Oct. 7, 1930. F. L. MORSE 1,777,526

DOOR OPERATING MECHANISM

Filed Oct. 2, 1925 4 Sheets-Sheet 1

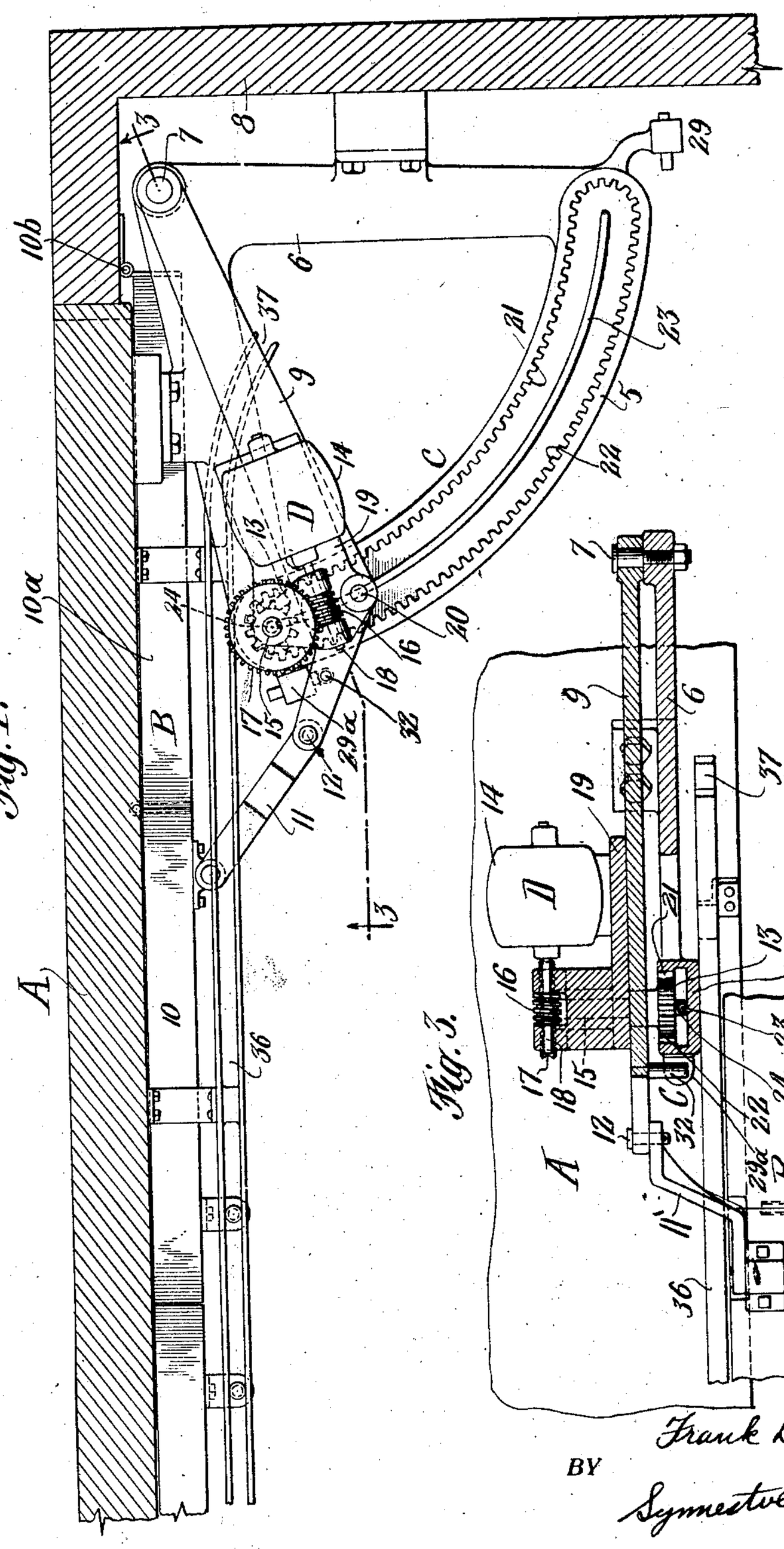

Fig. 1.

Fig. 3.

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DOOR OPERATING MECHANISM

Filed Oct. 2, 1925 4 Sheets-Sheet 2

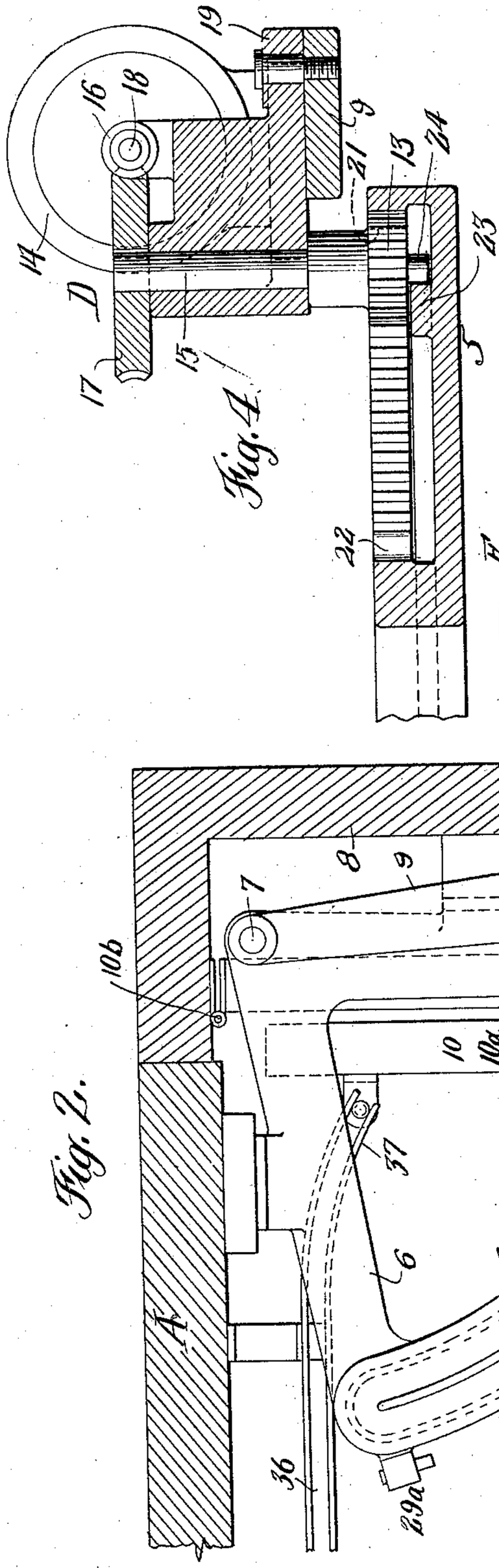

Fig. 4.

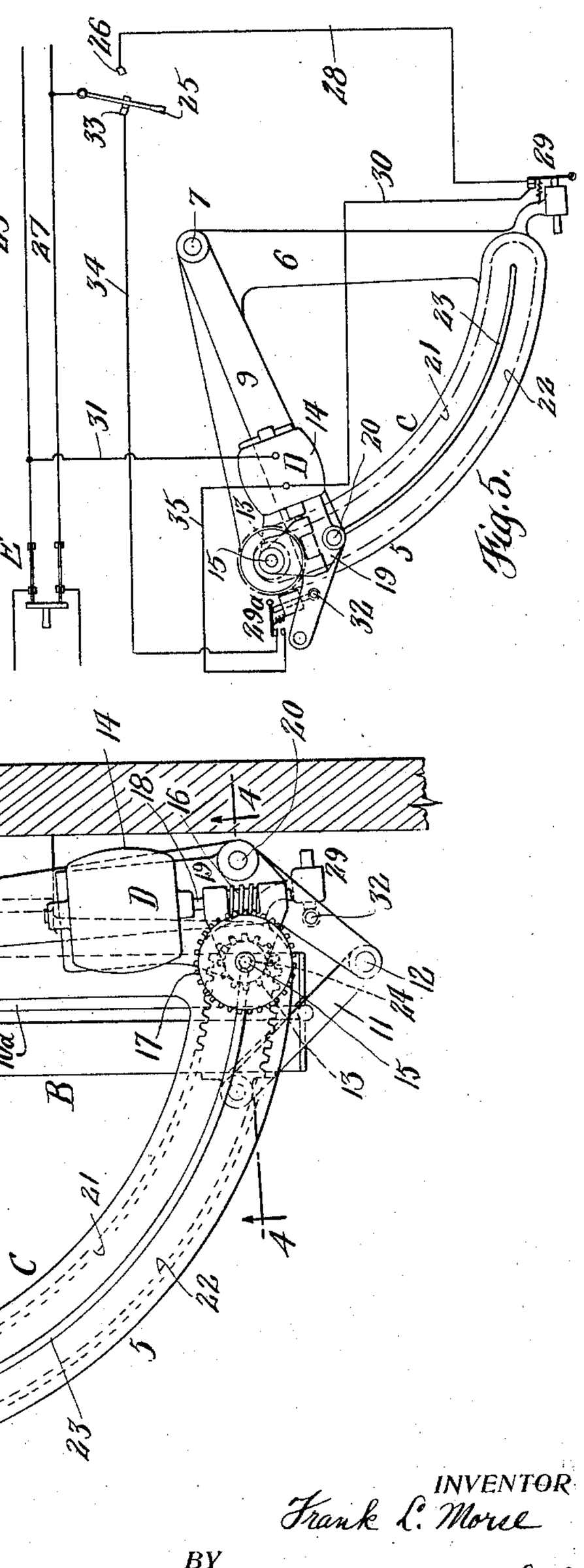

Fig. 5.

Fig. 2.

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DOOR OPERATING MECHANISM

Filed Oct. 2, 1925 4 Sheets-Sheet 3

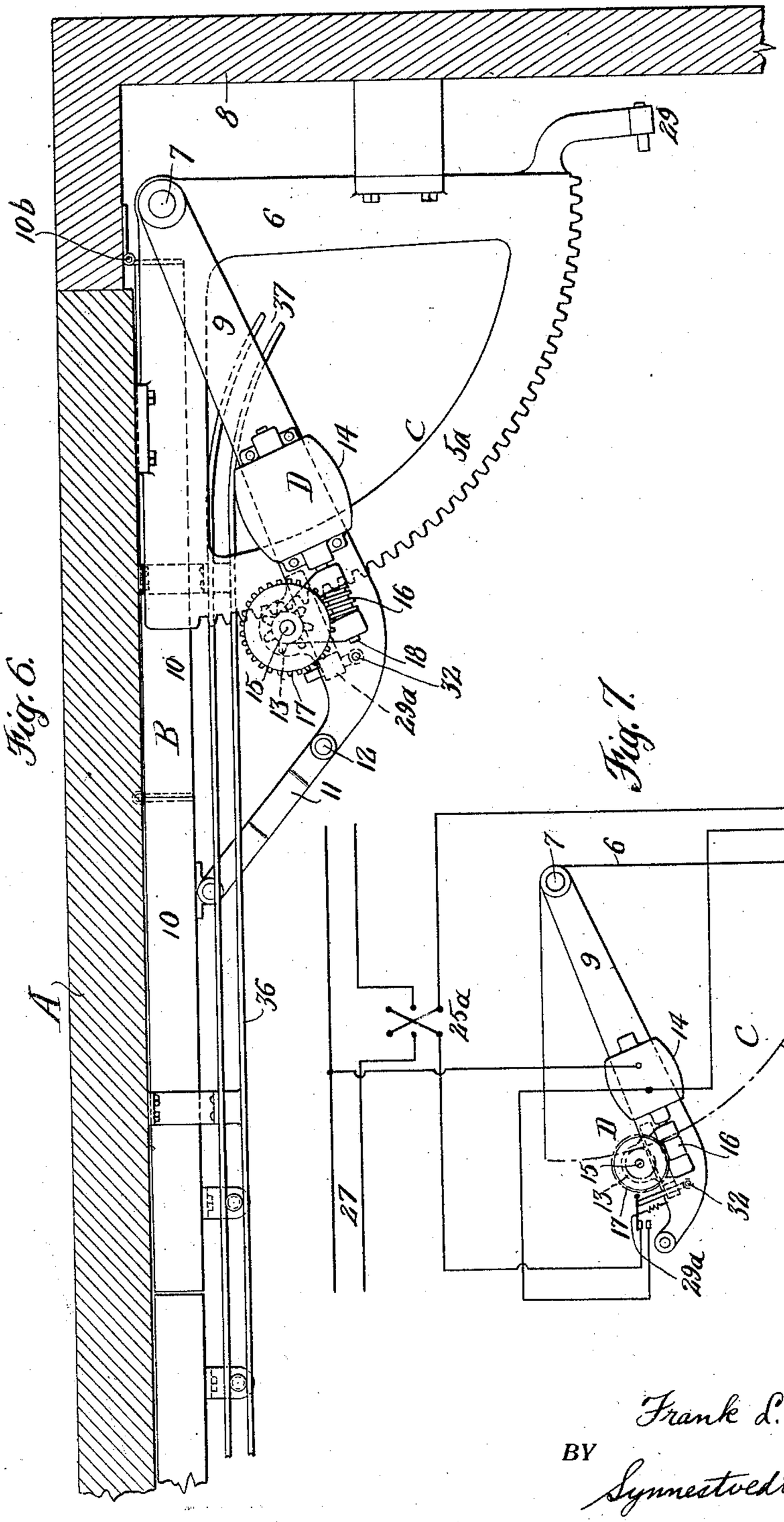

Fig. 6.

Fig. 7.

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DOOR OPERATING MECHANISM

Filed Oct. 2, 1925 4 Sheets-Sheet 4

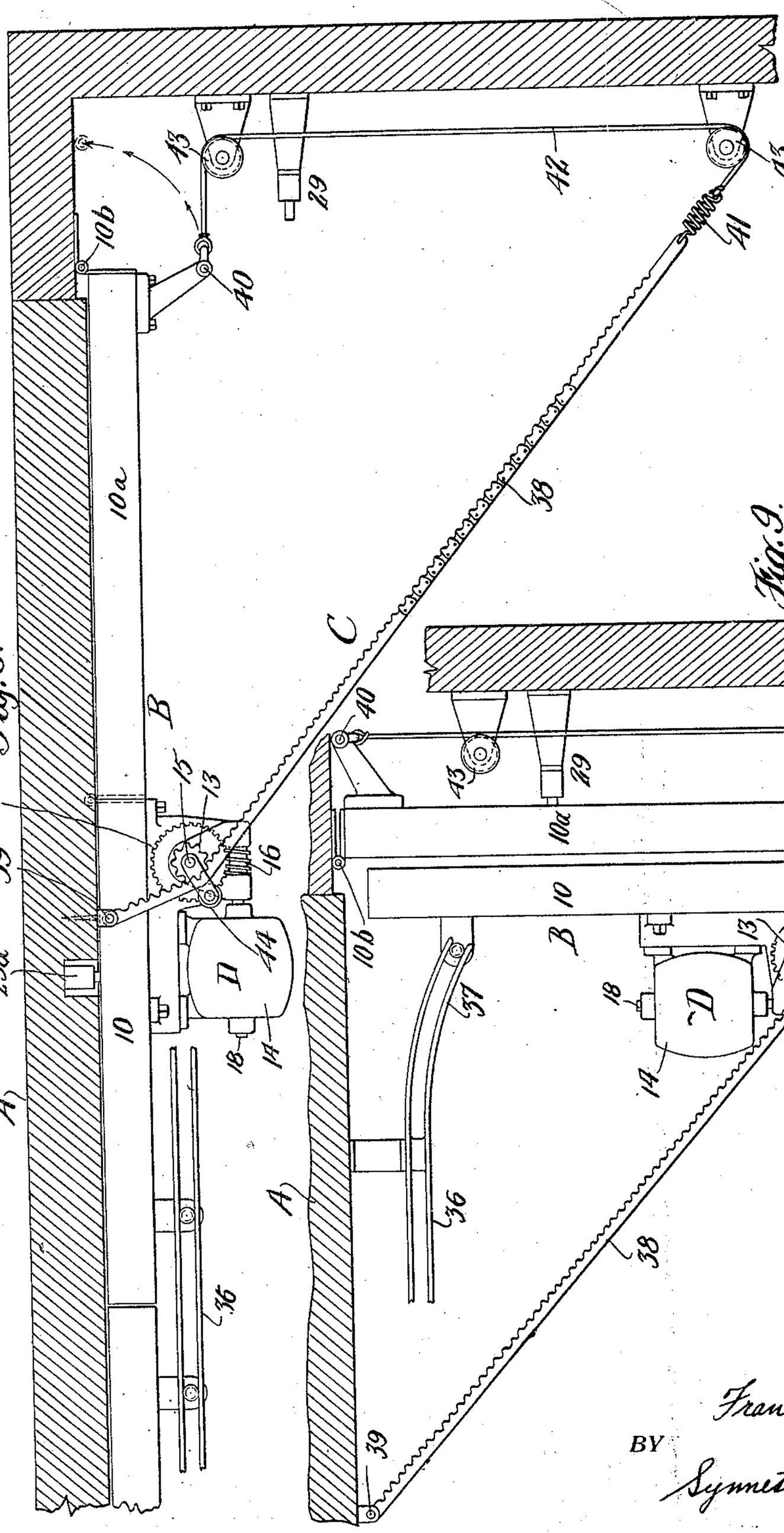

Fig. 8.

Fig. 9.

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Patented Oct. 7, 1930 1,777,526

UNITED STATES PATENT OFFICE

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DOOR-OPERATING MECHANISM

Application filed October 2, 1925. Serial No. 60,003.

This invention relates to door operating mechanisms and has for one of its primary objects the provision of a simple and compact mechanism for opening and closing doors, conveniently operated and automatic in its action.

Another object of the invention resides in the provision of means arranged to automatically shut off the source of power when the door reaches either its full open or closed position.

Still another object of the invention is the provision of a device of the character described in which the door hinges are not subjected to excessive strains and in which jamming of the doors is avoided.

How the foregoing together with such other objects as may hereinafter appear or are incident to my invention are realized, is illustrated in the accompanying drawings, wherein:

Fig. 1 is a fragmentary plan section taken thru the upper door frame and showing my door operating mechanism in elevation;

Fig. 2 is a fragmentary view similar to Fig. 1 but showing the door in open position;

Fig. 3 is a fragmentary section taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary section taken on the line 4—4 of Fig. 2;

Fig. 5 is a wiring diagram showing the control connections;

Fig. 6 is a view similar to Fig. 1 illustrating a modification of my invention;

Fig. 7 is a wiring diagram showing the control connections for the modification shown in Fig. 6;

Fig. 8 shows another modification of my invention; and

Fig. 9 shows the modification of Fig. 8 with the door in open position.

In the drawings I have shown a complete operating mechanism as applied to one door of a pair of two leaf doors, the mechanism for the other door of the pair being the same as that shown. It is obvious that where only one two leaf door is used only one operating mechanism would be necessary.

Referring now more particularly to Figs. 1 to 5 inclusive the reference letter A denotes the upper door frame, B a two leaf door and C the operating mechanism in general.

The operating mechanism C comprises an endless arcuate rack member 5 having a pair of radial arms 6, 6 extending from the axis 7 of the rack, said member 5 being supported from the upper door frame A and the adjacent structure 8 in any suitable manner. Pivoted about the axis 7 is an arm 9 which carries toward its free end the motor device indicated as a whole by the reference letter D. The free end of the arm 9 is connected to the folding leaf or second member 10 of the two leaf door B by means of the link 11 which link may be readily detached from the arm 9 by removing the pin 12, this for the purpose of operating the door by hand independently of the operating device C if desired to do so, as would be the case, for example, in the event of failure of the device C.

It is pointed out that by reason of the operating mechanism C being mounted independently of the door as above described, the operating thrusts will be transmitted to the pivot 7 and consequently taken by the operating device and not by the door hinge 10^b. Furthermore by reason of the connection from the operating device to the door being made at a point remote from the door hinge 10^b that is to the second member 10 of the door, the hinge is further relieved of strains.

The motor device D comprises a driven gear or pinion 13 drivingly connected to the motor 14 thru the medium of shaft 15, worm and worm gear 16 and 17 respectively and shaft 18.

In this connection it is pointed out that by cutting off the current from the motor 14 the door will be locked against movement, by virtue of the worm and worm gear connection, so that when the door reaches either its closed or open position it is locked in such position, the current to the motor being cut off by means of automatic switches to be hereinafter described. A safety switch E may b located at some secluded point for shutting off the power to the motor device, which switch may be opened after the door has been

closed by the control device thus locking the door.

The bed plate 19 of the motor device D is pivoted to the arm 9 at 20, by virtue of which the motor device is adapted to move about the pivot 20 for reasons now appearing. Intermediate the inner rack portion 21 and the outer rack portion 22 is an upstanding arcuate rib 23 adapted to be engaged by the roller 24 mounted on the lower protruding end of the shaft 15. Thus it will be seen that as the gear 13 travels from one rack portion to the other the motor device is swung on its pivot 20 thus maintaining effective driving connection between the rack and gear at all points in its travel.

Assuming the door to be closed as shown in Fig. 1 and that it is desired to open it to the position shown in Fig. 2, the conveniently located control switch 25 is thrown from the position shown in Fig. 5 to the right making contact at 26 to complete a circuit from one side of the power line 27, thru wire 28, switch 29 which is in closed position, wire 30, motor 14, and wire 31 back to the other side of the power line. This starts the motor device D in operation, rotating the gear 13 and causing it to move along the inner portion 21 of the rack and carrying with it the arm 9, which in turn carries the door with it, thru the medium of connections previously described. In this opening movement the leaf 10 folds on the leaf 10^a of the door, the whole swinging on the hinge 10^b. As the door approaches its full open position (see Fig. 2) the projecting stud 32 engages the switch 29 opening it and breaking the circuit thus stopping the motor and holding the door open until the switch 25 is operated for closing the door.

Closing of the door is accomplished by throwing the switch 25 to the left to make contact at 33 thus completing a circuit from one side of the line 27 thru wire 34, switch 29^a, which switch is closed when the door is open, thru wire 35, motor 14 and wire 31 back to the line 27. This starts the motor and moves the door to closed position in a manner similar to that of opening the door. In the closing stroke however the pinion engages the outer portion 22 of the rack 5 by virtue of the rib and roller arrangement previously described. As the arm thus moves the switch 29 closes and when the door approaches its closed position the switch 29^a is opened by the stud 32, breaking the circuit and again stopping the motor. Hence it will be seen that the switches 29 and 29^a are automatically set in proper operating positions. It is obvious that by employing a double rack a non-reversible motor may be used.

In order to prevent any jamming of the door when attempting to close it, I have provided a guide rail 36 having a curved portion 37 which tends to separate the leaves of the door when imparting closing movement thereto.

In the modification shown in Figs. 6 and 7 I have shown a single rack 5^a in substitution for the double rack above described, in which instance a reversible motor is employed, the operation of the device otherwise being similar to that just described. A reversing switch 25^a (see Fig. 7) is then used in place of the switch 25 shown in Fig. 5.

Figs. 8 and 9 show a modification in which I have employed a flexible rack 38 preferably a "silent type or block chain." I have here shown the motor device D mounted directly on the door leaf 10, having dispensed with the arm 9. One end of the flexible rack 38 is secured to the upper door frame at 39 and the other end is connected to the door at 40 thru the medium of the spring 41 and cable 42 passing over the rollers 43, 43. By this arrangement it will be seen that as the door opens the length of rack and cable between the point 39 and the roller 43 is increased, and this because of the relation of the point 40 to the pulley 43, thus compensating to a large degree for the arcuate travel of the gear 13, the balance being taken care of by the spring 41. As the door approaches its open position the increase in length of the rack and cable is taken out because the relation of the point 40 to the pulley 43 is then the same as it was in the closed position of the door. Thus it will be seen that the rack in effect is automatically lengthened and shortened to compensate for the arcuate travel of the gear 13. A swivel backing roller 44 is provided to keep the chain in contact with the rack.

While I have shown and described my device as applied to a two leaf door swinging inwardly it is to be understood that the device is also applicable to other types of doors.

No specific claim is made herein to the flexible rack or chain device illustrated in Figures 8 and 9 of the drawings, as claims directed thereto have been made part of the subject matter of a divisional application, Serial No. 409,785, filed November 26, 1929.

I claim:—

1. A door operating mechanism comprising in combination a pivoted arm, an endless arcuate rack having two arcuate rack surfaces each struck from a center coinciding with the center of pivot of the arm, a motor device including a driven gear carried by said arm, means adapted to engage said gear with one portion of the rack to move the arm in one direction and with the other portion to move the arm in another direction and a connection between the arm and the door.

2. A door operating mechanism comprising, in combination, an endless arcuate rack, a motor movable along one portion of said rack to open the door and movable along the

other portion of said rack to close the door.

3. A door operating mechanism comprising, in combination, an endless arcuate rack, a motor device including a driven gear, means adapted to engage said gear with one portion of the rack to move the door in one direction and with the other portion to move the door in another direction and a connection between the motor device and the door.

4. A door operating mechanism comprising, in combination, an endless arcuate rack, a motor movable along one portion of said rack to open the door and movable along the other portion of said rack to close the door, together with means for stopping the motor at predetermined points in its travel.

5. A door operating mechanism, comprising, in combination, an endless arcuate rack, a motor device including a driven gear, and a worm drive between the motor and said gear, means adapted to engage said gear with one portion of the rack to move the door in one direction and with the other portion to move the door in another direction, and a connection between the motor device and the door.

6. A door operating mechanism comprising in combination a pivoted arm, an arcuate rack having its rack surface struck from a center coinciding with the center of pivot of the arm, a motor carried by said arm, a driving connection between said motor and the rack whereby the arm is moved upon operation of the motor and a connection between said arm and the door.

7. A door operating mechanism comprising in combination a pivoted arm, an arcuate rack having its rack surface struck from a center coinciding with the center of pivot of the arm, a motor carried by said arm, a driving connection between said motor and the rack whereby the arm is moved upon operation of the motor and a connection between said arm and the door, together with means for stopping the arm at predetermined points in its travel.

8. An operating mechanism for a two leaf door comprising in combination a rack, a motor device having a driven gear engageable with said rack and being adapted to move along said rack, and a connection between said motor device and the door said connection being made to the second leaf of the door.

9. A mechanically operated door mechanism comprising a door, motor means mounted independently of the door but connected therewith, and means associated with the motor means for causing such motor means to move bodily when it is operated whereby the door is caused to move therewith.

10. A door operating device for hinged doors including a fixed support, an arm pivoted on said support, a motor device carried by said arm, a connection between said arm and the door, and means on said support engageable by the motor device for moving said arm in directions to open and close the door, said fixed support being adapted to take operating thrusts during operation of the device.

In testimony whereof, I have hereunto signed my name.

FRANK L. MORSE.