

June 8, 1937.

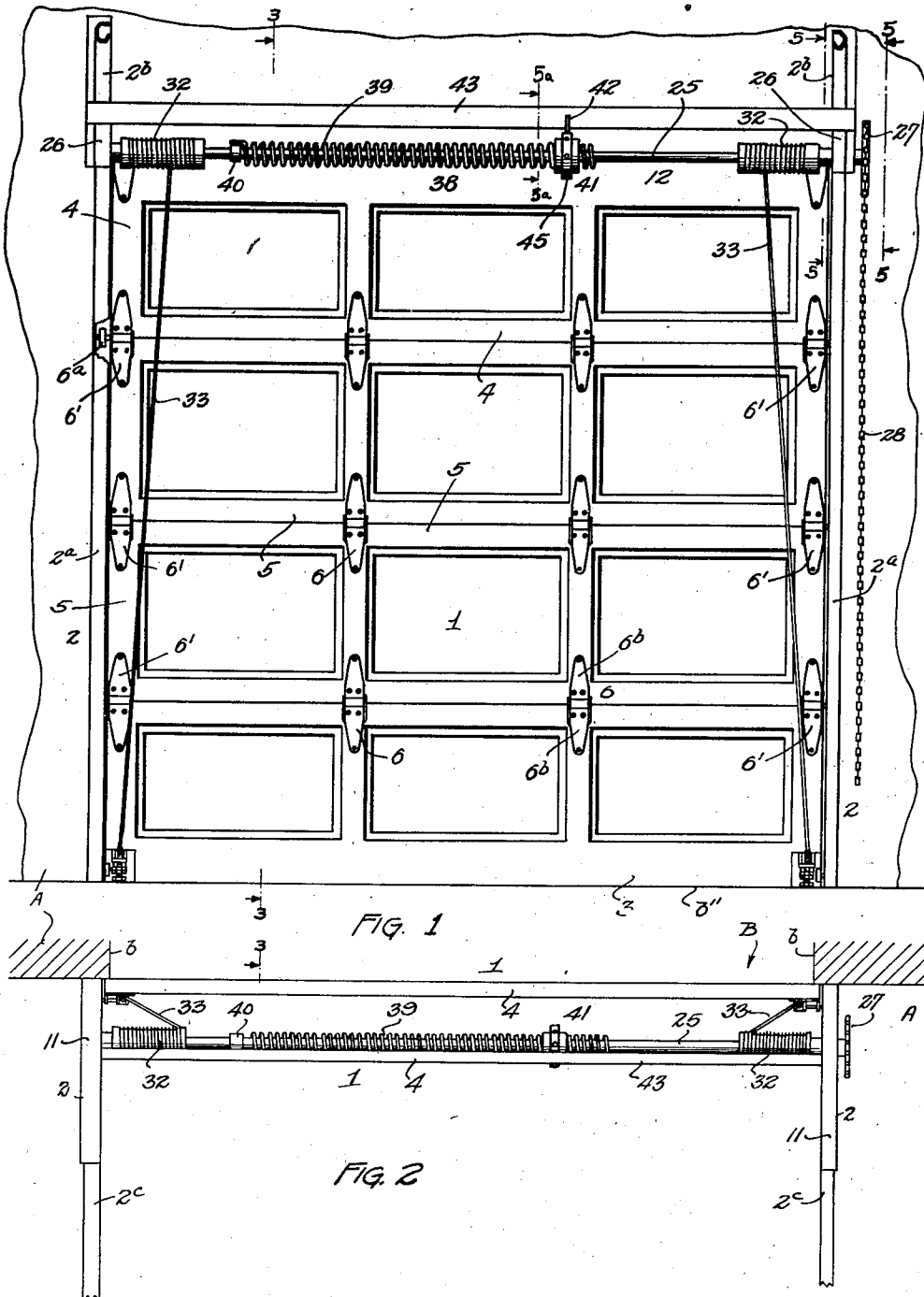
H. I. MORRIS

2,083,467

DOOR CONSTRUCTION

Filed April 29, 1930

7 Sheets-Sheet 1



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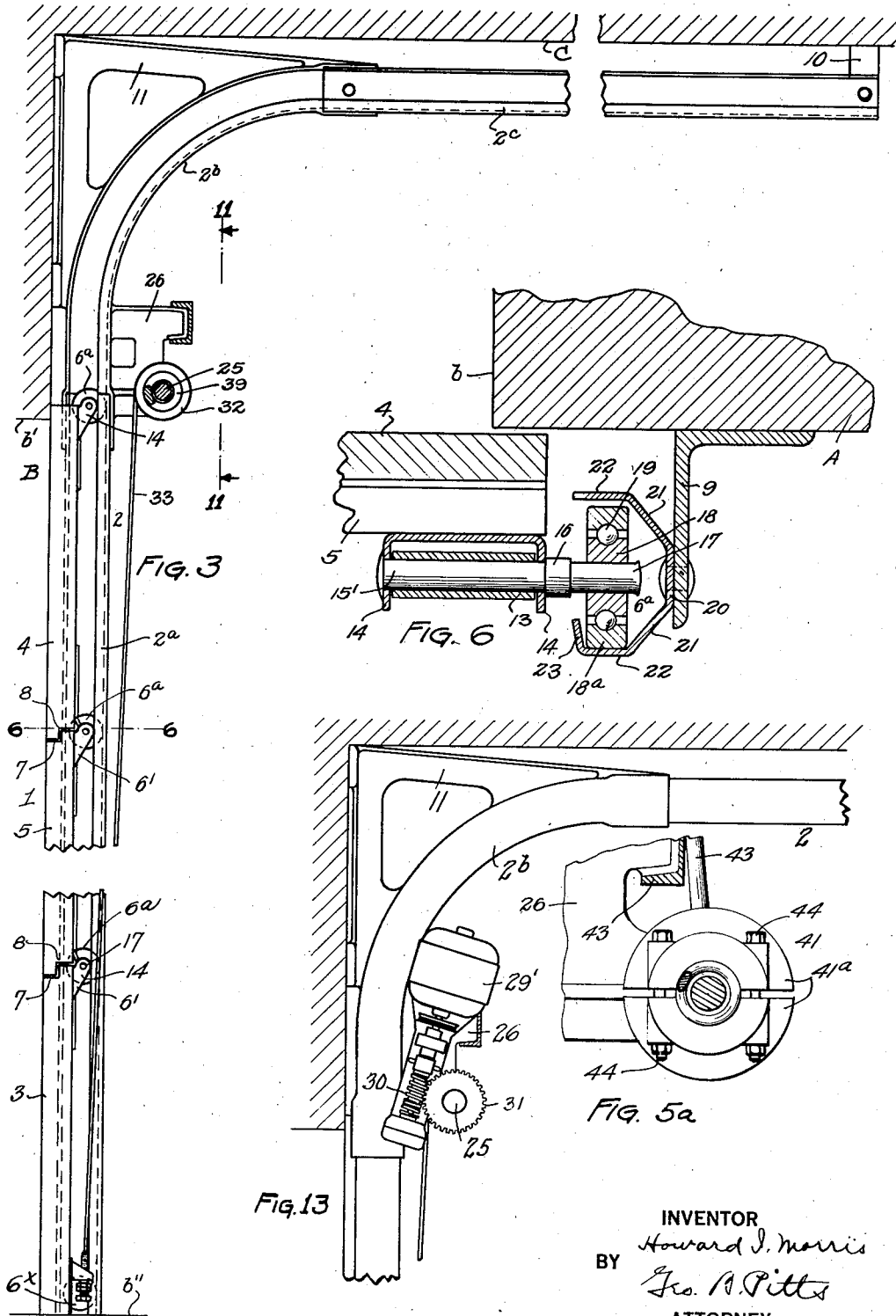
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7 Sheets-Sheet 2



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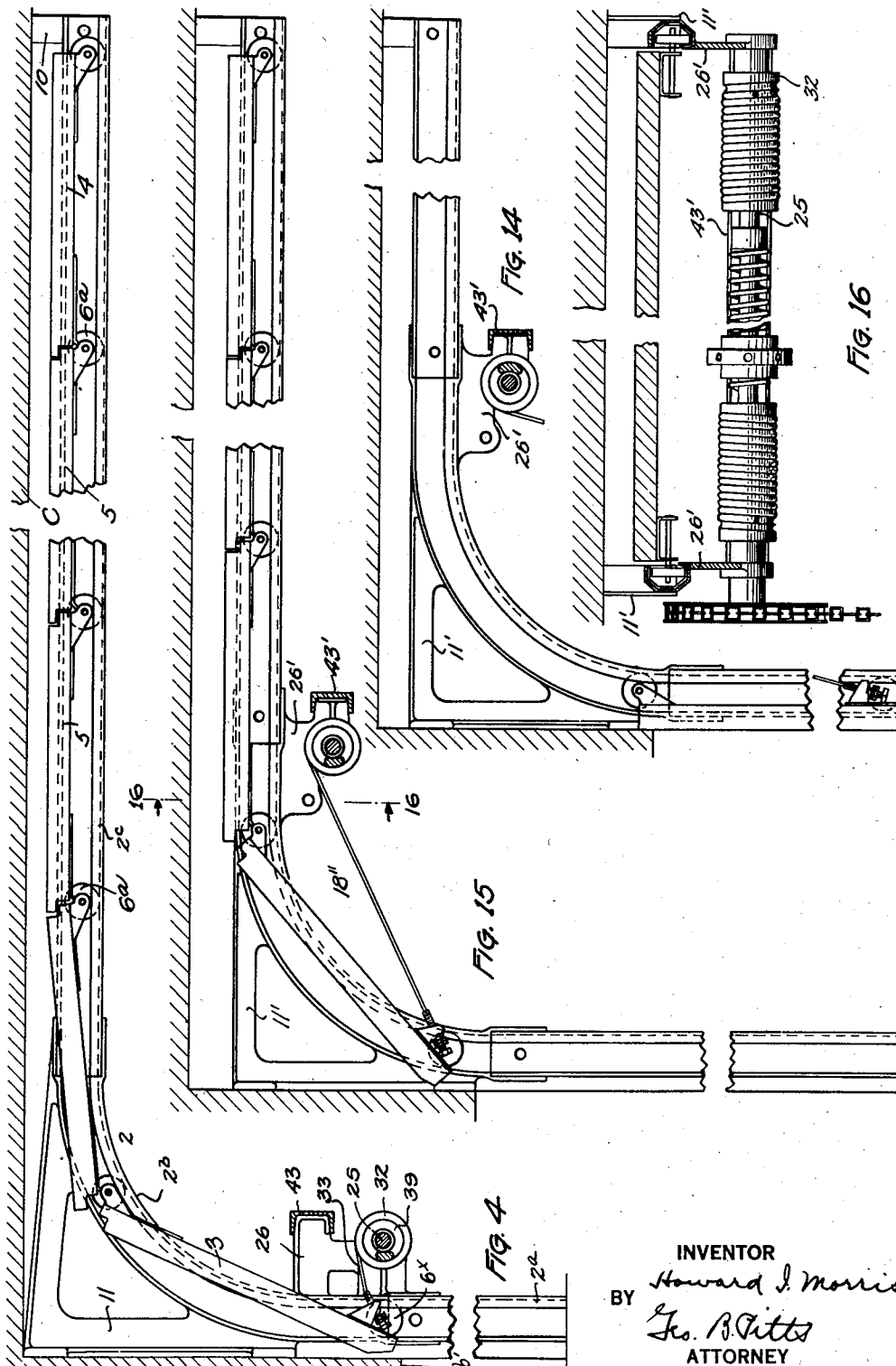
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DOOR CONSTRUCTION

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7 Sheets-Sheet 3



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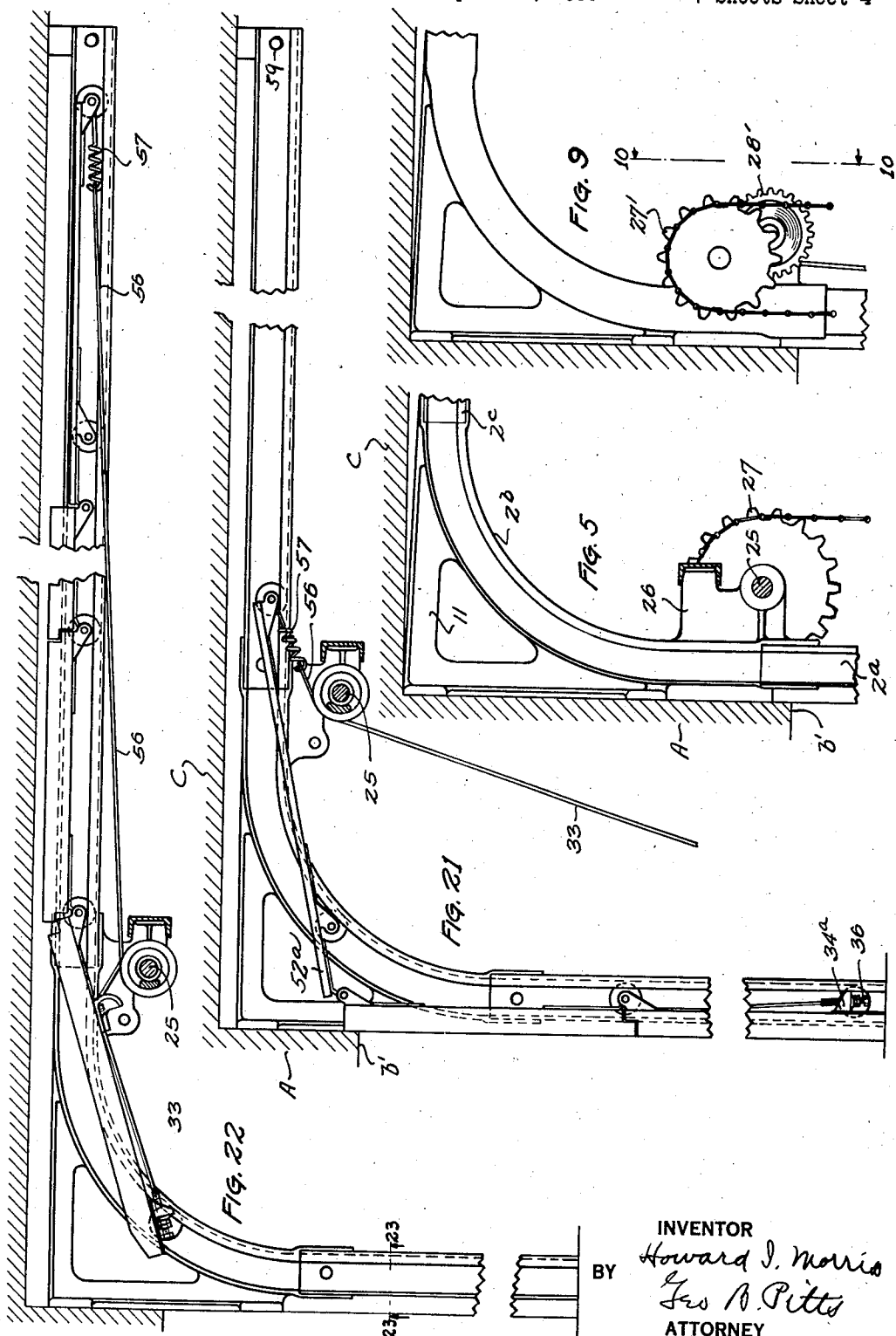
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DOOR CONSTRUCTION

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7 Sheets-Sheet 4



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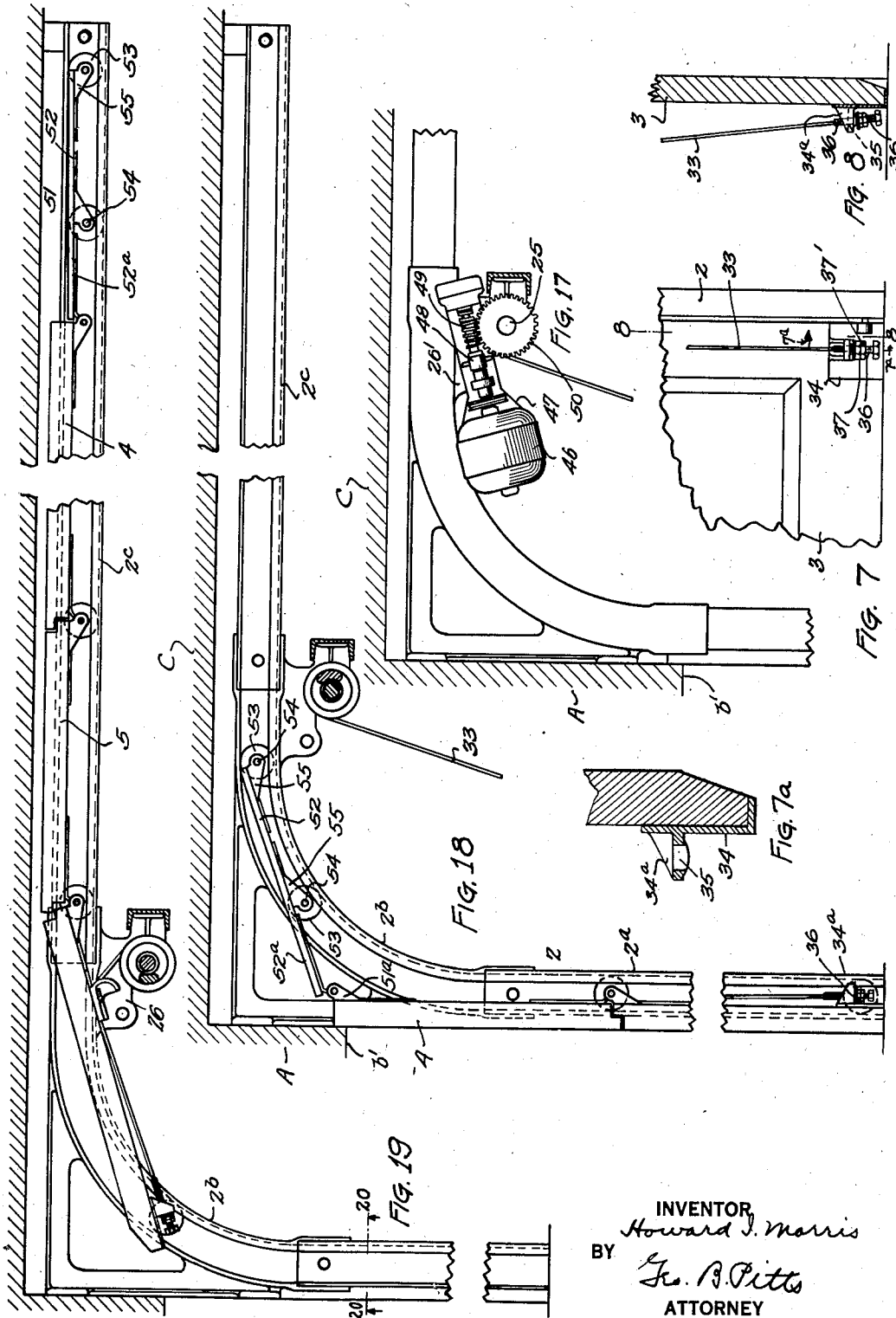
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DOOR CONSTRUCTION

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7 Sheets-Sheet 5



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DOOR CONSTRUCTION

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7 Sheets-Sheet 6

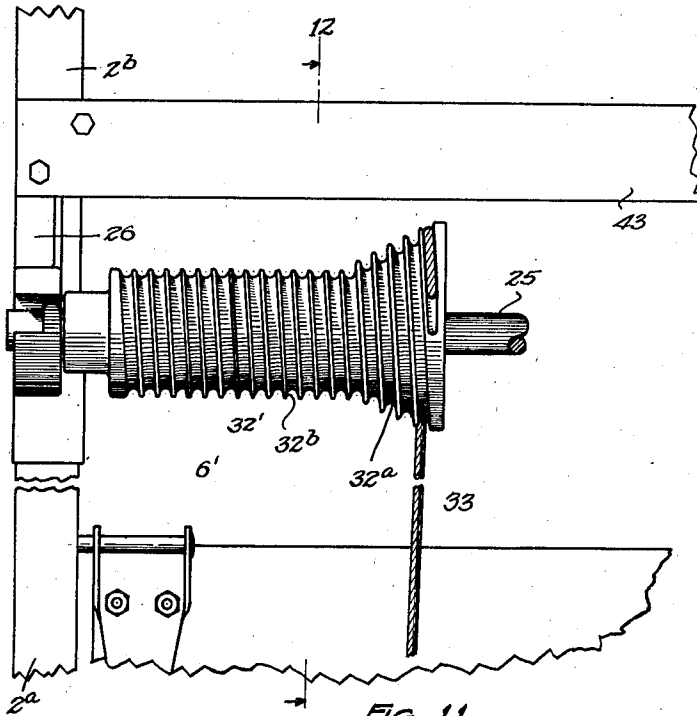


FIG. 11

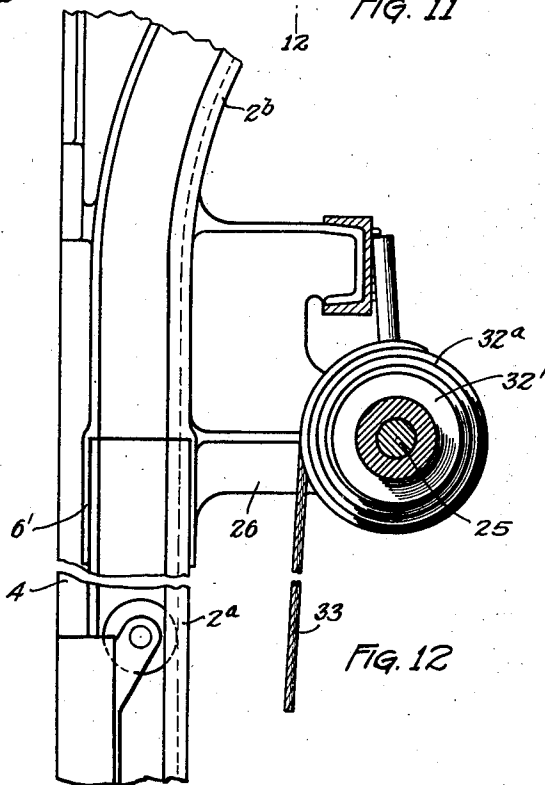


FIG. 12

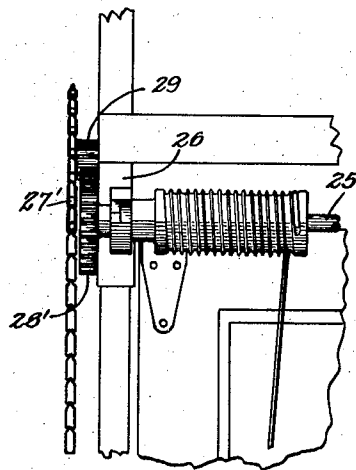


FIG. 10

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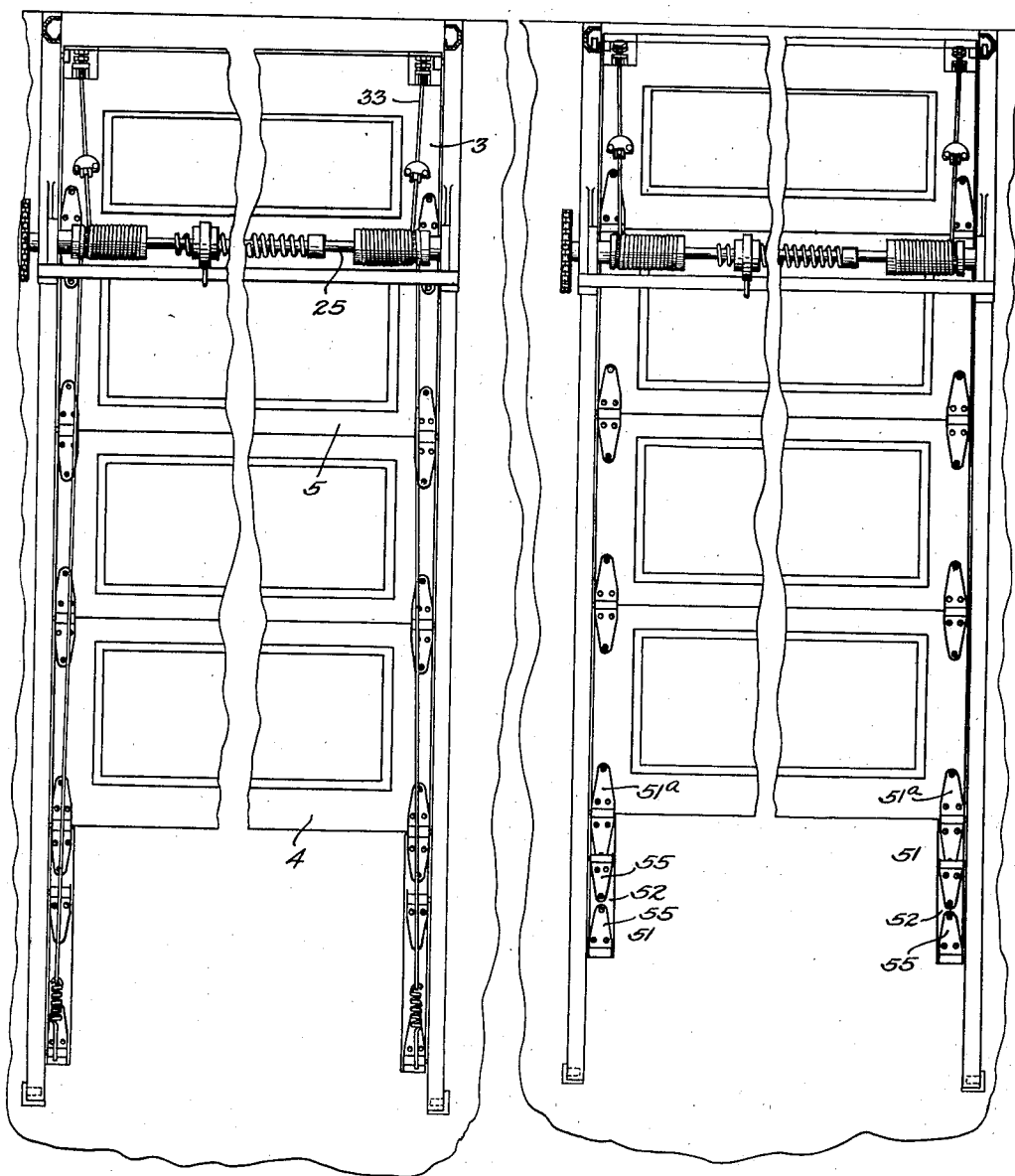


FIG. 23

FIG. 20

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UNITED STATES PATENT OFFICE

2,083,467

DOOR CONSTRUCTION

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Application April 29, 1930, Serial No. 448,377

8 Claims. (Cl. 20—20)

This invention relates to a door of the sectional sliding type and the supporting and operating means therefor.

One object of the invention is to provide a sectional sliding door which is relatively simple in construction and easily operated.

Another object of the invention is to provide a sectional sliding door having improved supporting means arranged to facilitate its installation and alignment.

Another object of the invention is to provide an improved mounting for the rollers between the door sections and the guides, whereby disalignment due to the position of walls on which the guides are mounted, or bulging and warping of the guides is fully compensated for to insure free travel of the door sections.

Another object of the invention is to provide a sectional sliding door having improved counterbalancing means in which the weight of the door during vertical travel thereof, prior to the articulation of the door sections, is compensated for.

Another object of the invention is to construct a sliding door having improved guiding and operating means arranged to control the rearmost door section, whereby complete closing of the door is insured.

A further object of the invention is to construct a vertically sliding door having an improved counterbalancing means capable of adjustment, whereby doors of varying sizes and weight may be readily installed.

Another object of the invention is to construct a vertically sliding door having improved combined operating and counterbalancing means serving to slide the door in either direction in a ready manner and with the exercise of minimum labor.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a fragmentary view of a structure showing a door opening closed by a door and operating means therefor embodying my invention; the view being interiorly of the structure and parts being broken away.

Fig. 2 is a fragmentary plan view of the parts shown in Fig. 1.

Fig. 3 is a section on the line 3—3 of Figs. 1 and 2.

Fig. 4 is a section similar to Fig. 3, but showing the door in open position.

Fig. 5 is a section on the line 5—5 of Fig. 1, somewhat enlarged.

Fig. 5a is a section on the line 5a—5a of Fig. 1, somewhat enlarged.

Fig. 6 is a section on the line 6—6 of Fig. 3.

Fig. 7 is a fragmentary elevation of parts shown in Figs. 1 and 3, somewhat enlarged.

Fig. 7a is a fragmentary section similar to Fig. 8 (enlarged), parts being omitted.

Fig. 8 is a section on the line 8—8 of Fig. 7.

Fig. 9 is a fragmentary side view, similar to Fig. 5, but showing a modified form of construction in which the operating shaft is operated through a reduction gearing.

Fig. 10 is an elevation of parts shown in Fig. 9.

Fig. 11 is a fragmentary elevation on the line 11—11 of Fig. 3, but showing a modified form of construction.

Fig. 12 is a section on the line 12—12 of Fig. 11.

Fig. 13 is a view substantially similar to Fig. 5, but showing the application of a motor to drive the drum carrying shaft.

Fig. 14 is a view similar to Fig. 3, but showing the drum operating shaft mounted in a different position.

Fig. 15 is a view similar to Fig. 14, but showing the door in open position.

Fig. 16 is a section on the line 16—16 of Fig. 15.

Fig. 17 is a fragmentary view of parts shown in Fig. 14, but showing the application of a motor to drive the drum carrying shaft.

Fig. 18 is a view showing a slight modification in which my invention is adapted to an opening the top of which is relatively close to the ceiling, the door being shown closed.

Fig. 19 is a view similar to Fig. 18, showing the door open.

Fig. 20 is a bottom plan view of parts shown in Fig. 19, partly in section on the line 20—20 thereof.

Fig. 21 is a view similar to Fig. 18, but showing a further modification of the invention, the door being shown in closed position.

Fig. 22 is a view similar to Fig. 21, but showing the door in open position.

Fig. 23 is a bottom plan view of the parts shown in Fig. 22, partly on the line 23—23 thereof.

In the drawings, A indicates a building having a door opening B, formed by side members b and a horizontal wall b' which may constitute an overhead beam or lintel, and a ceiling C. These parts are shown conventionally, since they may be variously constructed, more particularly the ceiling which may consist of depending cross beams and the like.

I indicates a door formed of a plurality of sections hingedly or pivotally connected along their adjoining edges for articulation to permit the door to be guided along guides or tracks 2 having curved portions intermediate their ends, so that one portion of the guides or tracks may be disposed at an angle to another portion thereof. In the illustrated application of the invention the guides have vertical portions 2a disposed parallel to the side members b, portions

2b which curve upwardly and inwardly adjacent the upper portion of the opening B and horizontal portions 2c extending inwardly parallel to the ceiling C. The door 1 comprises a lower end section 3, an upper end section 4 and a plurality of intermediate sections 5, connected in series, preferably by hinges 6 to be later described. The number of intermediate sections 5 will depend upon the length required to close the opening or space B extending from the floor b'' or a sill thereon to the beam b'. The door sections may be constructed in any desired manner, for example, of sheet metal, wood or laminated material, each section preferably having panels, certain or all of which may be formed of glass. The sections extend across the door opening B and have overlapping relation along their opposite side edges with the side members b as shown in Figs. 2 and 6. The articulation of the door sections may be provided for by means of a flexible band or chain, but I prefer to use hinges for this purpose and to utilize the pintles or hinge pins of certain of the hinges in the manner to be later set forth. I provide between the adjoining edges of the door sections a plurality or series of hinges 6, the two outer hinges (designated 6') of each series serving as the supporting means for the elements, namely, rollers 6a, which engage the guides 2 to support the door in closed position with respect to the door opening and to permit sliding movement thereof to and from its open position. The upper marginal edge portion of each section (except the upper end of the upper section 4) is cut away on its outer face from end to end, as shown at 7, and the lower marginal edge portion of each section (except the lower section 3) is similarly cut away on its inner face from end to end, as shown at 8, these cutaways forming complementary abutting edges having overlapping portions arranged to seal the joints between the sections when the door is closed. As will be understood, the hinge pins for the hinges 6, 6', are in line with the joints between the side walls of the cutaways 8 and the upper free ends of the lower sections, respectively.

The guides 2 are disposed in parallel relation to each other in planes beyond the opposite sides b of the door opening B and in spaced relation to the inner faces of the side members b and ceiling C. Each guide 2 may be and preferably is formed from sheet stock and is shaped in cross section as shown (see Fig. 6) for a purpose to be later set forth. The supporting means for each guide may consist of an angle 9 secured to the side member b and extending from the floor b'' to or adjacent the lower end of the curved portion 2b for supporting the guide portion 2a, one or more depending brackets 10 depending from the ceiling C and supporting the horizontal portion 2c, and a bracket 11 suitably secured to the wall A and supporting the curved portion 2b. While each guide may be formed from a single section or length of material, I prefer to make the portions 2a, 2c, in separate sections and to mount between them a casting shaped or fashioned to provide the curved guide portion 2b and the bracket 11. In the forms of construction shown the curved guide portion 2b registers with the adjacent ends of the guide portions 2a and 2c to form a continuous guide. As shown, the ends of the castings 11 are shaped to permit the adjacent ends of the guide portions 2a, 2c, to telescope into such ends to align with the curved portion 2b. This form of construction is advan-

tageous as it eliminates all curving of the guides and permits the guide sections 2a, 2c, to be cut from stock of the exact length required without waste. The castings 11 may also form a support for parts of an operating means 12 (to be later described) and it insures between parts of the operating means 12 and the door guides a fixed relation, which is not affected by relative movement between portions of the building A due to sagging or settling of its foundation.

Each hinge 6 preferably comprises a pair of plates 6b suitably secured to the inner faces of adjoining door sections, the inner end of one plate being rolled into a knuckle 13 and fitting between struck-up end portions 14 on the opposite sides of the inner end of the other plate and a pin extending through the knuckle 13 and openings formed in the end portions 14, the ends of the pin being headed over in a well known manner. Each hinge 6' is preferably of similar construction, except that its hinge pin 15' is (a) provided with a collar 16 engaging the outer end portion 14 to prevent endwise movement inwardly of the hinge pin and (b) its outer end is extended to form a shaft 17 on which loosely floats a roller 6a (already referred to), while running in the adjacent guide 2. Each roller 6a may be of the anti-friction type, preferably comprising an inner element 18 rotatably and slidably engaging the shaft 17, an outer element 18a having rolling engagement with the adjacent guide and interposed balls 19, which roll in the races provided on the opposed walls of the elements 18, 18a, and also lock these elements against endwise movement one relative to the other. Each guide section comprises a base portion 20 secured to the adjacent angle 9 (see Fig. 6) or hanger 10, diverging portions 21 and opposed roller engaging portions 22, and one of the latter portions is provided along its inner edge with an turned wall 23, which co-operates with the adjacent portion 21 to guide the roller 6a along or in line with the track portions 22. By forming the guides as above described, the rollers 6a are prevented from moving laterally relative to the roller engaging or track portions 22 as the door slides from one position to the other; but due to the fact that the rollers rotatably and slidably fit upon the shafts 17, the rollers are free to accommodate themselves to the position of the guides, due to (a) variations in the spacing of the guides, so that great care is not required, in installing the latter, to space them to any great degree of accuracy, (b) bulging of the respective guide sections between their ends and (c) disalignment of the guides due to sagging of the structural members of the structure or relative movement thereof incident to settling of the foundation, while permitting the door to slide in a substantially rectilinear direction. As shown in Fig. 6, the guides are spaced from the side edges of the door sections and the rollers 6a are normally arranged midway of the shaft 17, so that the rollers may slide laterally thereon in either direction. This form of construction also permits the door to float relative to the rollers due to (a) contraction or expansion of parts of the door operating means and (b) warping of the door sections. By providing the guides with the diverging portions 21, 21, ample room is provided for endwise movement of the shafts 17, in the event the rollers 6a, guided by the guides 2, slide inwardly.

The rollers 6a at the lower end of the section 3 are mounted on shafts supported by brackets 24

(see Fig. 7), the latter being secured to plates 24a, which will be later described.

Of the operating means 12, 25 indicates a shaft having journal bearing support at its opposite ends in suitable hangers 26 preferably formed integrally with and extending inwardly from the casings 11 to support the shaft inwardly of the door 1 when closed. One end of the shaft is extended and provided with a driving element, such element in Figs. 1, 2, 3, 4 and 5, comprising a sprocket 27, around which a chain loop 28 travels, the sprocket being fixed to the shaft 25 and the loop depending downwardly, whereby pull on either leg of the loop may be effected to rotate the sprocket and shaft in the desired direction to open or close the door.

Where it is found desirable to operate the shaft 25 through reduction gearing, the shaft is provided with a gear 28' that meshes with a pinion 29, the shaft for the latter being mounted on the adjacent hanger 26 and having the sprocket 27' secured to it. This form of driving means is shown in Figs. 9 and 10.

Also, where it is found desirable to apply power to rotate the shaft 25, I mount a reversible electric motor 29' on one of the hangers and connect to the motor shaft a worm 30, which meshes with a worm gear 31, fixed to the shaft 25, a suitable switch (not shown) being provided to control the supply of current to the motor. This form of construction is shown in Fig. 13.

32, 32, indicate drums fixed to the shaft 25 and arranged near the opposite side edges of the door sections, but preferably inwardly thereof. The drums are preferably formed with spiral grooves to guide cables 33, 33, as they wind on and off the drums. The upper ends of the cables 33 are suitably secured to the inner ends of the drums and extend from the latter to the lower end of the lower door section 3, to which end the cables are secured in the manner to be later set forth. The drums have a diameter proportioned to their length to permit winding of the complete length of the cable thereon when the door slides from its closed position (Figs. 1, 2 and 3) to its full open position (Fig. 4). In this arrangement, the shaft may be mounted approximately in or slightly above the plane of the top b', or adjacent the upper end of the guide section 2a.

Each cable is connected to the lower end of the lower door section 3 by the following instrumentalities: 34 indicates a plate secured to the inner face of the door section adjacent its side edge. The plate 34 is provided with an outwardly extending member 34a having an elongated opening 35 formed in its outer portion. 36 indicates a hollow bolt extending through the opening 35, the head of the bolt being formed with a conical recess communicating with the opening through the bolt. The adjacent cable extends through the bolt and its free end is suitably anchored in the recess in the bolt head. 37 indicates a nut threaded on the bolt 36 and arranged to engage the underside of the member 34a to secure the bolt and cable thereto. By preference the undersides of the member 34a at opposite sides of the opening 35 are convexed to permit the nut 37 to rock without undue friction to accommodate the bolt 36 to the direction of pull on the adjacent cable. By rotating the nut 37, the length of the cable from the adjacent drum to the connecting member 34a may be increased or diminished. By adjusting both nuts 37, the cables may be adjusted to suspend the door in horizontal

position, whereby it may be raised and lowered in a rectilinear direction and parallel to the guides 2. As the cables are disposed on the inner side of the door and connected to the inner face of the door section, they may be readily connected and disconnected as well as adjusted. A suitable nut 37' may be utilized to lock the nut 37 in adjusted position.

38 indicates a counterbalancing means for the door arranged to compensate for the weight thereof when in closed position and to proportionately decrease as the sections successively move from the guide portion 2a to the guide portion 2c; and likewise to proportionately increase in the closing movement of the door as the sections successively move from the guide portion 2c to the guide portion 2a. In the construction herein provided, I use a spring 39 which may be adjusted to provide a predetermined tension depending upon the weight of the door and also adjusted to provide for a predetermined number of turns of the spring end that is fixed to the shaft 25 as the door 1 moves from one position to the other, depending upon the length of travel of the lower door section 3. By reason of such dual adjustment I may use for all installations a spring of sufficient length and size to provide for doors of different weight (maximum weight or less) and doors of different height (maximum height or less) and thus avoid carrying in stock a large assortment of springs. The spring 39 is coiled around the shaft 25 and one end of the spring is anchored to a collar 40 adjustably secured to the shaft 25. The other end portion of the spring is held against turning by a device 41 which carries an arm 42 engaging a cross member 43, the latter being secured to the brackets 11 and serving to brace them. The device 41 comprises a pair of blocks 41a, 41a, engaging opposite sides of the spring 39 and rigidly clamped together and to the spring by a plurality of bolts 44. By adjusting the device 41 longitudinally of the spring 39, the effective length thereof is increased or diminished, so that in the rotation of the shaft 25 with the drums 32 as the door 1 moves from full open position to full closed position, that end of the spring fixed to the shaft may turn therewith and generate tension in the spring proportionate to the increase in weight of the door as its sections progressively move from the guide section 2c to the guide section 2a, to the end that when the door is completely closed sufficient tension will have been imparted to the spring to substantially counterbalance the weight of the door. As the spring tension increases proportionately to the increase in weight of the door in its closing movement, the tension of the spring decreases proportionately in the opening movement of the door as the weight thereof decreases due to its upper sections progressively sliding along the guides to the horizontal position. In this arrangement it will be seen that the spring operates to counterbalance at all times only that portion of the door which is in the guide portion 2a, so that very little manual or motor power is required to slide the door in either direction and due to the proportionate counterbalancing effect of the spring 39, as above described, it will be seen that its tension or pull to counterbalance the door is uniformly applied in all positions of the door and that therefore the required power to slide the door is substantially the same throughout its travel in either direction.

The blocks 41a are formed with radial openings 45 in their outer walls, any one of which may re-

movably receive the arm 42. By rotating the device 41, the spring may be placed under an initial tension.

In the form of construction shown in Figs. 1 to 10, inclusive, the lower ends of the curved guide sections are relatively close to but slightly above the top wall *b'*, so that in the opening movement of the door the upper end section 4 slides from the vertical toward the horizontal immediately as such movement takes place and effects a correspondingly decrease in the weight of the door. Where the arrangement and construction of the building A is such that the guide sections 2a extend vertically, to a point above the top *b'* so that the entire door slides vertically before its upper section traverses the curved portions 2b, I provide drums of special construction to compensate for this preliminary vertical travel so that the counterbalancing effect or tension of the spring 39 on the door will be uniform throughout such travel as well as the remaining travel of the door sections to the full open position. Referring to Figs. 11 and 12 I show a drum 32' for one of the cables, a similar drum (not shown) being provided at the other end of the shaft 25 for the other cable. The drum 32' is tapered, as shown at 32a, from its inner end to its body portion 32b, this tapered portion being so proportioned as to its length and inclination or angularity with respect to its body portion that the cable winds thereon during the preliminary vertical travel of the door and then winds on the body portion 32b during its remaining travel to the full open position. By reason of the tapered portions 32a, it will be seen that while in or during the preliminary upward travel of the door the spring tension is being reduced, the counterbalancing effect upon the door or upward pull on the cables 33 will remain uniform. In the vertical travel of the door in its closing movement the same uniform tension effect will result due to the unwinding of the cables from the tapered portions 32a.

In Figs. 14, 15 and 16 I show a slightly different form of construction wherein the supporting brackets, indicated at 26' are arranged at or adjacent the upper end of the curved guide section 2b, being formed integrally with the castings 11' and connected by a cross piece 43'. As shown, these brackets support the shaft 25 so that the drums 32 are arranged relatively close to the ceiling. This form of construction is advantageous where the space above the top *b'* of the door opening is restricted.

Fig. 17 shows a form of construction in which a reversible electric motor 45 is used to drive the shaft 25. In this arrangement, the motor 45 is mounted on a base 47 which is suitably secured to the adjacent bracket 26', and the motor shaft is connected to a shaft 48, also mounted on the base 47 and carrying a worm 49, which meshes with a worm gear 50 suitably fixed to the shaft 25.

Where the top *b'* of the door opening B is relatively close to the ceiling C, as shown in Figs. 18, 19, 21 and 22, it will be noted that the curved guide section 2b merges into the vertical guide section 2a at a point below the top *b'* and as a result the upper portion of the upper door section would not be guided into closing relation with the top *b'* as it is in Figs. 1, 2, 3, 4 and 5, in the closing movement of the door. To provide for the movement of the upper end of the door section 4 into closing position, I provide auxiliary supporting means therefor so constructed and mounted and connected to such door section end

that the latter is moved into closed position when the door slides downwardly to the limit of its movement (see Figs. 18 and 21) and is moved in the opposite direction and supported in the plane of the remaining door sections when the door slides to its open position. The auxiliary supporting means comprise a pair of carriers 51, each pivoted at their inner ends to the upper end of the section 4, by a hinge 51a, preferably similar to the hinges 6 already described. Each carrier comprises a plate 52 disposed at the inner side of and parallel to the adjacent guide and slidably mounted on the latter, by a pair of rollers 53, one arranged adjacent the outer end of the plate 52 and the other roller arranged intermediate the ends of the plate, both rollers being mounted on shafts 54 carried by fixed supports 55. In this arrangement of the rollers 53, the inner ends 52a of the plates 52 project inwardly beyond the inner roller, so that as the rollers 53 traverse the curved guide section 2b, the ends 52a, which, being hingedly connected to the upper end of the door section 4, will carry the latter in a path beyond the curved guides 2b and into the position shown in Fig. 18, thereby positioning the door section 4 in the plane of the remaining door sections and against the wall A above the top *b'*.

Where it is found that in the open position the weight of the lower door section 3 is not sufficient to permit ready movement of the door to or towards its closed position, I may provide a pair of supplemental cables 56 (see Figs. 21, 22 and 23) between the drums and the upper end portion of the door or the outer ends of the carriers, as shown, these cables being adapted to wind on and off the drums 32. In this arrangement, the carriers are made somewhat longer so that the outer ends of the carriers will be rearward of the cable drums when the door is closed, and the rollers therefor spaced a greater distance and the extended supporting end 52a proportioned so as to guide the upper end of the door section into closing position—see Fig. 21. Accordingly, when the shaft 25 is rotated, the cables 56 will wind on the drums (as the cables 33 unwind therefrom) and exert a pull on the door to slide it along the guides. I interpose in each cable 56 a spring 57 to compensate for the non-uniform movement of the supporting rollers in traversing the curved guide sections 2b.

58 indicates means for yieldingly stopping the door at its upper limit of movement. Such means may be applied to the forms of construction shown in Figs. 1 to 17, inclusive, although I have only shown it applied to the forms shown in Figs. 18 to 23, inclusive. The form of means shown comprises devices which guide the cables to and from the drums and is so arranged that it causes the spring tension to be exerted in a direction which relieves pull on the door section 3. Each device 58 consists of a plate having a groove through which the adjacent cable extends and an outwardly extending guide portion 58a the device being arranged near the upper portion of the section 3 so that when the latter reaches the position shown in Figs. 19, 20, 22 and 23, the spring tension is relieved and whatever tension is exerted such tension is exerted at an angle to the door, the effect of which is to yieldingly stop the doors. Should the doors be thrust upwardly with sufficient force to move the devices beyond the shaft 25, the tension of the counterbalancing spring will yieldingly arrest the door, as well as serve to return them to its normal open position.

To prevent breakage I may also provide positive stops 59 at the outer end of each guide portion 2c, these stops comprising pins which secure such section to the adjacent hanger.

To those skilled in the art to which my invention relates many changes in construction and widely differing embodiments and applications of my invention will suggest themselves without departing from the spirit and scope of the invention. My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides and between and inwardly of said portions thereof, drums on said shaft disposed inwardly of the side edges of said door sections, flexible members extending from said drums and connected to the inner face of one of the door sections, and means for rotating said shaft.

2. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides and between and inwardly of said portions thereof, drums on said shaft disposed inwardly of the side edges of said door sections, flexible members extending from said drums and connected to the inner face of the lower door section adjacent its lower edge, and means for rotating said shaft.

3. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to said vertical portions, a door comprising connected sections articulatable to traverse said guides, devices carried by said door sections and engaging said guides to slidably support said sections thereon, a shaft supported adjacent the top of the door opening between said guide portions, a drum secured to said shaft, a flexible member arranged to wind on and off said drum and connected to the lower portion of the lower door section, a flexible member arranged to wind on and off said drum and operatively connected to the outer portion of the upper door section, and means for operating said shaft.

4. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to said vertical portions, a door comprising connected sections articulatable to traverse said guides, devices carried by said door sections and engaging said guides to slidably support said sections thereon, a shaft supported adjacent the top of the door opening between said guide portions, a drum secured to said shaft, a flexible member arranged to wind on and off said drum and connected to the lower portion of the lower door section, a flexible member arranged to wind on and off said drum and operatively connected to the outer portion of

the upper door section, and means for operating said shaft, the connection between the last mentioned flexible member and the upper door section including an expansion spring.

5. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides and inwardly of and between said portions thereof, a drum on said shaft, a flexible member extending from said drum and connected to the lower door section, a spring coiled around said shaft and fixed thereto at one end, and a relatively fixed connection for the opposite end of the spring, said connection being adjustable longitudinally of the spring.

6. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides, a drum on said shaft, a flexible member extending from said drum and connected to the lower door section, a spring coiled around said shaft and connected thereto at one end, and a relatively fixed connection for the opposite end of said spring, the effective length of said spring being variable.

7. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides, a drum on said shaft, a flexible member extending from said drum and connected to the lower door section, a spring coiled around said shaft and connected thereto at one end, and a relatively fixed connection for the opposite end of said spring, the effective length of said spring being variable, and one of said connections being adjustable to affect the tension of said spring.

8. In a door construction, the combination of a pair of spaced guides comprising vertical portions related to a door opening and portions disposed at an angle to the vertical portions, a door comprising connected sections articulatable to traverse said guides, rollers carried by the door sections and engaging said guides, an elevated shaft disposed between the ends of said guides, drums on said shaft disposed inwardly of the side edges of said door sections, flexible members extending from said drums and connected at their outer ends to the lowermost door section and guide devices on one of the door sections in spaced relation to the connection of said members to the lowermost door section and engaging said members at points intermediate their ends and arranged when the door is raised to dispose adjacent portions of the members leading from said drums at angles to the adjacent door section, whereby upward pull on the door through said members is relieved.

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