G. F. JENKINS.

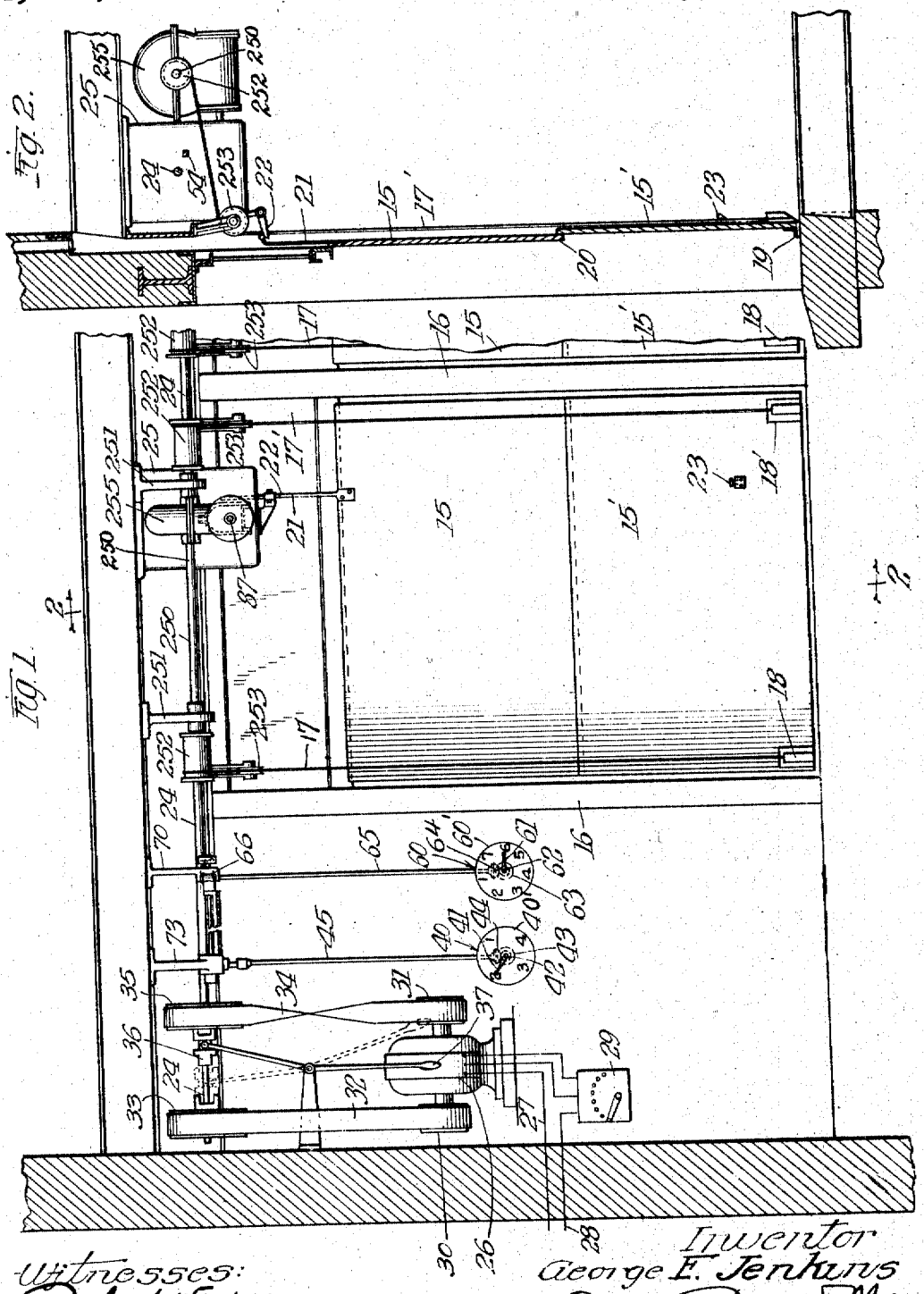
DOOR OPENING AND CLOSING MECHANISM.

APPLICATION FILED MAY 29, 1916.

1,254,696.

Patented Jan. 29, 1918.

5 SHEETS—SHEET 1.



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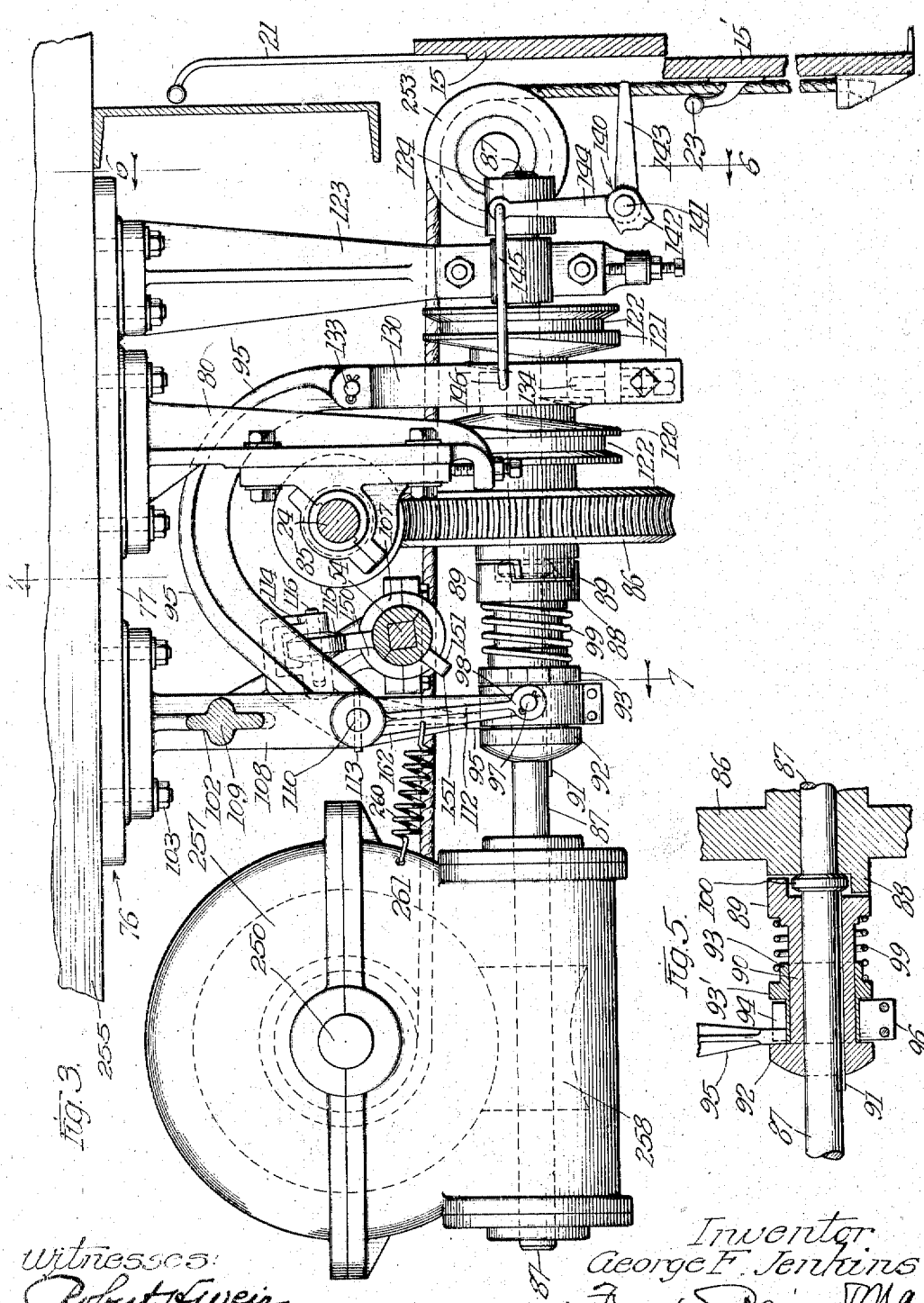


Fig. 3.

Fig. 5.

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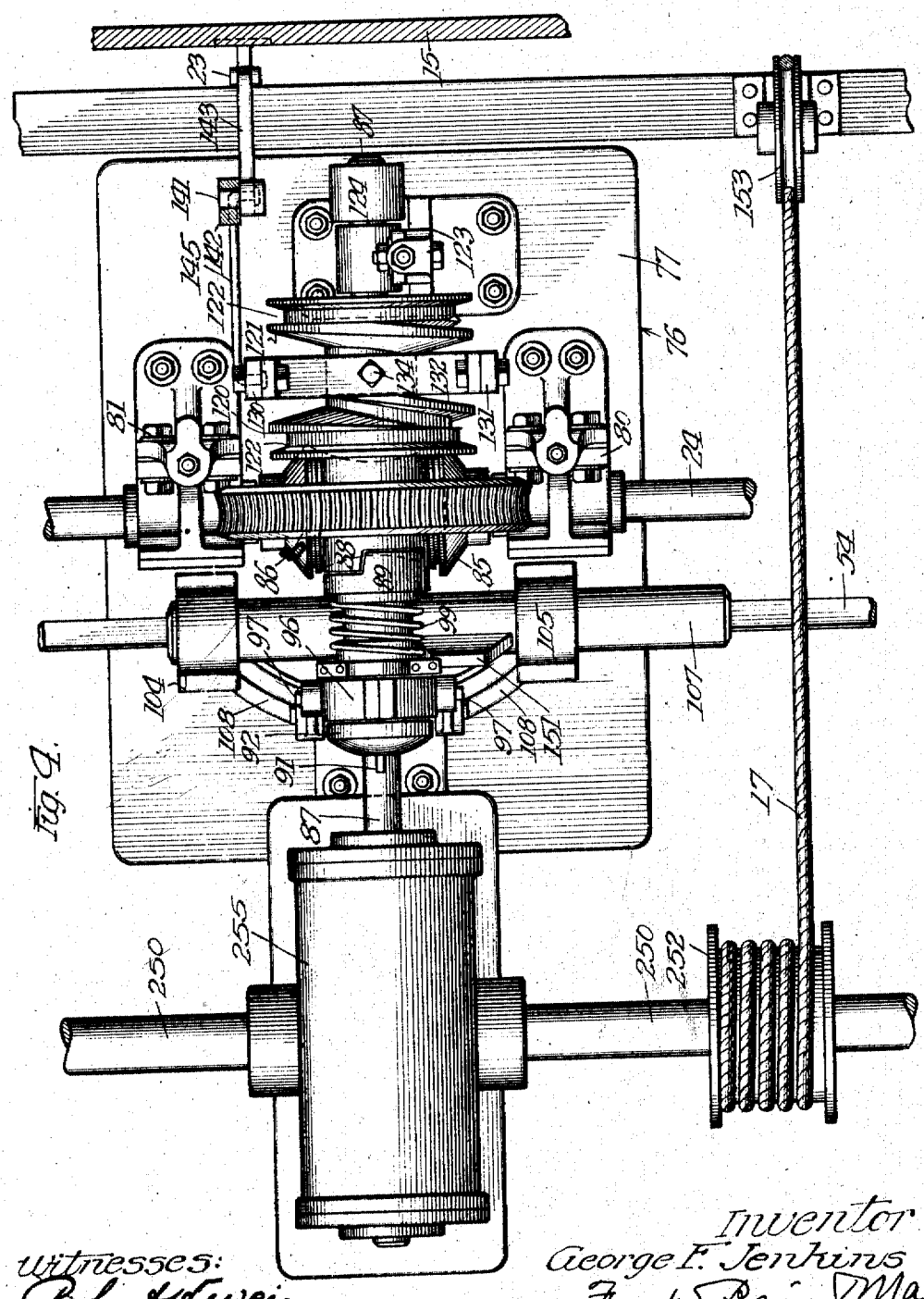


Fig. 1.

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5 SHEETS—SHEET 4.

Fig. 6.

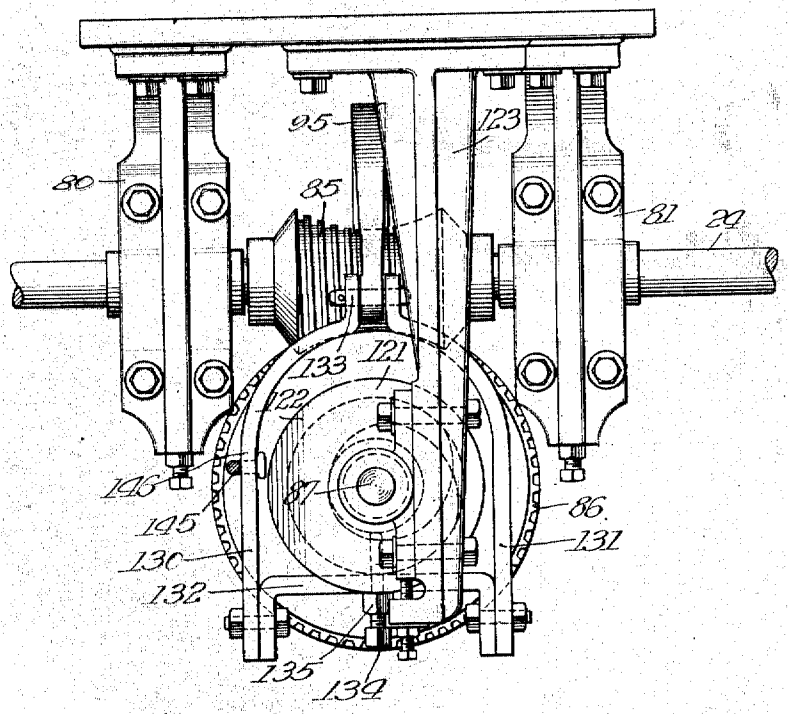
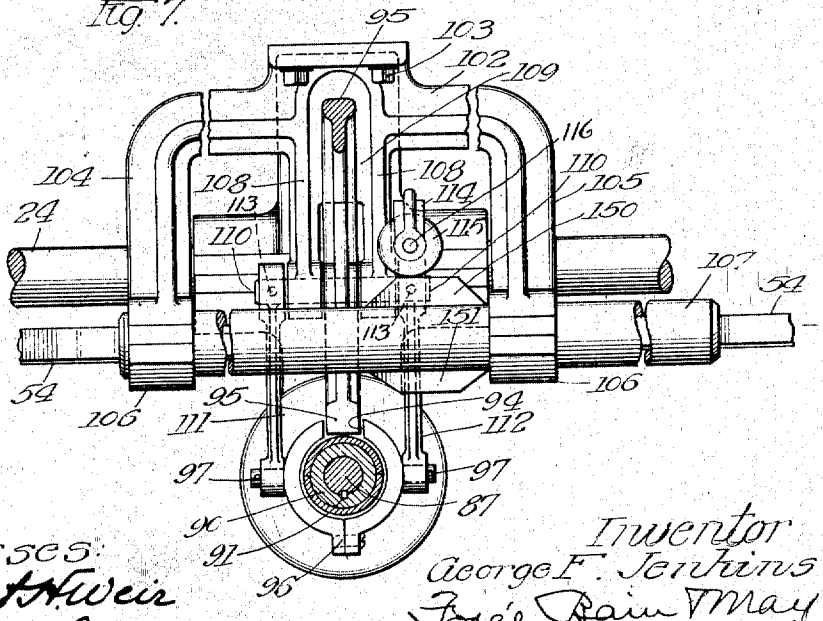


Fig. 7.



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5 SHEETS—SHEET 5.

Fig. 8.

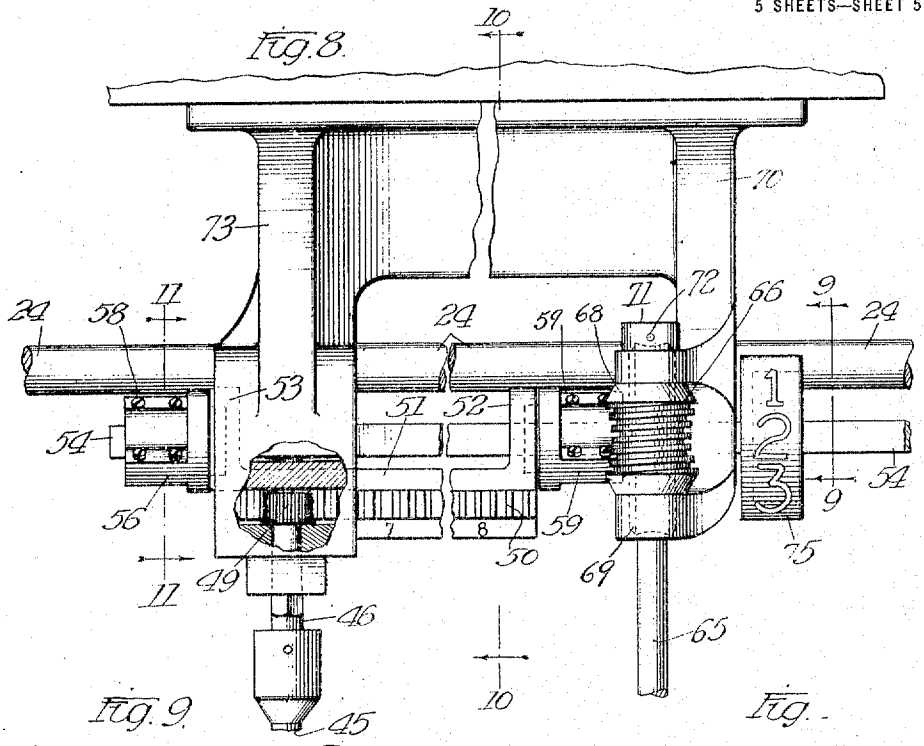


Fig. 9.

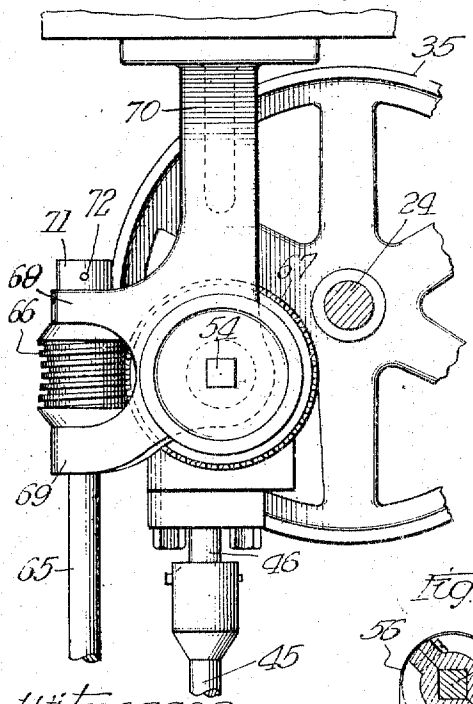


Fig. 10.

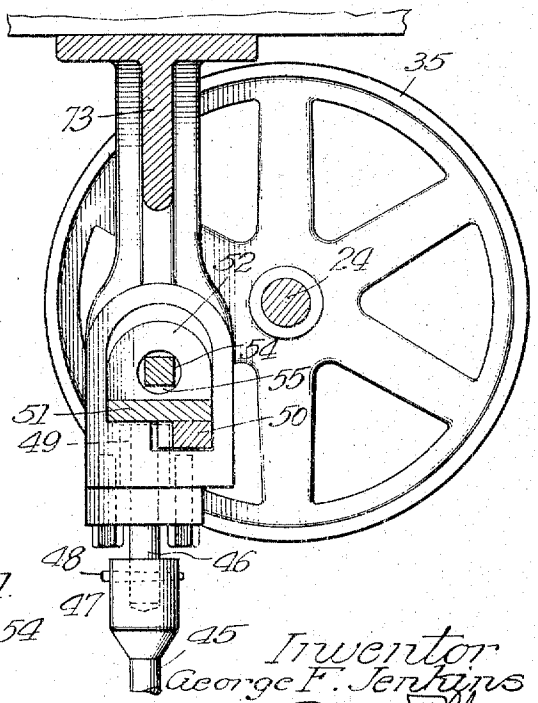
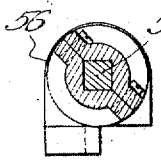


Fig. 11.



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UNITED STATES PATENT OFFICE.

GEORGE F. JENKINS, OF LA GRANGE, ILLINOIS.

DOOR OPENING AND CLOSING MECHANISM.

1,254,696. Specification of Letters Patent. Patented Jan. 29, 1918.

Application filed May 29, 1916. Serial No. 100,456.

To all whom it may concern:

Be it known that I, GEORGE F. JENKINS, a citizen of the United States, residing at La Grange, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Door Opening and Closing Mechanism, of which the following is a specification.

My invention relates to selective door opening and closing mechanisms.

One of the objects of my invention is to provide improved means for opening and closing doors, and the like, from points remote from the door.

Another object of my invention is to provide simple and effective means for mechanically opening and closing selected doors and controlling means for said door-operating means, whereby to operate any given door from a selected group of doors, or simultaneously a selected number of doors from a plurality of groups of doors or all of the doors of a given group.

Other and further objects of my invention will become readily apparent to persons skilled in the art, from a consideration of the following description when taken in conjunction with the drawings, wherein:—

Figure 1 is a front elevation of one door of a group, and a part of another, and the operating mechanism for a given door and selective mechanism for a plurality of doors and groups of doors.

Fig. 2 is a transverse section, taken on line 2—2 of Fig. 1.

Fig 3 is a side elevation of the operating mechanism necessary for a single door.

Fig. 4 is a plan view of the same, looking from the bottom.

Fig. 5 is a central, longitudinal section of the clutch to connect the cable drums to their driving shaft.

Fig. 6 is an end elevation of a door-operating mechanism showing the door-operated controlling lever, taken on line 6—6 of Fig. 3.

Fig. 7 is a transverse section taken on line 7—7 of Fig. 3.

Fig. 8 is a side elevation of the group-selecting mechanism and door-selecting mechanism.

Fig. 9 is a transverse section taken on line 9—9 of Fig. 8.

Fig. 10 is a transverse section taken on line 10—10 of Fig. 8.

Fig. 11 is a section taken on line 11—11 of Fig. 8.

In all the views the same reference characters are employed to indicate similar parts.

Briefly, my invention consists of a separate mechanism for opening and closing each door of a number of doors, which may derive operating power from a common source of power, such, for example, as a continuously rotating shaft, arranged in substantial alinement with the series of doors and which may be turned in a given direction to raise, or to open the doors, and capable of being reversed, so as to be turned in the opposite direction to lower or close the doors.

The energization of a particular mechanism for a given door is determined by a door-selector operable for all the doors, from a given, or central point. Furthermore, it consists of a group-selector whereby any group containing a number of doors may be selected and subsequently any door within the selected group or all of the doors of a given group, determined by the door selector.

In the illustration of the specific embodiment, which I have chosen to disclose my invention, and which is capable of wide deviation, being limited only by the scope of the appended claims, 15—15′ is a two-part vertically-slidable door, movable in guideways 16, placed on either side of the doors. The door raising mechanism, operates transmission ropes or cables 17—17′, which are connected to the lower edge of the door section 15′, as at 18—18′. The lower door section 15′, on its inner edge, carries a projection, an angle iron 19 is one form which may be used for engagement with the bottom edge 20 of the door section 15, so that when the door section 15′ has been raised until the projection 19 makes contact with the lower edge 20 of the door section 15, then further movement of the cables will raise both doors. The door 15 carries a projection 21 for coöperation with a pivoted control lever 22 of the door-moving mechanism, whereby to arrest the movement of the cables 17—17′ when the doors 15—15′ have moved downwardly by effect of gravity, into their normally closed positions, as shown in Figs. 1 and 2. The door 15′ carries a similar projection 23, to engage the

pivotal lever 22 when the door sections 15—15′ have been moved to substantially their upper limit of movement, so as to stop the movement of the lifting cables 17 and 17′ when the doors have been moved upwardly to their full open positions.

A means for operating all of the door moving mechanisms may take the form of a shaft 24 which may extend longitudinally, in alinement with a series of doors, preferably above the doors, in suitable bearing hangers and through the casings 25 of the door-operating mechanisms. Suitable means for controlling the source of power for rotating the shaft may be employed. In the particular embodiment I have shown an electric motor 26, connected with electric current supply-wires 27 and 28 and controllable by the rheostat 29. The motor 26 is provided with pulleys 30 and 31, on the respective ends of its armature shaft, the former being connected by a straight belt 32 to a pulley 33 on the power shaft 24, the latter being connected by a cross belt 34 to the pulley 35. A clutch member 36 is slidable upon the power shaft 24 by means of a hand operated lever 37, whereby to change the direction of rotation of the shaft 24, which is supplied with power, by the uni-directional-speed motor. When the clutch part 36 is axially moved on the shaft 24 into connection with the clutch member on the pulley 33 the straight belt 32 will rotate the shaft in a given direction which, for example, is the direction necessary to raise the door sections 15—15′, or to open the door whereas when the clutch member 36 is axially moved on the shaft 24 in connection with the clutch member on the pulley 35 the cross belt 34 will rotate the shaft 24 in the opposite direction or in the direction necessary to lower the door section, or to close the door.

40 is the group-selecting mechanism. The drawings show a hand operated, indicating lever 41, capable of being rotated and stopped at either of four positions, indicated by the numerals 1, 2, 3 and 4, to designate as many different groups of doors. On the axis 42 of the lever 41 is a beveled gear wheel 43 which meshes in a similar gear wheel 44 that is connected to a vertical shaft 45. The shaft 45 is connected to the stub shaft 46 by a coupling 47 and a pin 48. A pinion 49 is fixed to the upper end of the stub shaft 46 and meshes in a rack 50 to axially move it when the shaft is rotated. A plate 51 immediately over the rack, guided in the hanger 73, is provided with a vertically projecting head 52, at one end, and a similar projecting head 53 at the other end. The heads 52 and 53 and intervening rack 50 are slidable along a squared shaft 54, in the hanger bearing, which shaft is generally parallel with the power shaft 24 and substantially coextensive therewith. The heads 52 and 53 are perforated with round orifices 54 so that the squared shaft 54 may freely be axially moved therein and so that the heads will not interfere with the rotation of the squared shaft. A two-part collar 56 is secured to the shaft 54 in substantial contact with the head 53, as by screws or bolts 58, and another similar collar 59 is secured substantially in contact with the head 52, to the shaft 54, as by bolts 60, so that as the rack 50 is longitudinally moved by rotation of the pinion 49 the shaft 54 is axially moved therewith.

The group-selector, as indicated, is adapted to control four groups of doors. The number of doors in each group is indicated by the door-selector 60. Like the group selector it is provided with a dial 60′ upon which are indicated, at uniform distances near the periphery, the numerals 1 to 7 indicative of the number of doors, within the several groups, controlled by the door selector 60. A handle or pointer 61 is secured to a shaft 62, which carries on its inner end a bevel pinion 63, which meshes with a similar bevel pinion 64 that is secured to a vertically extending shaft 65. This shaft carries a worm 66 upon its upper end, which meshes in a worm wheel 67 loosely carried upon the squared shaft 54. The worm wheel 67 permits axial movement of the shaft 54 but is rotatably secured thereto. The worm wheel is located between arms 68 and 69, which are prolongations of the hanger 70. The collar 71 is fixed upon the upper end of the shaft 65 and is held in place by a pin 72.

The distance between the hanger 70 and the hanger 73 may be varied to accommodate the number of door requirements, for the axial movement of the shaft 54, for a purpose to be hereinafter more fully explained.

An indicating disk 75 is fixed to the shaft 54 and is rotatable therewith and indicates the position of the cams carried by the shaft 54 with reference to its rotary path.

The door-operating mechanism 76 consists of a base 77 provided with hangers 80 and 81 for the power shaft 24, or a section thereof, carrying a worm 85 which is secured thereto and rotatable therewith and which meshes into a worm wheel 86. The worm wheel 86 is revolubly loose upon the shaft 87, but carries upon its side face a three-jaw clutch 88. A coöperating three-jaw clutch 89 is a part of the sleeve 90 (see Fig. 5) that is slidable upon the shaft 87, but is rotatably fixed thereto by a spline and feather 91. The sleeve 90 is provided with an enlarged head 92. A sleeve 93 is loose on the sleeve 90, and has an annular head 93′ between which and the hub 92 there is an open space 94 when the clutch is closed,

within which a clutch operable lever 95 is adapted to be moved. Within the annular space between the head 92 and the annular enlargement 93′ on the sleeve 93, is a loose two part yoke member 96 provided with oppositely disposed studs 97 for pivotal engagement with arms 111 and 112. The sleeve 93 is axially movable upon the sleeve 90 resisted by the spring 99, and between the clutch portion 89, of the sleeve 90, and the head 93′ of the sleeve 93, is this open helical spring 99. An annular enlargement 100 is placed upon the shaft 87 to prevent the worm wheel 86 from moving out of its position when the clutch members are disengaged. The sleeve 90 and clutch member 89 are adapted to be automatically moved by the clutch operating lever 95, axially of and on the shaft 87 to disengage the clutch members 88 and 89.

A hanger 102 is fixed to the base 76, as by bolts 103. It is provided with downwardly extending arms 104 and 105 (Fig. 7) to afford bearings 106 for a prolonged cam-carrying sleeve 107, that surrounds the squared shaft 54 and which is axially movable therewith. It is also provided with two downwardly and outwardly extending arms 108—108 with a connecting web 109. The distance between the arms 104 and 105, to provide intervening space, may be varied accordingly to the number of groups of doors and the number of doors in the respective groups to be operated. Passing through the lower ends of the arms 108 is an oscillatable arbor or shaft 110 carrying downwardly depending arms 111 and 112. The arms, 111 and 112, are fixed to the arbor 110 by pins 113. The lever 95 is pivoted on the arbor 110 between the arms 108—108. The arm 112 is prolonged, above the shaft 110, into a housing 114 in which a roller, or wheel 115, is pivoted, as at 116. The roller 115 is off to one side of its pivotal point 110 so that when the roller is raised, as shown in Fig. 3, the arms 111 and 112 are thereby moved toward the worm wheel 86 and the clutch member 89, carried by the sleeve 90, is moved into rotative coöperation with the clutch member 88 carried by the driving worm wheel 86, thereby causing the worm wheel 86 to drive the shaft 87.

Fixed to, or an integral part of, the worm wheel 86, and loose on the shaft 87, are two spiral taper-threaded cams 120 and 121. The threads of the cams, 120 and 121, extend from approximately mid-way position, outwardly, in directions away from each other, but progressively increasing distance in radial planes from the shaft until they communicate with the annular groove 122 at the largest diameter.

The outer end of the shaft 87 is supported by a hanger 123 and the collar 124 is fixed to the outer end of the shaft 87.

A swinging yoke which consists of the side members 130 and 131 (Fig. 6) connected together by a cross piece 132, are pivoted to the longer curved end of the lever 95, as at 133. The cross piece 132 carries an adjustable screw or pin 134, fixed in adjusted position by a nut 135. The pin 134 normally rests in the interspace between the threads of the cams 120 and 121, at the smallest diameter, as shown in Fig. 3.

A bell crank 140 is pivoted, as at 141, to a fixed part 142 of the apparatus. It is provided with an outwardly-extending arm 143, which is in the path of the projections 21 and 23 of the door sections 15 and 15′, respectively. A vertically extending arm 144, of the bell crank, is connected by a link 145 to the swinging arm 130, as at 146, so that by movement of the arm 143, of the bell crank, the link 130 may be swung over so that the pin 134 will engage the thread of the rotating cam 121 or swung in the opposite direction so that the pin 134 will engage the thread of the rotating cam 120. When the pin 134 engages the threads of either of the cams, the swinging link, composed of the arms 130 and 131, is depressed, on account of the continually growing diameter of the threaded portions of the cams. The outer end of the lever 95 is thereby pulled downwardly, on its pivot 110, causing the shorter arm of 95 (Fig. 5) to engage the head 92 of the slidable clutch member 89, thereby disconnecting the clutch members 88 and 89 and stopping the rotation of the shaft 87.

The two-part cam sleeve 107, 107 (Fig. 3 and Fig. 7) is provided with a series of cams 150 and 151. These cams may be located on the sleeve 107 at various points between the depending arms 104 and 105. As the sleeve 107 is clamped to the axially movable shaft 54 the cams will be moved axially with the shaft when the latter is moved by the group selecting mechanism. The cams 150 for the various doors in the respective groups, are located at different circumferential points on the sleeve 107, but the cam 151 for all of the doors in a single group are located in the same radial plane or circumferential point for all the door operating mechanisms of a given group so that all the doors of that group may be simultaneously operated. Similar sets of cams for other groups are distributed around the sleeves 107 at other axial positions.

A drum shaft 250 extends substantially a distance equal to the width of a door 15—15′, and is supported by hangers 251, and on each of its outer ends it carries a drum 252 for the cables 17—17′. The cables pass over loose sheaves 253 in order to be vertically in line with the doors 15—15′. The drum shaft 250 also passes through a housing 255 in which is contained a worm wheel 257 which meshes with a driving worm 258

carried by the shaft 87. By this means the drums 252—252 are rotated for winding up the cables 17—17′ for opening the doors or rotated in the opposite direction to unwind the cables to permit the doors to descend by the operation of gravity to closed positions.

A spring 260 is fixed to the housing 255, as at 261, and to the depending lever 112, as at 262, whereby to yieldingly and normally hold the clutch members 88 and 89 out of driving relation when they are not positively held in such engagement by cams 120—121 and lever 95.

The operation of the device is as follows:—Assume that the door to be opened or closed, as the case may be, is in group 2 and is door No. 6, the first operation is to turn the hand lever 61 of the door selector 60, to a position shown in Fig. 1 indicating 6. This operation rotates the shaft 65 and thereby the square selecting shaft 54 through the instrumentality of the worm 66 and the worm wheel 67, until the cam 150 is in a vertical plane with the roller or pulley 115, then the hand lever 41 of the group-selector 40 is rotated until it comes opposite the indication 2 on the disk 40′. This operation causes the pulley 49 to be rotated, and meshing with the rack 50, it causes the shaft 54 to be axially moved until the cam 150, of the proper group, is brought under the roller 115, thereby raising the roller 115, as shown in Fig. 3, and causing the arms 111 and 112 to move the sleeve 90, which is splined to the shaft 87, inwardly toward the worm wheel 86, which is constantly rotating,—power having previously been applied to shaft 24—until the clutch members 89 and 88 of the power wheel 86 are in driving relation. This operation causes the worm wheel 86 to drive the shaft 87 and through the worm wheels 257 and 258, to rotate the drum shaft 250 that carries the drums 252, whereby the cables 17—17′ are wound upon the respective drums 252, or unwound therefrom depending upon the direction of rotation of the shaft 24. Assuming that the cables are being wound upon the drum and the doors 15—15′ are being raised or opened. When the door 15′ has reached near the point of its upper limit of travel, the projection 23, will engage the arm 143 of the bell crank 140, thereby vertically displacing it in an upward direction, causing the link 145 to move the swinging yoke 130, 131 until the pin 134 engages the threaded spiral cam 120. When the pin 134 enters the threads of the cam 120, it is gradually forced downwardly thereby until it enters the annular raceway 122 of the cam, thereby pulling down the outer end of the pivoted lever 95 on its pivotal point 110, and causing the shorter end of the lever 95 to move outwardly, in the space 94, of the clutch sleeve 90, thereby axially moving the clutch and sleeve, on the shaft 87, and causing disengagement of the clutch members 88 and 89, and stopping the rotation of the shaft 87. The sleeve 90 may be moved by the lever 95 notwithstanding the fact that the levers 111 and 112 are held in clutch-engaging position by the elevation of the roller 115, upon the cam 150 because there is lost motion between the sleeve 93, part 96, and the sleeve 90, which is taken up by the yielding spring 99.

As heretofore explained the shaft 24 is rotatable by the electric motor 26 and the direction of rotation is determined by the slidable clutch member 36. If it now becomes desirable to close the door it is only necessary to rotate the shaft 24 in the opposite direction whereupon the pin 134 carried by the yoke 130 and 131 will be automatically returned to its midway position, as shown in Fig. 3, permitting the outer longer end of the lever 95 to be raised into its normal position, whereupon spring 99 will cause engagement of clutch members 88 and 89. The shaft 87 will now be rotated in the opposite direction because the cam 150 is under the roller 115, and will continue to be rotated until the projection 121, from the door 15, is brought into contact with the lever 143, thereby pulling the yoke 130 131 to the right, into contact with the cam 121, causing the shorter end of the lever 95 to be pushed out and the clutch members 88 and 89 to disengage as heretofore.

Should it be desirable to open or close another door in the same group or in another group, before closing the door just opened, the selectors must first be operated, which operation will remove the cam 150 from under the roller 115, of the door just opened, after which shaft 24 may be rotated in either direction, without affecting the door operating mechanism of the door under consideration. When the door of the example is to be closed, the selecting mechanism must be again operated to bring the proper cam 150 again under the roller 115, as before, and the shaft 24 rotated in the direction opposite to that required to open the door and the door will be closed, as heretofore explained.

The cams 150 are in the same circumferential zones, on the sleeve 107, one for each individual door of the group occupying different radial positions with space therebetween for the roller 115. The cam 151, on the sleeve 107, of the respective doors are located all in the same radial plane, for all of the doors of a given group, so that when the shaft 54 is rotated in order to bring the cams 151 under the rollers 115, all of the doors of that group will be simultaneously operated, either to open or closed positions, in a manner heretofore described. While the rollers 115 of a given group are elevated upon the respective cams 150, the rollers 115

of other unselected groups are not so elevated, but are in substantial contact with the outer surface of the respective sleeves 107, so that the doors of these groups are not affected by the rotation of the shaft 24.

The series of cams 150, 151, for the respective groups, are located at different longitudinal positions on the sleeve 107. The extent to which the sleeves 107 are axially moved, by the group selecting mechanism, will determine the groups, and the rotation of the shaft 54 will determine the particular door-operating mechanism. The space between the arms 104 and 105 may be of any suitable distance to contain any given number of series of cams for a respective number of groups.

As heretofore stated the shaft 24 may extend in sections, the full length of the series of doors, if desired, and be operated by a single electric or other motor, as the motor 26, or a separate motor may be employed for each door and the shaft 24 limited to individual unconnected short sections near the respective doors. This is so manifest and equivalent that it is believed that an extra illustration is not necessary.

Having described my invention, what I claim is:—

1. A system of door control, for a plurality of doors, comprising a door-operating mechanism for each door, a rotatable shaft extending to the doors, means located at a remote point for selectively connecting any door operating mechanism to the shaft, a source of power for rotating the shaft, and means to automatically disconnect said door from its operating mechanism after the door has been operated.

2. A system of door-control for a plurality of doors, divided into groups, comprising a normally inactive door-operating mechanism for each door, one located at each door; a rotatable shaft for driving said door operating mechanism; a selector, at a remote point, to select the groups in which a door is contained and a door of a selected group; means extending from the selector to said mechanism to connect said mechanism with said shaft to operate the door and automatic means to stop the movement of said door.

3. A system of door-control, for a plurality of doors divided into groups, comprising a door-operating mechanism for each door; means, remote from the doors, for selecting the group; similar means for selecting the door, in the selected group; a rotatable shaft extending to all of the doors for energizing the door-operating mechanism of the selected door, to open or to close said door and means extending from the selector to each door operating mechanism to connect the rotatable shaft thereto.

4. A system of door-control, for a plurality of doors, comprising a door-operating mechanism for each door; a shaft extending to each door and detachably connectible to each door-operating mechanism; a door-selecting mechanism for connecting the operating mechanism of the selected door to said shaft operable from a common remote point, means for rotating the shaft in a given direction to open the door and in the opposite direction to close it and automatic means operable by movement of the door to stop the operation of said door operating mechanism.

5. A system of door-control, for a plurality of doors, comprising a door-operating mechanism for each door; a power shaft extending to each door and detachably connectible to each door-operating mechanism; another shaft extending to each door; a door-selecting mechanism to rotate and to axially move the last named shaft to connect the operating mechanism of the selected door to said power shaft; means for rotating the shaft in a given direction to open a door and in the opposite direction to close it; and means to disconnect said power shaft from said door-operating mechanism at or about the time the door has reached the limit of its movement.

6. A system of door-control, for a plurality of doors divided into a plurality of groups of doors, comprising a door-operating mechanism, one for each door; a power shaft connectible to said door-operating mechanisms; another shaft extending to all said door-operating mechanisms, axially movable to select the groups and rotatable to select a given door of the selected group, whereby to connect the selected door-operated mechanism to said power shaft and door-selecting means for rotating the shaft and group-selecting means for axially moving said shaft.

7. A system of door-control, for a plurality of doors divided into a plurality of groups of doors, comprising a door-operating mechanism, one for each door; a power shaft, connectible to said door-operating mechanisms; another shaft extending to all said door-operating mechanisms, axially movable to select the group and rotatable to select a given door of the selected group, whereby to connect the selected door-operating mechanism to said power shaft; door-selecting means for rotating the said shaft; group-selecting means for axially moving said shaft and means, near the limit of movement of said doors, to positively disconnect said door-operating mechanism from said power shaft.

8. A door-operating mechanism, comprising a constantly rotatable power shaft; a counter-shaft provided with drums; cables on said drums; a clutch to connect said counter-shaft to the power shaft; a select-

ing-shaft, axially and rotatably movable to operate one of said clutch members to connect the power shaft to the counter shaft; a door, operable by said cables, and means operable by movement of the door to positively open said clutch, to stop movement of said door-operating mechanism.

In testimony whereof I hereunto set my hand in the presence of two subscribing witnesses.

GEORGE F. JENKINS.

In the presence of—
FORÉE BAIN,
MARY F. ALLEN.