

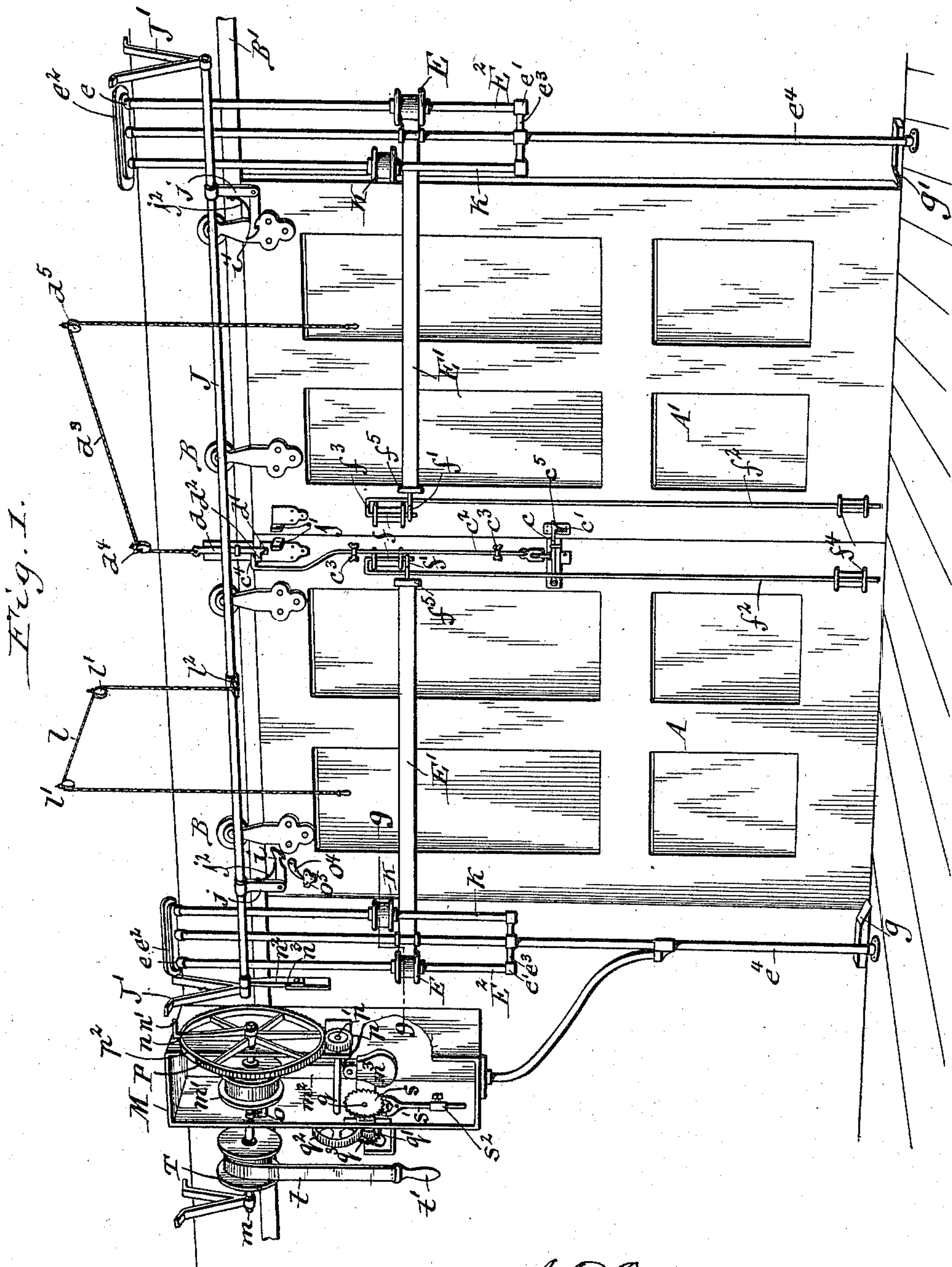
(No Model.)

4 Sheets—Sheet 1.

A. T. CANFIELD.
DOOR OPERATING DEVICE.

No. 580,370.

Patented Apr. 13, 1897.



Witnesses:
Chas. F. Burkhardt.
Theo. L. Popp.

A. T. Canfield Inventor.
By Wilhelm H. Brown
Attorneys.

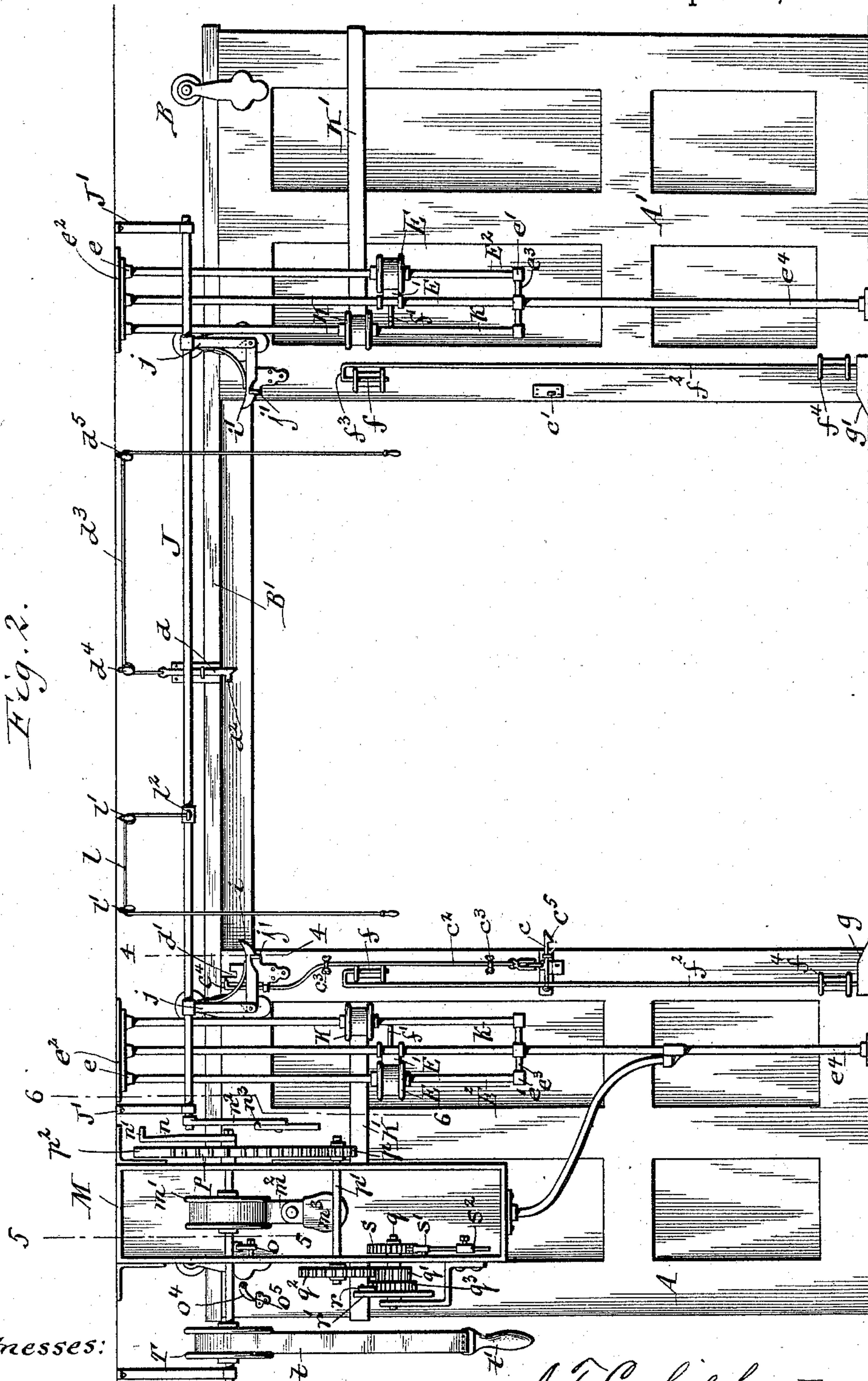
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4 Sheets—Sheet 2.

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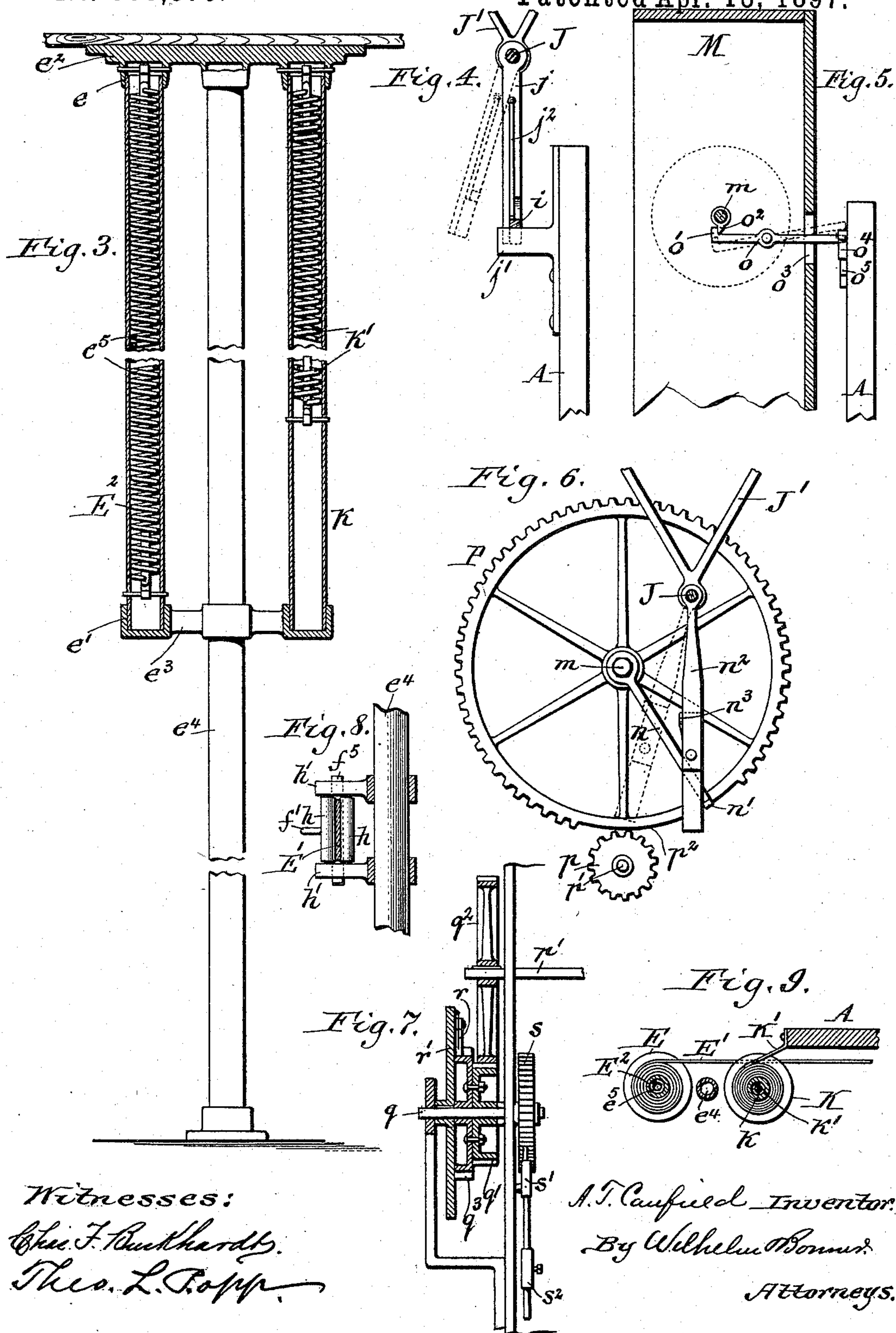
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4 Sheets—Sheet 3.

A. T. CANFIELD.
DOOR OPERATING DEVICE.

No. 580,370.

Patented Apr. 13, 1897.



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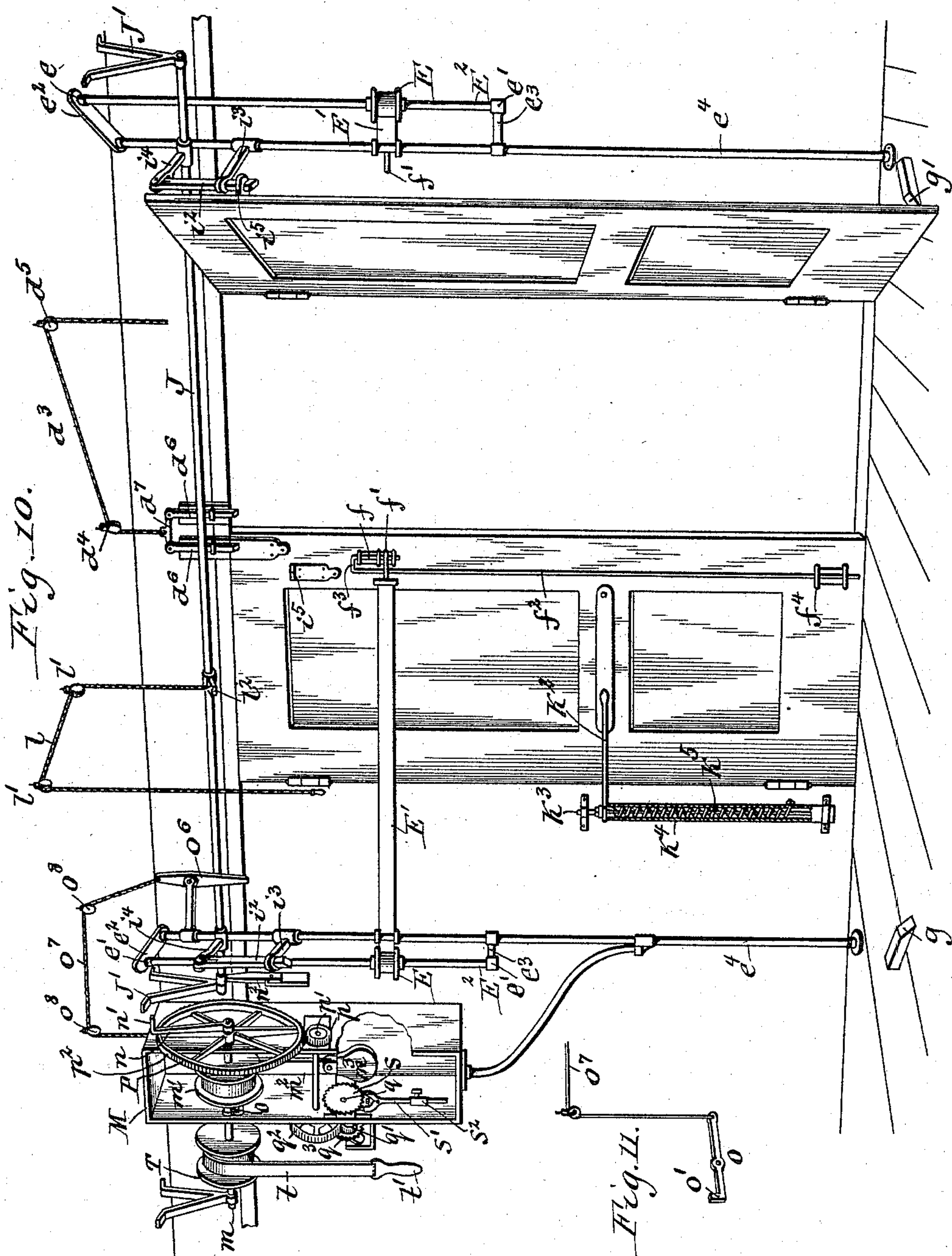
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4 Sheets—Sheet 4.

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DOOR OPERATING DEVICE.

No. 580,370.

Patented Apr. 13, 1897.



Chas. F. Buckhardt.
Theo. L. Popp. } Witnesses.

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UNITED STATES PATENT OFFICE.

ABRAM T. CANFIELD, OF BUFFALO, NEW YORK.

DOOR-OPERATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 580,370, dated April 13, 1897.

Application filed March 18, 1896. Serial No. 583,680. (No model.)

To all whom it may concern.

Be it known that I, ABRAM T. CANFIELD, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Door-Operating Devices, of which the following is a specification.

This invention relates more especially to the class of door-operating devices which automatically close as well as open the door or doors.

My invention has for its object to produce a reliable mechanism of this character which can be readily restored to its operative condition after closing the doors.

In the accompanying drawings, consisting of four sheets, Figure 1 is a perspective view of my improved door-operating apparatus in connection with a pair of sliding doors, showing the doors closed. Fig. 2 is a front view thereof, showing the doors opened. Fig. 3 is a sectional elevation of the operating-springs of the doors and the hollow shafts inclosing the same. Fig. 4 is a cross-section, on an enlarged scale, of the catch which retains the door in its open position, the section being in line 4 4, Fig. 2. Fig. 5 is an enlarged vertical cross-section of the main shaft of the door-releasing mechanism in line 5 5, Fig. 2, showing the detent in engagement therewith. Fig. 6 is a vertical cross-section in line 6 6, Fig. 2, on an enlarged scale. Fig. 7 is a transverse vertical section, on an enlarged scale, of the escapement mechanism which controls the door-releasing device. Fig. 8 is an enlarged vertical section of the guide of the strap whereby the door is opened. Fig. 9 is a fragmentary horizontal section, on an enlarged scale, in line 9 9, Fig. 1. Fig. 10 is a perspective view showing my improved door-operating device applied to a pair of hinged doors. Fig. 11 is a detached perspective view of the means employed for operating the detent of the releasing-shaft in this application of the improvement.

Like letters of reference refer to like parts in the several figures.

A A' represent a pair of sliding doors having ordinary door-hangers B, the rollers of which run upon a horizontal track B'. The doors are held in their closed position preferably by a vertically-swinging latch c, piv-

oted to the inner side of one of the doors and engaging with the keeper c' on the other door.

c² is a vertically-sliding lifting-rod connected with the latch c and moving in guides c³, secured to the adjacent door. This lifting-rod extends to the upper edge of the door and terminates in an outwardly-projecting lip c⁴.

d is a gravity or spring bolt which slides vertically in guides secured to the top of the door-frame, on the inner side thereof, and which engages normally in a coinciding notch or recess d', arranged at the upper end of one of the doors, as shown in Figs. 1 and 2, so as to lock the two doors in their closed position. The locking-bolt d is provided with a laterally-projecting lug d², over which the lip c⁴ of the lifting-rod c² engages when the doors are closed, as shown in Fig. 1, so that the bolt operates the lifting-rod and the latch connected therewith when the bolt is raised. The bolt is operated by a cord d³, running upwardly, rearwardly, and downwardly over guide-pulleys d⁴ d⁵, secured to the ceiling of the room, and having at its free end a handle which terminates within convenient reach of the driver's seat.

Each of the doors is provided with an opening device consisting, preferably, of a spring-drum E and a strap or cord E', wound upon the drum and connected with the door near its front edge. This spring-drum is rigidly secured to a hollow upright shaft E², which turns in bearings or sockets e e', the upper bearing e being arranged in a plate e², secured to the ceiling, and the lower one being carried by an arm e³, projecting from a post or standard e⁴, extending from the floor to the ceiling.

e⁵, Fig. 3, is a spiral spring arranged in the hollow drum-shaft and connected at one end with the shaft and at the other end with the upper bearing e, so that when the door is closed the strap E' is unwound from the drum and the spring of the latter strained, as shown in Fig. 1.

The strap E' is detachably connected with the door by any suitable means, so that the same may be disconnected from the door after the latter has been opened. The detachable connection in the drawings consists of a vertically-sliding rod or bolt f, suitably guided on the door and engaging with its lower por-

tion in an eye or ring f' , secured to the free end of the strap E' . This sliding bolt is provided with an upright releasing rod or extension f^2 , which is connected with the upper 5 end of the bolt by a horizontal portion or bend f^3 and which extends downwardly nearly to the lower edge of the door, where it slides in suitable guides f^4 , secured to the door.

$g g'$ are cams or inclines arranged at or near 10 opposite ends of the threshold of the doors and in the path of the lower ends of the actuating-rods f^2 of the attaching-bolts f , so that during the final portion of the opening movement of the doors these rods are caused to 15 ride upon said cams or inclines, as shown in Fig. 2, thereby raising the rods, withdrawing the bolts f from the eyes of the straps E' , and detaching the latter from the doors.

In order to keep the released end of the 20 strap E' in a horizontal position or in line with its drum, the same is supported adjacent to the drum in a guide consisting of a pair of upright rollers $h h'$, mounted in horizontal arms h' , projecting from the standard e^4 , as 25 shown in Fig. 8, the rollers being separated sufficiently to admit the strap between them. Withdrawal of the strap from this guide is prevented by a cross-bar f^5 , secured to the 30 end of the strap.

$i i'$ represent automatic locking latches or 35 catches, whereby the doors are temporarily held in their open position preparatory to being closed. Each of these catches consists of a vertically-swinging spring-pawl pivoted to a depending arm j , secured to a horizontal releasing or rock shaft J and interlocking with 40 a lug or projection j' , secured to the inner side of the door near its front edge, as shown in Figs. 2 and 4. The joint of each of these 45 pawls is so constructed that the spring j^2 of the pawl cannot depress the same below a horizontal or nearly horizontal position, as shown in Fig. 1, so as to insure its engagement with the lug of the door when the latter 50 is opened.

The rock-shaft J is arranged above the doors and journaled in suitable hangers or supports J' . When this rock-shaft is turned so as to 55 swing its arms j away from the inner sides of the doors, the spring-catches carried by these arms are moved laterally out of engagement with the lugs j' of the doors, thereby releasing the latter and allowing the door-closing 60 devices to close the doors. These closing devices consist of spring-drums K , which are secured to hollow upright shafts k , journaled in bearings supported on the ceiling-plate e^2 and the standard e^4 in a manner similar to the shafts of the spring-drums E .

k' represent the springs of the drums K , 65 which are connected at one end with the hollow shafts and at the other with the upper bearings of said shafts. The doors are actuated from their spring-drums by straps K' , wound upon the drums and connected with the outer portion of the doors. The two straps 70 of each door are wound upon their respective

drums in opposite directions, so that when one strap is wound up the other is unwound, the straps E' being unwound and the straps 70 K' wound up when the doors are closed, and the straps E' being wound up and the straps K' unwound when the door is opened, thus straining or relaxing the springs of the corresponding drums accordingly. The springs 75 of the door-opening drums E are stiffer than those of the door-closing drums K , so as to be strained to a greater extent, and possess the requisite strength to open the doors against the resistance of the door-closing springs as 80 the latter become strained by the unwinding of their straps.

l is an operating-cord for the rock-shaft J , which runs over guide-pulleys $l' l'$, attached 85 to the ceiling, and has one end thereof connected with an actuating-arm l^2 of the rock-shaft, while its free end has a handle which hangs in convenient reach, so that the rock-shaft may be operated by hand, if desired. 90 While the doors may be released by hand in this manner, the automatic releasing mechanism shown in the drawings is preferably employed for this purpose, rendering it only necessary to unlock the doors by hand, when 95 the doors will be opened and closed automatically. This releasing mechanism is constructed as follows:

m is a horizontal main shaft arranged opposite one end of the rock-shaft and counter 100 to the latter and journaled in an upright casing M or other suitable support. m' is a drum secured to said shaft, and m^2 a strap or cord wound thereon and carrying a weight m^3 at its free end, which weight tends to unwind the band m^2 and rotate the shaft m . 105

n is a trip-arm secured to the inner end of the shaft m and having at its free end a lip or projection n' , which is adapted to strike 110 against a depending actuating-arm n^2 , secured to the adjacent end of the rock-shaft, so as to rock the latter in the proper direction to disengage the spring-catches $i i'$ from the lugs 115 j' of the doors.

o is a detent whereby the shaft m is held against rotation in the direction in which its 115 arm n strikes the actuating-arm of the rock-shaft, as shown in Figs. 1 and 5. This detent is arranged at right angles to the shaft m and pivoted between its ends, its front end being provided with a lip o' , which engages 120 against the front side of a lug o^2 of the shaft m .

The rear arm of the detent o extends rearwardly through an opening o^3 , formed in the back of the case M , and projects into the path 125 of a trip-cam o^4 , arranged near the upper inner edge of the adjacent door, so that during the last portion of the opening movement of the door the cam engages under the rear arm and raises the same, thereby depressing its front arm, disengaging its lip from the lug of 130 the shaft m , and allowing the latter to turn under the influence of the weight. The cam o^4 consists of an inclined pawl pivoted at its rear end and sloping toward the detent and

resting at its free end upon a ledge o^5 , secured to the adjacent door. By this construction the pawl forms a rigid cam during its forward movement and yields upwardly and rides over the rear arm of the detent o during its return movement.

In order to retain the doors in their open position for a sufficient period to allow the vehicle to pass out of the building, the rotation of the shaft m when released is preferably retarded by a suitable escapement or retarding mechanism, so that its trip-arm does not come in contact with the rock-shaft J until some time after the shaft m has been set in motion.

The retarding mechanism shown in the drawings is constructed as follows:

P is a comparatively large gear-wheel mounted on the main shaft m and meshing with a pinion p , secured to a counter-shaft p' , journaled in the case M below the main shaft.

q is an escapement-shaft arranged below the counter-shaft p' , and q' is a pinion mounted loosely on the shaft q and meshing with a gear-wheel q^2 , secured to the adjacent end of the counter-shaft. The pinion q' is secured to or formed with a ratchet-wheel q^3 , which is mounted loosely on the shaft q . The shaft q is compelled to turn with this ratchet-wheel in one direction by a pawl r engaging with the ratchet-wheel and carried by an arm r' , which is keyed or otherwise rigidly secured to said shaft, as shown in Fig. 7. When the ratchet-wheel is turned in the opposite direction, the pawl slides over the same, and this movement of the ratchet-wheel is therefore not imparted to the escapement-shaft q .

s is a ratchet or escapement wheel secured to the inner end of the escapement-shaft q . and s' is a pallet of any suitable or well-known construction which engages with said escapement-wheel and compels said wheel to turn intermittently in an obvious manner. The intermediate train of gearing reduces the speed of the main shaft, and the escapement mechanism further retards the rotation of the shaft by allowing it to turn only intermittently. A comparatively long interval of time will therefore elapse between the locking of the door in its open position and the release of the door, and this interval may be varied by adjusting the weight s^2 of the pallet toward or from its pivot.

It is desirable to deliver a quick blow against the actuating-arm of the rock-shaft J in releasing the latter, so as to overcome the friction between the spring-latches $i i'$ and lugs j' of the doors, and for the purpose of giving the trip-arm the desired momentum the gear-wheel on the main shaft m is mutilated or smooth on the portion of its face adjacent to the trip-arm n , as shown at p^2 in Figs. 1 and 6, so that when the mutilated portion arrives opposite the gear-pinion p the wheel and the shaft are unrestrained by the escapement mechanism and allowed to turn rapidly, thereby causing the trip-arm n to

give the actuating-arm of the rock-shaft a sharp blow and insuring the release of the doors from the locking-latches.

T is a winding or resetting drum secured to the projecting outer end of the main shaft m of the releasing mechanism, and t is a band or strap wound upon said drum and having a handle t' . The band t is wound upon its drum in a direction opposite to that in which the weighted band m^2 is wound upon the drum m' , so that the unwinding of the latter band causes the band t to be wound upon its drum. After the weighted band is unwound it is again wound up for resetting the releasing and escapement mechanism by pulling the strap t . In order to allow the main shaft to be thus turned backward without causing the trip-arm to rock the shaft J, the actuating-arm of the latter is constructed of two sections jointed in such a manner that they form a rigid arm in one direction, while permitting the lower section to yield or swing loosely on the upper section in the other direction. For this purpose the lower section is provided with a lip or stop n^3 , which overlaps the front side of the upper section, so that when the trip-arm strikes the rear side of the lower section the upper section is compelled to move therewith and rock the shaft, while when the trip-arm strikes the front side of the lower section the latter yields and allows the trip-arm to ride over it without affecting the upper section.

The operation of my improved door-operating mechanism is as follows: In the normal position of the parts shown in Fig. 1 the doors are closed, the straps of the drums E are unwound and connected with the doors, thus placing the springs of these drums under tension, the straps of the other drums K are wound up and their springs relaxed, and the operating-weight m^3 of the retarding mechanism is elevated. When it is desired to leave the stable or other building, the driver, seated on the vehicle, pulls the cord d^3 , whereby the latch c is raised and the upper locking-bolt d is withdrawn from engagement with the doors, thereby releasing the doors and allowing the spring-drums E to open the same through the medium of the connecting-straps E'. Just before the doors reach the limit of their opening movement the spring-catches $i i'$ automatically interlock with the lugs j' of the doors, holding them open temporarily, and at the same time the straps E' are detached from the doors by the bolt-rods f^2 riding upon the cams $g g'$, and the main shaft m of the releasing mechanism is released by the cam o^4 engaging against the rear arm of the detent o , thus allowing the main shaft m to turn intermittently under the control of the escapement mechanism. The opening movement of the doors causes the straps K' to be unwound from the drums K, straining the springs of the latter, and as soon as the trip-arm n actuates the rock-shaft J by striking the actuating-arm of the latter the spring-latches $i i'$ are caused to release the doors, whereupon the

latter are closed by the reaction of the spring-drums K through the medium of the connecting-straps K'. In order to allow the swinging latch of one door to engage automatically with the keeper of the other door, the latch has an inclined nose c^5 , as shown in Figs. 1 and 2. This latch is caused to descend by its own weight and the weight of its lifting-rod. At the same time that the doors are thus latched the lip at the upper end of the lifting-rod of said latch overlaps the lug of the bolt d , ready to be operated by said bolt at the next opening of the doors.

In resetting the door opening and releasing devices the straps of the spring-drums E are again attached to the doors by passing the eyes of the straps over the lower ends of the sliding bolts f , by which operation the straps are unwound and the springs of said drums are strained. The operating-weight of the releasing mechanism is then elevated by hand by unwinding the strap t from the drum m' , the detent engaging with the lug of the main shaft m and holding the shaft against turning until the detent is again tripped by the opening of the doors. During this backward movement of the main shaft m the ratchet-wheel q^3 of the escapement-shaft also turns backward, causing it to slide past the detent-pawl r and throwing the escapement-wheel and pallet out of gear. By this provision the main shaft can be turned backward rapidly for raising its actuating-weight without restraint from the escapement mechanism. The rock-shaft is returned to its normal position by the weight of its arms and the catches carried thereby.

My improved door-operating apparatus is applicable to hinged doors as well as to sliding doors, Figs 10 and 11 showing the improvements in that connection. In this case the door-opening drum E and strap E' and the strap-detaching devices are the same as the corresponding parts of the first-described construction, except that the cams $g g'$, which lift the operating-rods f^2 of the strap-bolts f , are arranged at a suitable distance from the front wall of the building and in the arc in which operating-rods move when the doors are opened. The latch employed in the first construction for connecting the sliding doors is omitted, and each door is provided with a separate locking-bolt d^6 , the two bolts being united by a cross-bar d^7 , to which the operating-cord is connected.

i^2 are the latches or bolts which temporarily retain the doors in their open position. Each of these bolts, instead of being pivoted to swing vertically, is arranged to slide vertically in a guide-arm i^3 , projecting from the standard e^4 , and is pivoted at its upper end to an arm i^4 of the rock-shaft J, while its lower end is adapted to engage with an eye or lug i^5 , secured to the inner side of the door, as shown in Fig. 10. The lower end of this bolt is beveled on its front side, so as automatically to enter the eye when the door is opened, and

in order to permit the requisite vertical play of the bolt without rocking the shaft the bolt is provided with a longitudinal slot, through which its pivot passes. In this adaptation of the improvement the door-closing device preferably consists of a horizontally-swinging arm k^2 , which bears against the inner side of the door and which is attached to the upper end of an upright shaft k^3 , supported in a tubular case k^4 , secured to the front wall of a building adjacent to the door.

k^5 is a spiral spring which tends to turn the shaft in the proper direction to cause the arm to close the door and which is secured at its ends to the shaft and the case k^4 , respectively. This spring is lighter or less powerful than the spring of the door-opening device for the purpose already described. The operating or trip mechanism of the rock-shaft and the actuating devices of the operating mechanism are the same as those of the first-described construction, but the means for tripping the detent o of the releasing-shaft is changed to adapt it for operation by a hinged door. For this purpose a depending trip-lever o^6 is arranged in the path of the swinging door, and the rear arm of the detent is connected with the upper arm of this lever by a cord o^7 , running over guide-wheels o^8 , attached to the ceiling, so that when the door trips the lever the latter disengages the detent through the medium of the cord.

I claim as my invention—

1. The combination with a door and means for locking the same in its closed position, of an automatic door-opening device detachably connected with the door, means for detaching said opening device from the door after the same has been opened and an automatic door-closing device also connected with the door and arranged to come into action after the detachment of the door-opening device, substantially as set forth.

2. The combination with a door and means for locking the same in its closed position, of a door-opening device detachably connected with the door, an automatic catch whereby the door is held temporarily in its open position, means for automatically detaching said opening device from the door, a door-closing device also connected with the door and a releasing device adapted to disengage said automatic catch from the door after the detachment of the door-opening device, substantially as set forth.

3. The combination with a door and means for locking the same in its closed position, of a door-opening device detachably connected with the door, an automatic catch whereby the door is temporarily held in its open position, means for automatically detaching said opening device from the door, a door-closing device also connected with the door, a releasing device adapted to disengage said automatic catch from the door after the detachment of the door-opening device and a retarding mechanism for controlling the action of

said releasing device, substantially as set forth.

4. The combination with a door and a bolt or catch for locking the same in its closed position, of a spring-drum for opening the door having a strap connected with the door in its open position, an automatic catch whereby the door is temporarily held open, a spring-drum for closing the door having a strap connected with the door, the spring of said door-opening drum overpowering the spring of the door-closing drum, automatic means for detaching the strap of the door-opening device from the door, and a releasing device for disengaging said automatic catch from the door, substantially as set forth.

5. The combination with a pair of doors and a vertically-movable locking-bolt, of a latch connecting the two doors, and a lifting-rod connected with said latch and arranged to be actuated by said locking-bolt, substantially as set forth.

6. The combination with a pair of doors and a vertically-movable locking-bolt having a laterally-projecting lug, of a latch connecting the two doors, and a lifting-rod connected with said latch and having a lip adapted to engage with the lug of said locking-bolt, substantially as set forth.

7. The combination with a door and a spring-drum for opening the same, of a strap wound upon said drum and having an eye or attachment at its free end, a movable bolt arranged on the door and adapted to engage with said eye or attachment, and means whereby said bolt is operated for detaching said strap from the door, substantially as set forth.

8. The combination with a door and a spring-drum for opening the same, of a strap wound upon said drum and having an eye or attachment at its free end, a movable bolt arranged on the door and adapted to engage with said eye or attachment, an actuating-rod connected with said bolt, and a cam arranged to shift said rod during the opening movement of the door, substantially as set forth.

9. The combination with a door and means for retaining the same in its closed position, of opening and closing devices connected with the door, an overhead rock-shaft arranged adjacent to the upper end of the door and having an arm carrying an automatic catch for retaining the door in its open position, and means for actuating said rock-shaft, substantially as set forth.

10. The combination with a door and means for retaining the same in its closed position, of door opening and closing devices connected with the door, a rock-shaft having an actuating-arm and a carrying-arm, an automatic catch for retaining the door in its open position mounted on said carrying-arm, a releasing-shaft having a trip-arm adapted to engage against the actuating-arm of said rock-

shaft, and means for turning said releasing-shaft, substantially as set forth.

11. The combination with a door and means for retaining the same in its closed position, of door opening and closing devices connected with the door, a rock-shaft having an actuating-arm and a carrying-arm, an automatic catch for retaining the door in its open position mounted on said carrying-arm, a releasing-shaft having a trip-arm adapted to strike the actuating-arm of said rock-shaft, a detent for holding the releasing-shaft against rotation, means for turning the releasing-shaft, and a trip device arranged on the door and adapted to disengage said detent from the releasing-shaft when the door is opened, substantially as set forth.

12. The combination with a door and means for retaining the same in its closed position, of door opening and closing devices connected with the door, a rock-shaft having an actuating-arm and a carrying-arm, an automatic catch for retaining the door in its open position mounted on said carrying-arm, a releasing-shaft having a trip-arm adapted to strike the actuating-arm of said rock-shaft, a detent for holding the releasing-shaft against rotation, a retarding device for said releasing-shaft, and intermediate gearing connecting said releasing-shaft with said retarding device and having one of its gear-wheels mutilated, substantially as set forth.

13. The combination with a door and means for retaining the same in its closed position, of door opening and closing devices connected with the door, a rock-shaft having an actuating-arm and a carrying-arm, an automatic catch for retaining the door in its open position, mounted on said carrying-arm, a releasing-shaft having a trip-arm adapted to strike said actuating-arm, means for turning the releasing-shaft, a detent for holding the shaft against rotation, a trip device arranged on the door and adapted to engage with said detent, and an escapement mechanism controlling the rotation of said releasing-shaft, substantially as set forth.

14. The combination with a door and means for retaining the same in its closed position, of door opening and closing devices connected with the door, a rock-shaft having an actuating-arm and a carrying-arm, an automatic catch for retaining the door in its open position mounted on said carrying-arm, a releasing-shaft having a trip-arm adapted to strike said actuating-arm, means for turning the releasing-shaft, a detent for preventing rotation of the releasing-shaft, an escapement mechanism controlling the motion of said releasing-shaft and a train of gearing arranged between the releasing-shaft and said escapement mechanism and having one of its gear-wheels mounted loosely on its shaft and connected therewith by a pawl and ratchet,

whereby the releasing-shaft can be turned backward without restraint from the escapement mechanism, substantially as set forth.

15. The combination with a door, and opening and closing devices connected therewith, of a catch for holding the door in its open position, a releasing-shaft for disengaging said catch from the door, an automatic actuating-drum mounted on said shaft and a resetting-

drum also mounted on said shaft and having a strap wound thereon, substantially as set forth.

Witness my hand this 24th day of February, 1896.

ABRAM T. CANFIELD.

Witnesses:

THEO. L. POPP,
ELLA R. DEAN.