE.

988,265.

Specification of Letters Patent.

Patented Mar. 28, 1911.

Application filed December 16, 1910. Serial No. 597,649.

To all whom it may concern:

Be it known that I, MILTON H. HART, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented certain new and useful Improvements in Door Opening and Closing Devices, of which the following is a specification.

This invention relates to improvements in devices for operating doors or like parts, and is designed especially for opening and closing the doors of fire departments, vaults and other structures.

The invention relates particularly to improvements in the devices shown and described in United States Patents numbered 829,365 and 975,507, bearing dates respectively August 21, 1906 and November 15, 1910.

The object of the invention is to provide a mechanism which will open a door or like part instantly upon the unlatching or otherwise releasing of the same, and which will automatically close the door or part after the lapse of a predetermined time, without attention or assistance from any other source.

A further object is to provide a detached auxiliary mechanism for measuring and regulating the interval of time the doors may remain in open position.

A further object is to provide electrically operated means carried by the main device and connected with and controlled by the timing mechanism for permitting or preventing the automatic closing of the door by the main device.

A further object is to improve and simplify the construction and arrangement, and to reduce the number of parts, for rendering the whole more reliable, more durable, quicker acting and less expensive than the devices of the former patents.

The various novel features of my invention will be described in the subjoined specification and particularly pointed out in the claims.

Figure 1 is an elevation of portions of a pair of doors and the frame; showing the application of the opening and closing device, the latter being set for operation. Fig. 2 is an enlarged front view of the main device. Fig. 3 is a part elevation and part section of the device as it appears when the door is open, as in Fig. 8. Fig. 4 is a verti-

cal longitudinal section through the center of the main device. Fig. 5 is a part elevation and part section similar to Fig. 3. Fig. 6 is a vertical cross-section substantially on line 6—6 of Fig. 3. Fig. 7 is a top plan view of the main device, as when the door is closed. Fig. 8 is a top plan view of the device, as when the door is open. Fig. 9 is a vertical cross-section substantially on line 9—9 of Fig. 5. Fig. 10 is an enlarged side elevation of the clock-work timing mechanism showing the method of closing the electric circuit. Fig. 11 is a detail view of the circuit breaker. Fig. 12 is a cross-section through one of the springs taken on line 12—12 of Fig. 4. Fig. 13 is a cross-section taken on line 13—13 of Fig. 2. Fig. 14 is an enlarged detail sectional view showing the electric trip in full release.

Similar characters of reference are assigned to corresponding parts throughout the several views.

In the drawings, 2 and 3 represent the doors, and 4 the frame or casing thereof. The main parts of the opening and closing device are operatively supported on the frame by a bracket comprising a base 5, end lugs 6 and 7, and a central lug 8, the said lugs projecting from the face of the base and arranged one above the other. The bracket is secured to the frame by bolts or screws 9. Near the free ends, the lugs of the bracket are perforated, as at 10, to receive a common bolt or rod 11, which passes through all of the lugs for pivotally securing certain of the working parts of the device.

The power for opening and closing the door is obtained from a pair of reversely arranged spirally-wound main-springs 12 and 13, which encircle arbors 14 and 15. The main springs are attached to the arbors by means of slots 16, and the arbors are bored out centrally to receive the bolt 11. The outer end of each arbor is provided with a flange 17, and the arbors are held from rotation when the springs are wound up by pins 18 which pass through the lugs 6 and 7 and are then received in sockets 19 formed in the outer faces of the flanges 17. The main springs 12 and 13 are inclosed respectively in cylindrical cups or casings 20 and 21 which are arranged concentric to the arbors 14 and 15 and the rod 11. To provide for giving tension to the main springs, their

outer ends are formed into hooks for engaging the edges of slots 20', which are formed in the walls of the casings. The open ends of the casings 20 and 21 are closed
 5 by circular caps 22, which may be secured to the ends of the casings by any suitable means. The adjacent closed ends of the casings 20 and 21 are perforated to receive the inner ends of the arbors 14 and 15 for afford-
 10 ing suitable bearings for these parts. In the assembled device, the casing 20 is disposed between the lugs 6 and 8, and the casing 21 is disposed between the lugs 7 and 8 of the bracket. The main spring 12 is em-
 15 ployed for opening the door, and is wound up to give it the proper tension for handling the door by rotating the arbor 14 in the direction indicated by an arrow on the flange 17 of said arbor. The main spring 13 is
 20 employed for closing the door, and is wound up by rotating the arbors 15 in the direction indicated by the arrow on the flange of said arbor. To wind the springs 12 and 13 a rod or other suitable device may be inserted
 25 in sockets or holes 23, which occur at intervals in the periphery of each of the flanges 17. During the winding or unwinding of the main-springs, the pins 18 are temporarily withdrawn from the sockets 19. After the
 30 springs are wound to a certain normal tension, the pins 18 are driven in, and thereafter the arbors will be held stationary, while the casings 20 and 21 may be rotated to a limited extent, in either direction on the
 35 said arbors, for opening and closing the doors.

The opening and closing movements of the door are effected by a relatively long arm or lever 25, which extends horizontally across
 40 the face of the door. One end of the lever 25 is fitted with a head 26, which is bored out lengthwise to receive the lever, and these parts may then be held rigidly together by means of a set-screw 27. The free end of the
 45 head 26 is formed into a fork having arms 28 and 29, both having perforations arranged concentric to each other, and also to the bolt 11 and the cylinders 20 and 21; the perforations in the fork being large enough to receive the
 50 inner ends of the arbors 14 and 15. The arms of the fork straddle lug 8 of the main bracket, and when the parts are assembled the lever 25 and the head 26 become pivoted to the central lug 8 by means of the said ar-
 55 bors. The head 26 has a hollow portion 30 which extends longitudinally and is disposed above and parallel to the lever 25, to provide a housing for a latch bolt 31, which is normally held in position to engage a flange 24
 60 of casing 20, by means of a coil-spring 33 which exerts its tension against a shoulder 34 of the latch bolt (see Fig. 5). The opposite end or stem 31' of the latch bolt passes through a perforation 35, and normally pro-
 65 jects beyond the outer surface of the head

26, the exposed portion of the stem having a slot 36 for receiving a part employed for withdrawing the bolt. The free end of the door operating lever 25 is yieldingly con-
 nected to the door by means of a bracket 37, 70 having parallel lugs or arms 38, between which are secured like rollers 39, the latter being pivotally supported by bolts or pins 40 which pass through the lugs and said rollers. The lever 25 is positioned between and 75 frictionally engages the rollers 39, by means of which arrangement the lever 25 is allowed free play reciprocally when the door is opening and closing. The bracket 37 may be secured to the door by bolts or screws 41. 80

When the device is first assembled and applied to a door, and the main-springs 12 and 13 are wound up ready for operation, the casings 20 and 21 will be in the positions indicated in Figs. 1, 2, 4 and 7, the door then 85 being in closed position, and neither of the main springs being in condition for moving the door, because they practically balance each other. To set the device for automatically opening and closing the door, the door 90 should first be unlatched and then swung by hand from the closed position shown in Figs. 1, 2, 4 and 7 to the open position shown in Figs. 3, 5 and 8. When the door is in the closed position a lug or projection 42 car- 95 ried by cylinder 21 is in engagement with the head 26 of the lever 25. The opening movement of the door will therefore rotate the casing 21 to the right about a quarter of a turn, thereby increasing the tension of spring 13 to that extent. When the door reaches the open position shown in Figs. 3, 5 and 8 the head 26 engages a lug 43 which is carried by cylinder 20, the opposite end of said lug at this time engages the lug 8 of 105 the main bracket, which serves to stop the further opening movement of the door. When the door is swung to the open position, as described, the latch bolt 31 is forced by its spring 33 into a notch 44 formed in the flange 24 of cylinder 20. As soon as the connection is made between the latch bolt 31 and the notch 44 the operator should close the door. The subsequent closing movement of the door by hand, will then 115 carry casing 20 around toward the left about a quarter of a turn to the position shown in Figs. 1, 2, 4 and 7, and thereby increase the tension of spring 12, to the same extent that the tension of spring 13 had been increased by the opening of the door. The device is then set for automatically opening and closing the door. At the instant the latch bolt 31 drops into the notch 44, as described, the cylinders 20 and 21 are held in such position 120 that an arm 45 of a rocking pawl or lever engages a recess 46 which is formed in flange 24 of the cylinder 20. As the point of the arm 45 enters the recess 46, a second arm 47 of the double pawl is thrown outwardly 125 130

free from engagement with a notch 48 of the casing 21 by spring 49, which normally bears against the free end of the arm 45. The initial closing movement of the door, owing to the engagement of latch bolt 31 with notch 44, rotates cylinder 20 toward the left, and throws arm 45 of the pawl out of the recess 46 on to the face of flange 24, and this action throws the point of arm 47 of the pawl into notch 48 of the cylinder 21, thus preventing the accidental recoil of said cylinder, and thereby retaining the extra tension which had been given to spring 13 by the opening of the door. The further closing movement of the door rotates casing 20 to the position shown in Figs. 1, 2, 4 and 7 at which time the arm 45 of the pawl rides upon the flange 24 of said casing. Upon closing the door for setting the device for operation, it should be securely latched so as to prevent the device from opening it until the proper time. During the interval the door is closed latch bolt 31 remains in the notch 44 of cylinder 20. The instant the door is unlatched, the opening spring 12 exerts its power through casing 20 and the said latch bolt against the head 26 of lever 25, and swings the door open to the extent shown in Figs. 3, 5 and 8.

The parts employed for opening and closing the doors, together with the functions and arrangement of the said parts as hereinbefore described, are substantially the same as shown and described in the latest of the two patents referred to. The method and means for setting in motion the automatic closing parts of the device, and also the means for timing the closing of the doors, are the really novel features of the invention, the construction, arrangement and operation of which will now be described.

50 represents a part which is mounted upon the lugs 6 of the bracket, and secured thereto by screws or bolts 51, the said part being arranged to overhang the main-spring cylinders, the overhanging portion being arranged in part circular and disposed concentric to the said cylinders, the forward portion of the said part being curved downwardly from each side, the lowest point being at 50', serves as a means for depressing a reciprocating plunger 52, which engages a tilting lever 53, which is employed for withdrawing the latch bolt 31 from engagement with the notch 44 of cylinder 20. The upper end of plunger 52 is fitted with a hollow reciprocating sleeve or head 54, which is adapted for endwise movement on said plunger, and the sleeve 54 is fitted with a roller 55 which is constantly in engagement with the underside of the guide 50 and travels back and forth when the door opens and closes.

56 represents a coil spring mounted upon the upper portion of the plunger 52 and

which is confined between the head 54 and a fixed stop 57. The object of this spring is twofold: first, to hold the roller of head 54 normally in engagement with the cam-guide 50; and, second, to be compressed for increasing its tension for the depressing of the plunger 52 each time the door is opened, sufficiently to tilt the lever 53, for withdrawing the latch bolt 31, thereby to permit the main device to close the door. The bell-crank lever 53 is pivoted at 60, to standard 61, which projects from the upper side of the head 26. The long arm of lever 53 plays in a slot 62 of the plunger 52; the short arm of said lever passing through the slot 36 of the stem of latch bolt 31. The lower portion of plunger 52 is preferably formed into a fork having arms 63 and 64, which are received, and adapted to freely play in slots 65 which are arranged vertically in the opposite sides of the head 26. When the door opens, the roller 55 of plunger 52 is made to track perfectly along the underside of the guide 50, which owing to its concentric and inclined arrangement effects the compression of the spring 56 between the head 54 and the stop 57, from the relaxed condition shown in Fig. 4, to the extent shown in Fig. 3. When the door is in closed position, spring 56 is always relaxed, and the top of lever 53 bears against the upper end of slot 62 of the plunger, and said lever by reason of the power exerted by spring 33 of the latch bolt, during this time, supports the weight of the plunger, which is comparatively light, and holds the roller 55 normally in engagement with the guide 50. As the door is swung to its open position, as shown in Fig. 3, the head 54 is made to telescope the upper end of the plunger, which starts the compression of the spring 56. In the first stage of the compression of spring 56, the plunger moves downwardly and depresses the long arm of lever 53 to a slight extent, but not enough to withdraw the latch bolt 31 from notch 44 of cylinder 20, for allowing the untimely closing of the door. By the time the parts have been moved to the extent indicated, the further or full downward travel of the plunger 52 is arrested temporarily by the engagement of the lower end of arm 63 of the plunger with a roller 66, which is carried by a yieldable stop 67, which is pivoted by a rod 68 within a casing 69, which is disposed beneath the head 26, and is secured thereto by means of lugs 70 and screws 71. The roller 66 is pivoted in a recess of the stop 67 by a rod 72, the opposite ends of which project beyond the lateral edges of the stop, and are received in semi-circular notches 73, which are formed in the corresponding edges of a pair of pending triggers 74, which are eccentrically and loosely mounted on the opposite inner walls of the

casing 69 by pins 75, as best seen in Fig. 14. When the tripping attachment, which comprises the roller 66, the stop 67, and the triggers 74, is at rest and awaiting operation, the triggers 74 are disposed vertically, by their connections with the stop 67 which is normally held in its upper position shown in Figs. 1, 3, 4 and 6, by means of a spring 76 which is coiled around the pivot rod 68.

Within the casing 69 and beneath the stop 67 are disposed two electro-magnets 77—77, which may be secured to the bottom of the casing in any suitable manner. Immediately above the magnets is disposed an armature 78, which is pivoted to the casing by a pin 79, and a spring 80 carried by the armature is employed for holding the armature away from the magnets, (see Figs. 1, 3, 4 and 6). While the armature is in the latter position, its free edge is disposed behind and engages the free ends of the triggers 74, and serves to hold the said triggers and also the stop 67 rigidly in their normal positions, as shown in Figs. 1, 3, 4 and 6. The stop 67 and its roller 66 are intended to be in the position last described at all times, whether the door is closed or open and particularly during the interval in which the plunger 52 is being depressed by the part 50, excepting for an instant when the closing movement of the door begins. Upon the first downward movement of the plunger 52, which is effected by the opening of the door, the lower end of arm 63 of plunger 52 comes to a firm bearing upon and is stopped by the roller 66, which prevents the plunger from fully depressing the lever 53 for releasing latch bolt 31 from notch 44 of cylinder 20. The drop or incline of the part 50, which depresses the plunger, is greater than that required to bring the plunger 52 into engagement with the roller 66, and as the door continues to swing to its open position shown in Figs. 3, 5 and 8, spring 56 is still further compressed by reason of the play of the head 54 upon the plunger. By this latter provision the said spring is given considerable extra tension or power, which is subsequently employed for completing the withdrawal of the latch bolt 31 from notch 44, for permitting the closing of the door by main-spring 12.

To carry out the objects and working of the device, the doors are intended to be held open for a short time, so as to allow the fire apparatus to pass out of the building, and then the device, through its own automatic arrangement is intended to close and lock the doors, after the lapse of a predetermined time, which may be varied as desired, and which is preferably controlled by a detached timing mechanism. The timing mechanism is electrically connected with the magnets 77, by wires 81 and 82, the latter being sup-

plied with electric current by means of a battery generally designated by the numerals 83. As explained, the initial opening movement of the door having brought arm 63 of plunger 52 to a firm bearing against roller 66 of stop 57, and the final opening movement of the door having fully compressed spring 56, ready for driving the plunger to its lowest position for releasing the latch bolt, the said parts will be held in the described positions, (shown in Figs. 3 and 6), until magnets 77 are energized by the closing of the circuit through the wires 81 and 82. Upon the closing of the circuit through the wires 81 and 82, armature 78 is drawn down upon the magnets, as shown in Figs. 5, 9 and 14, and breaks its engagement with the triggers 74, then the triggers and the stop 67 acting under the power of the spring 56 exerted through the plunger 52, are shifted from their upper position, shown in Figs. 3 and 6, to their lower position, shown in Figs. 5, 9 and 14. At the same time, the plunger is forced by the spring 56, to its lowest position shown in the last named figures, it carries with it the long arm of lever 53, and then the short arm of said lever withdraws the latch 31 from the notch 44 of cylinder 20, thereby permitting the main spring 12 to recoil for closing the door. As soon as the door starts on its closing movement, the roller 55 travels back over the inclined surface of part 50, and gradually allows the plunger 52 to be lifted to its ready-to-act position, as shown in Figs. 1, 2 and 4. The raising of the plunger to the last named position is effected indirectly by the joint power of spring 33 of the latch bolt, and the spring 76 of the stop 67.

The clock-work timing mechanism which is employed for opening and closing the electric circuit through magnets 77 and wires 81 and 82, consists of a number of parts which will now be described.

The parts of the clock-work are fitted in a frame comprising a base 85 and a front 86. The base may be mounted in any suitable position by means of screws 87. The front and base are connected by means of bolts 88 and 88', and are spaced sufficiently to receive the gears and other parts between them. The power for operating the clock-work is derived from a spring 89, which is mounted upon, and the inner end thereof, is secured to a bolt 90, the other end being anchored to the bolt 88' which passes through the front and base. Upon bolt 90 between the front and base is also mounted a sector gear 91, the said gear being directly connected to the said rod by means of a radial arm 92, and the said gear is adapted for movement within a limited space within the said frame.

93 represents a pinion which is rigid on a shaft 94, and which is normally in engagement with and driven by the sector 91. In

Fig. 1 the clock-work is shown wound up by the closing of the door and held ready for operation, while in Fig. 10 the clock-work is shown run down, for closing the electric circuit, which takes place at the end of its operation. To wind the clock-work for setting it for measuring the interval of time the door may remain open as shown in Fig. 1, I employ a lever 95, which is made rigid upon the shaft 90, and a rod 96 which is pivoted to the said lever by means of a pin 97. The said rod preferably extends along the top of the door and passes through the loop 98 of a part 99, which is secured near the top of the door. The rod 96 is preferably given free play in the loop 98, which is made large enough to permit the opening and closing of the door without cramping the rod.

100 represents an adjustable stop which is rigidly set upon the rod 96, as by a set screw, in position to be engaged by the loop 98 when the door is closing, for shifting the said rod 95, and the sector gear from the position shown by full lines in Fig. 10, to the position shown in Fig. 1. When the door is in the full open position, the loop 98 and the stop 100 are disconnected, as shown in Fig. 8. The sector gear may then be operated from the position shown in Fig. 1 to that shown in Fig. 10, by the recoil of the spring 89. At each closing of the door the rod 96 is operated, in the manner described, for the winding up of the spring 89, and immediately following each opening of the door, the said spring exerts its tension for operating the sector. In order to prevent the sector gear from being instantly shifted from the wound-up to the run-down position, a train of gears and an escapement are employed. The operation of the latter parts are as follows: 101 represents a spur gear journaled on the shaft 94 and driven by a pawl 102 and a ratchet gear 103, which are respectively connected to the gear 101 and pinion 93. Gear 101 meshes with and drives another pinion 104, carried by a shaft 105, which said shaft also carries an escapement gear 106, which is controlled by a double pallet 107, which is mounted upon a shaft 108, and a fan or governor 109 also mounted upon the shaft 108, all co-operate for regulating or prolonging the automatic operation of the clock-work. The function of the sector gear 91 is to open and close the electric circuit for operating the magnets 77 of the tripping device. The electric circuit referred to is normally an open one. 110 and 111 represent similar electric conductors which are mounted upon the opposite sides of an insulating part 112, which is secured to an arm 113 of the base 85 by screws 114. The free ends of the conductors 110 and 111 are preferably flexible or spring-like, and are arranged to

normally stand spaced apart, as shown in Figs. 1 and 11, while the clock-work is wound up. The tips or points of these parts forming the contacts are brought together for closing the circuit by the power of the spring 89 exerted through the sector gear 91 and a small arm or lever 115, which is pivoted to the extension 113 by a screw 116. The free end of the lever 115 is provided with a roller 117, which preferably consists of a non-conducting material, and which engages the conductor 110 when under pressure of the sector gear, for closing the circuit through wires 81 and 82, as best seen in Fig. 10. The arrangement of the clock-work is such that as long as the door is held in closed position the spring 89, remains wound up to its highest tension, the sector gear 91 at this time being thrown back to the position shown in Fig. 1, the contact points of the conductors 110 and 111 and also the lever 115 stand in the open position shown in Fig. 11, and the electric circuit is open.

119 represents an adjustable stop for limiting the winding movement of the sector-gear. The inner end of the stop is intended to strike the arm 92 of said gear, when the latter is moved to the position shown in Fig. 1. The stop 100 may be shifted and set in different positions, for varying the travel of the sector gear, for lengthening or shortening the interval of time between the opening and the closing of the doors.

Assuming that the doors have been opened and closed for winding main-springs 12 and 13, and also the clock-work timing mechanism, and the doors are latched by any suitable means, the automatic operations of my device are as follows: Upon the releasing of the doors, main-spring 12 through the connection of the latch bolt 31 with the casing 20, swings the door to the open position shown in Figs. 3, 5 and 8. This movement of the door depresses plunger 52 and compresses spring 56, and forces arm 63 of the plunger tightly against the roller 66 of the stop 67. As the door is swung open the loop 98 leaves the stop 100 of rod 96, and then spring 89 starts to recoil for shifting the sector gear 91 from the position shown in Fig. 1, to that shown in Fig. 10. When the sector gear completes its travel, it closes the circuit through the wires 81, 82 and the magnets 77, by effecting a contact between the points of the conductors 110 and 111. The closing of the circuit and the energizing of the magnets, draws armature 78 down upon the poles of the magnets, which frees it from the triggers 74. The triggers are then tilted on their pivot pins 75 to the position shown in Fig. 14 by the power of spring 56 acting through the plunger arm 63. This allows the plunger to drop to its lowest position, for forcing lever 53 to the

position shown in Fig. 5, which withdraws the latch bolt 31 from the notch 44, and permits the spring 13 acting through casing 21 and the lug 42 to close the door. The opening and closing of the door for setting the device for subsequent automatic action, may then be repeated.

It will be understood that the electric tripping parts, carried by casing 69 may be shifted so as to face in the opposite direction, from that shown in the drawings, in case the opening and closing device should be installed on the opposite side of the doorway and connected to door 3. In that case the roller 66 would be disposed directly beneath the arm 64 of plunger 52, and the arm 63 now in operative position would then be idle. It will also be understood that the clock-work timing mechanism, the battery, and the several parts employed for connecting these with the doors and with the tripping parts, may be located at any convenient point around or near the doors, instead of being positioned above the doors as shown. All parts of the main, and also the tripping devices are made interchangeable and all are also capable of being employed on either the right or left hand side of a doorway.

What I claim as new, and desire to secure by Letters Patent, is—

1. A door opening and closing device, comprising a pair of reversely operable main-springs inclosed in independent casings, supported by the frame of a door, a lever pivoted between said casings and capable of being swung in opposite directions by said casings acting under the power of said main-springs, the said lever operatively connected with the door, an electric tripping mechanism carried by said lever adapted for effecting the releasing of said lever from one of the casings so as to permit the other casing to operate the door, and a clock-work for opening and closing the electric circuit which controls said tripping mechanism.

2. A door opening and closing device, comprising a pair of reversely wound springs inclosed in separate casings supported by the frame of a door, the said casings adapted for rotation with said springs, a lever pivoted between said casings and capable of being swung in opposite directions alternately by engagement with said casings, the said lever operatively connected with a door, a latch-bolt carried by said lever adapted to engage one of said casings for opening the door, a lug carried by the other casing for engaging said lever for closing the door, a bell-crank lever carried by said lever adapted for operating the latch-bolt, a forked plunger carried by said lever adapted for operating the bell-crank lever, a guide mounted above said casings adapted for depressing said plunger at each opening of the door, and a tripping mechanism carried by said

lever adapted for permitting the final operation of the plunger and the closing of the door after the lapse of a given time.

3. The combination with a pair of reversely operable main-springs disposed near a door, and a lever pivoted between said springs capable of being swung in opposite directions by said springs for opening and closing the door, said lever connected to the door, of a plunger carried by said lever adapted when depressed to its full extent to effect the releasing of said lever from one of said main-springs for permitting the other main-spring to operate the door, a tripping device carried by said lever comprising a pair of electro-magnets, an armature and a yieldable stop, adapted to first stop, and then after the lapse of a predetermined time, to permit said plunger to complete its operation, a mechanism for determining the interval of time between the initial and final operation of said plunger, and means for electrically connecting the timing mechanism with said tripping device.

4. A door opening and closing device, comprising a pair of casings operated by reversely wound springs, a lever pivoted between the casings capable of being swung in opposite directions, said lever connected to the door, a bolt for interlocking with one of said casings for opening the door, a bell-crank lever for withdrawing said bolt for permitting the other casing to close the door, a depressible plunger for operating said bell-crank lever at predetermined moments, means for depressing the plunger at each opening of the door, means for restoring said plunger and said bell-crank at each closing of the door, and means for measuring the interval of time between the opening and closing of the door, the said means adjustable for varying said interval.

5. The combination with a pair of springs incased in separate cylinders adapted for opening and closing a door, of a lever connected to the door adapted to be alternately engaged by said cylinders and to be swung in opposite directions by the power of said springs, a latch-bolt carried by said lever and normally in engagement with one of said cylinders adapted for interlocking with said cylinder for opening the door, a plunger carried by said lever adapted for downward movements, for first, partially, and then fully, withdrawing said latch-bolt from its interlocking position for allowing the door to be closed by the second cylinder, a stop for arresting and temporarily holding said plunger stationary between its initial and final movements, and means for effecting the yielding of said stop for permitting said plunger to complete its downward movement.

6. The combination with a pair of re-

versely operable springs supported adjacent a door, of a lever pivoted between and concentric to said springs and operatively connected to the door, said lever capable of
 5 being moved in opposite directions by said springs for opening and closing the door, a latch-bolt for connecting said lever with one of said springs, adapted to cooperate with said spring for opening the door and for
 10 holding the door open, a bell-crank lever for releasing said latch-bolt, a plunger for operating said bell-crank lever, means for partially depressing said plunger by the opening of the door without disconnecting said
 15 latch-bolt, a yieldable stop adapted for temporarily arresting the movement of said plunger so as to retard the closing of the door, an electro-magnet for controlling said stop, and means for depressing said plunger
 20 to the full extent after the door has remained open for a time, for withdrawing said latch-bolt and permitting the closing of the door.

7. In a door opening and closing device, the combination with an opening and a closing spring, each incased in a cylinder mounted near a door, of a lever pivoted between the cylinders and yieldingly connected to the door, capable of being operated in opposite directions alternately by engagement
 30 with said cylinders, a clock-work timing mechanism disposed at a distance and electrically connected with parts carried by said lever, adapted for measuring the interval
 35 of time between the opening and the closing of the door, and means carried by the door and connected with the clock-work adapted for winding said clock-work by each closing movement of the door.

8. In a door opening and closing mechanism, the combination with a pair of reversely wound springs incased in independent casings capable of being mounted adjacent to a door, the said casings operable
 45 with said springs, of a lever pivoted between the said casings and yieldingly connected to the door adapted to be swung in opposite directions by the power of said springs by alternate engagement with said
 50 casings, a clock-work timing mechanism detached from the casings, and said lever, adapted for determining the interval of time between the opening and closing of the door, a tripping device carried by said lever
 55 adapted for releasing said lever from operative connection with one of said casings and for permitting the other casing to operate said lever for closing the door, and a pair of wires, a pair of magnets, and a battery,

for electrically connecting said tripping device with said clock-work.

9. The combination with a pair of reversely operable springs, supported adjacent a door, of a lever pivoted between and concentric to said springs, and operatively connected to the door, said lever capable of
 65 being moved by said springs for opening and closing the door, a part carried by said lever adapted to cooperate with one of said springs for opening the door and for holding the door open, a plunger for operating
 70 said part, said plunger carried by said lever and capable of being partially depressed by the opening of the door, a yieldable stop disposed in the path of said plunger adapted
 75 to arrest the downward movement of said plunger for delaying the closing of the door, an electro-magnet adapted to effect the yielding of said stop, and a spring carried by said plunger adapted to operate said plunger
 80 to the full extent after the lapse of a predetermined time.

10. In a door opening and closing device, the combination with the opening and closing springs, pivotally mounted on the frame
 85 of a door, and an operating-lever pivoted to the frame and connected to the door, of a latch-bolt carried by the operating-lever adapted to cooperate with the opening spring for opening the door, a bell-crank
 90 lever carried by said operating-lever and operatively connected to said latch-bolt, a depressible plunger carried by said operating-lever and normally in engagement with the said bell-crank lever, a guide carried by
 95 the frame adapted for partially depressing said plunger when the door opens, a spring carried by said plunger capable of being compressed by said guide, and adapted for completing the depressing movement of said
 100 plunger after the door has remained opened for a predetermined time, a stop carried by said operating-lever for preventing the final depressing of said plunger, an electro-magnet for releasing said stop, a normally open
 105 electric circuit for controlling said magnet, and a clock-work located at a distance from the main device for closing said electric circuit at the end of the predetermined time, for permitting the closing spring to close
 110 the door.

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

MILTON H. HART.

Witnesses:

FREDK. F. HOY,
 H. G. BATCHELOR.