Oct. 13, 1931. W. H. KENDALL 1,827,433

SLIDING DOOR

Filed Sept. 5, 1929 4 Sheets-Sheet 1

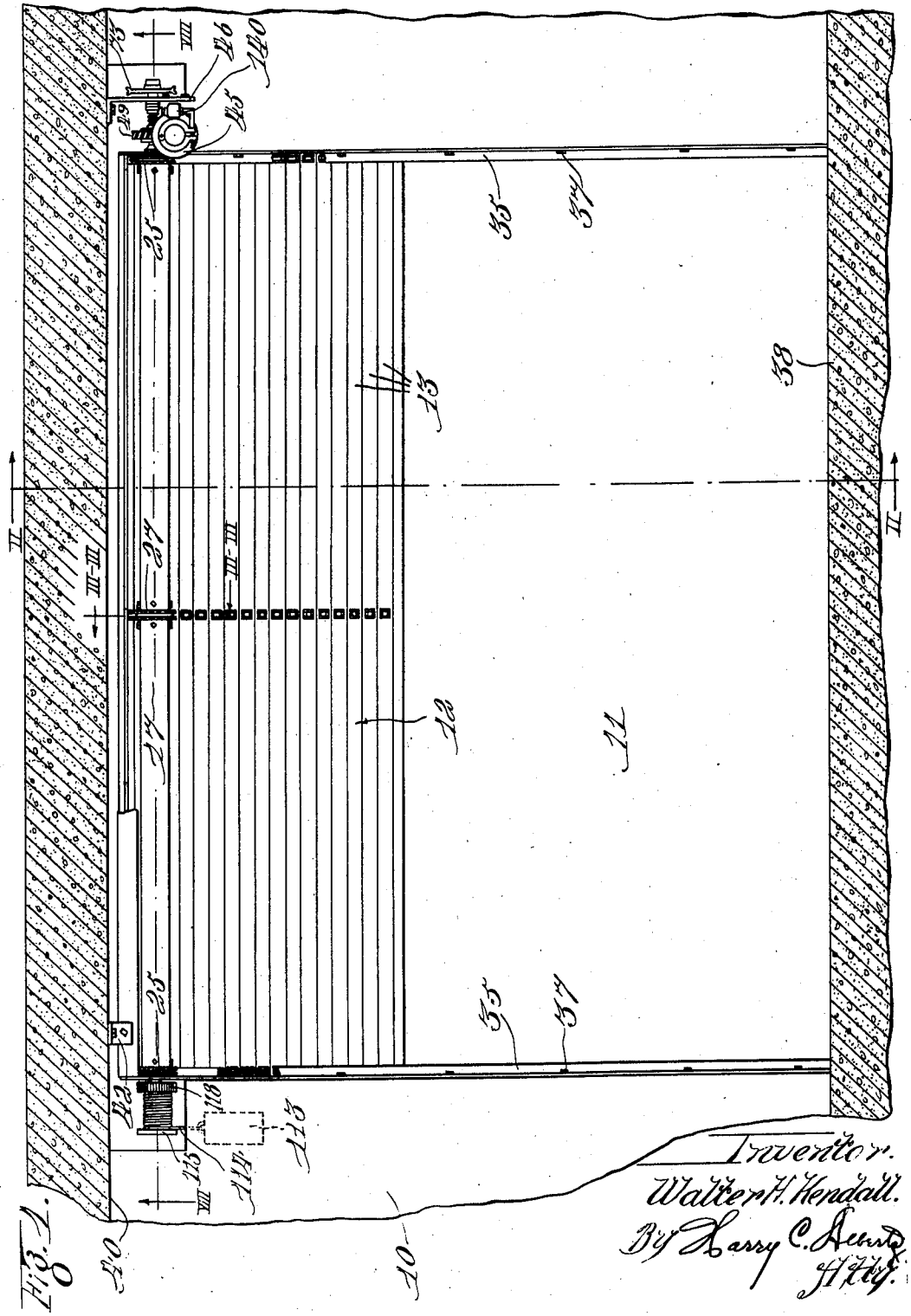


Fig. 1.

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SLIDING DOOR

Filed Sept. 5, 1929 4 Sheets-Sheet 2

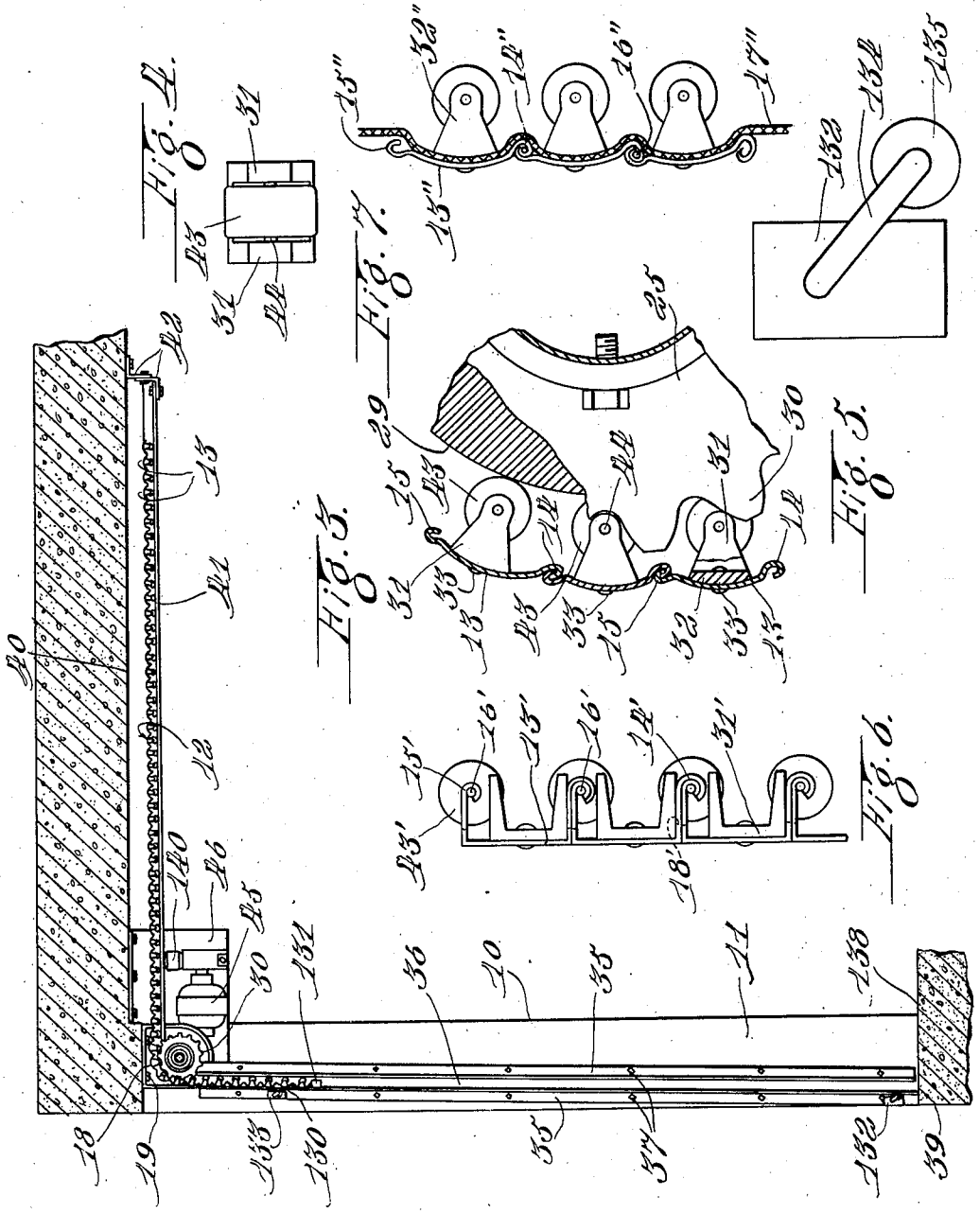


Fig. 2.

Fig. 4.

Fig. 7.

Fig. 5.

Fig. 3.

Fig. 6.

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SLIDING DOOR

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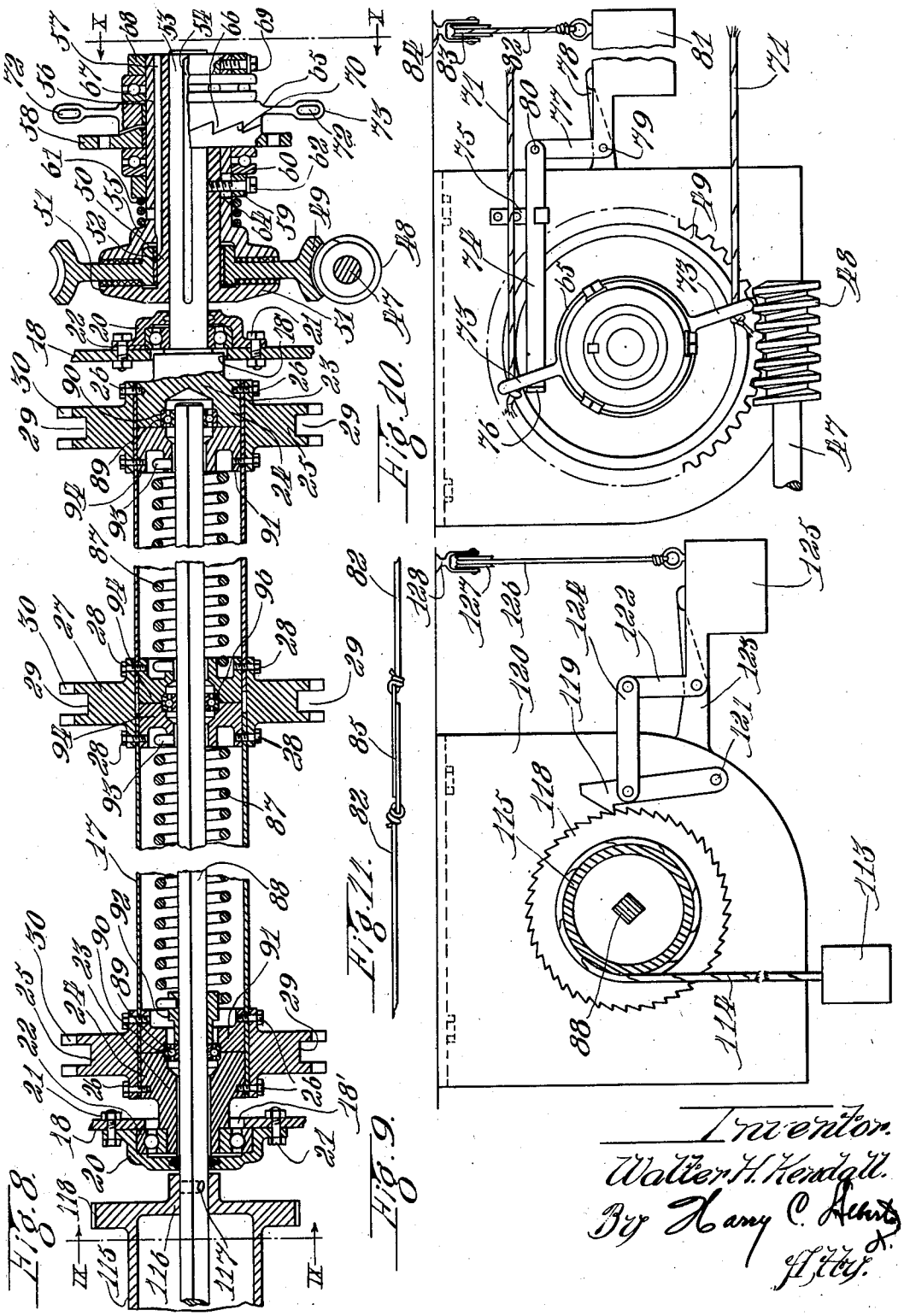


Fig. 8.

Fig. 10.

Fig. 11.

Fig. 9.

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SLIDING DOOR

Filed Sept. 5, 1929 4 Sheets-Sheet 4

Fig. 12.

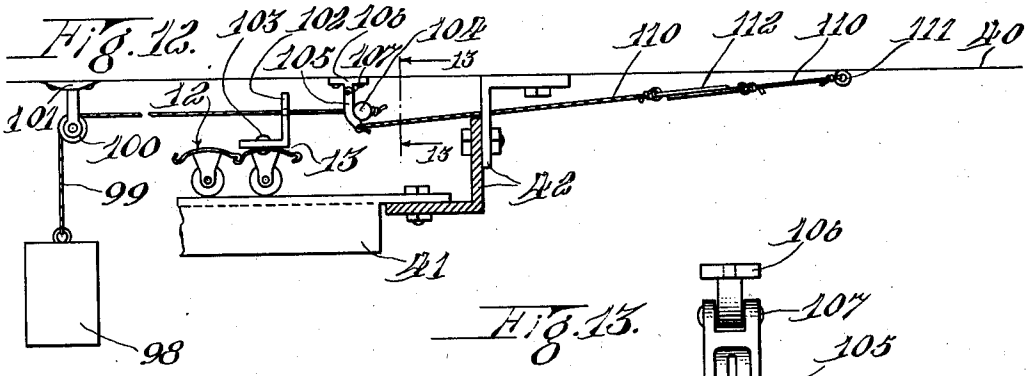
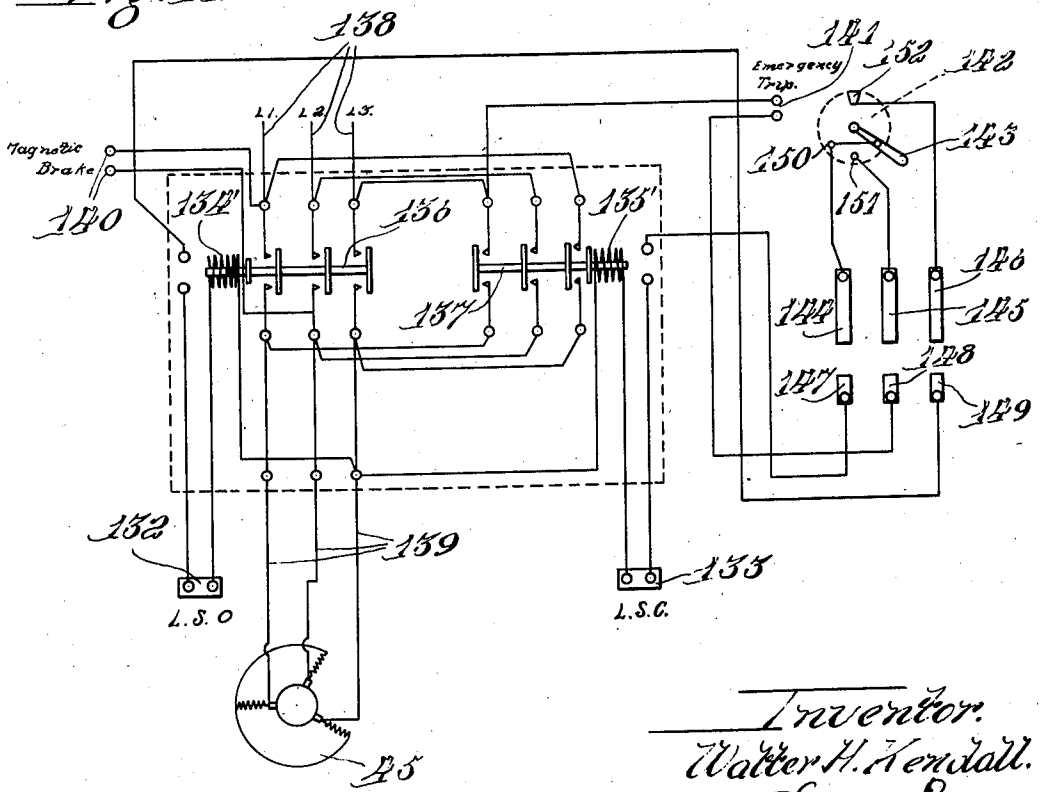


Fig. 13.

Fig. 14.



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UNITED STATES PATENT OFFICE

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SLIDING DOOR

Application filed September 5, 1929. Serial No. 387,141.

This invention relates to sliding doors and more particularly to doors for industrial purposes, although certain features thereof may be employed with equal advantage for other purposes.

It contemplates more especially the provision of a power driven door for warehouses, elevator shafts and similar situations where speed and perfection in operation are necessary in order to meet the requirements of commercial practice.

Numerous types of doors have heretofore been proposed for industrial purposes; however these have not proven entirely satisfactory owing to their sluggish and slow speed operation as well as their lack of dependability from the standpoint of maintenance, operation and replacements incidental to the use thereof. Moreover, known devices are not adaptable to every situation and require special design to meet even more or less standard conditions in order that they may be effective for their intended operation. Furthermore, doors of known construction soon become inoperative or at least defective in so far as enabling their movement responsive to the normal application of power contrivances or manual effort originally sufficient in magnitude for the operation thereof. This is especially true of flexible doors of the roll type, and in consequence thereof such have not been popularized in spite of certain advantages inherent in flexible constructions.

One object of the present invention is to simplify the construction and improve the operation of devices of the character mentioned.

Another object is the provision of a flexible door of novel construction which is capable of being elevated or lowered at high speed.

Still another object is to provide a flexible door which is capable of slidable movement to its open and closed positions without requiring any appreciable space or specially designed building structures therefor.

A further object is the provision of a flexible door capable of movement along a predetermined curved path at high speed and with minimum friction responsive to the traverse thereof.

A still further object is to provide a flexible door which is capable of traverse past a shaft without any appreciable deformation therein.

Still a further object is the provision of improved means for operating a door of the character mentioned with speed and minimum wear over extended periods.

Other objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the drawings:—

Figure 1 is a front view in elevation of a device embodying features of the present invention.

Figure 2 is a sectional view in elevation taken substantially along line II—II of Figure 1.

Figure 3 is a fragmentary sectional view taken substantially along line III—III of Figure 1.

Figure 4 is a front view of a roller of anti-friction device disclosed in Figure 3.

Figure 5 is a side view in elevation of a limit switch shown in Figure 2.

Figure 6 is a sectional view of a modified flexible door construction capable of employment in a manner which will appear more fully hereinafter.

Figure 7 is a still further modified door construction possessing features of the present invention.

Figure 8 is a sectional view taken substantially along line VIII—VIII of Figure 1.

Figure 9 is a sectional view taken substantially along line IX—IX of Figure 8.

Figure 10 is an end view taken substantially along line X—X of Figure 8.

Figure 11 is a view of a fuse element employed in connection with a door to automatically permit the descent thereof in the event of fire.

Figure 12 is a side sectional view of fuse controlled door lowering instrumentalities.

Figure 13 is a detail of a lever viewed substantially from line XIII—XIII of Figure 12.

Figure 14 is a conventional diagram of an electrical circuit for operating a door of the character mentioned.

The structure selected for illustration is shown in association with a building wall 10 having a substantially rectangular opening 11 provided therein to define a door-way to an elevator shaft, warehouse or other structure where passage is necessary for industrial or other purposes. In order to effect the closure of the opening 11 to preclude any passage therethrough as well as decrease the fire hazards to a minimum, a flexible door 12 is arranged for selective association with the opening 11 so as to serve as a partial or complete closure therefor. In the present embodiment, the door 12 consists of a transverse series of adjacently disposed elongated elements or slats 13 which extend for substantially the entire breadth of the opening 11. In order to render the closure 12 flexible as well as contiguous for the entire depth of the opening 11, the door slats 13 are bent or articulated along the parallel edges thereof to present flanges 14 and 15 curved in opposite directions so as to be complemental with the flanges 15 and 14 of the succeeding or adjacent slats 13 which are thus interlocked to impart the desired flexibility thereto. The width of the slats 13 and the number thereof so interlocked or combined may be varied within a wide range depending upon extent of the opening 11 and other requirements of each particular installation.

In order to sustain the door 12 as well as regulate the elevation or descent thereof, a shaft 17 is transversely disposed within the opening 11 proximate to the top thereof for rotary movement in aligned bearings sustained by spaced plates 18, in this instance two, fastened or otherwise anchored to the top wall of the opening 11 by means of fasteners 19, the plates 18 being suitably bored as at 18′ to receive bearing caps 20 provided with bolts 21 around the peripheral flange thereof to enable their attachment over and in confronting relation with the bore 18′. As shown, the bearing caps 20 are secured to the plates 18 on the exterior sides thereof in confronting relation to receive ball bearing raceways 22 therein. Axially bored hubs 23 are journaled in the raceways 22, these being provided with a peripheral shoulder 24 which extends within the tubular shaft 17 to effect the support thereof for rotary movement therebetween. Sprocket wheels 25 are secured to the ends of the shaft 17 by means of studs 26 which extend entirely therethrough to engage the hubs 23, thereby effecting a rigid connection therebetween. A similar sprocket 27 or any number thereof depending upon the width of the door 12, is disposed between the end sprockets 25 for attachment to the shaft 17 by means of suitable studs 28 which extend through the hubs therein as will be more specifically described hereinafter.

It is to be noted that the sprocket wheels 25 and 27 are provided with peripheral channels 29 intermediate teeth 30 which extend therefrom on both sides thereof for meshing engagement with similarly shaped lugs or furcations 31 constituting, in this instance, a portion of brackets 32 secured to each of the elements 13 by suitable rivets or other fasteners 33, these being spaced in confronting relation with the teeth 30 of each of the sprocket wheels 25 and 27. In view thereof, the sprocket wheels 25 and 27 with the teeth 30 in alignment therewith, constitute interengaging means for elevation or lowering the door 12 responsive to the rotation of the tubular shaft 17 in either direction. In order to guide the door 12 along any predetermined path, angle-irons 35 are secured to the side surfaces of the openings 11 in paired spaced relation to define confronting guide grooves or tracks 36 therebetween to enable the passage of the door therealong. To this end, the angle-irons 35 defining the channelled tracks 36, are secured to the side walls of the opening 11 in confronting alignment so that the edges of the door 12 will be slidable therein to guide the movement thereof. It is to be noted that the angle-irons 35 are bolted or otherwise secured to the walls of the opening 11 by means of fasteners 37, the angle-irons 35 being inclined so that the lower edge of the door 12 will rest in its lowermost or closed position on the floor 38 within four inches or other distance of the edge 39 of the elevator shaft to meet the requirements of the building code depending upon the geographic location of the particular installation.

It is to be noted the tracks 36 extend in the path of the sprocket teeth 30 to slidably guide the door 12 thereover and, in this instance, along the ceiling 40 of the building structure. To this end, tracks 41 composed of similar angle-irons are supported by suitable brackets 42 for horizontal extension in the path of the sprocket teeth 30. In consequence thereof the tracks 41 are disposed in a direction substantially normal to the tracks 35, thereby permitting the door 12 to be elevated or lowered with corresponding movement along the ceiling 40 for support in the tracks 41. In order to reduce the friction to a minimum between the door 12 and the tracks which guide the traverse

thereof, rollers 43 are journaled between the furcations 31 of the brackets 32 by means of pins 44. Rolling contact between the door 12 and the channels 29 of the sprocket wheels 25 and 27 as well as with the tracks 36 and 41 is thus established and maintained throughout the path of its movement, thereby enabling the traverse of the door 12 therealong with speed and minimum wear on the coacting surfaces. The brackets 32 are attached at spaced intervals along the door slats 13 in confronting relation with the tracks 35 and sprocket channels 29, the brackets 32 being riveted to each slat 13 or any number thereof as commercial practice may dictate.

Rotation is imparted to the driving shaft 17 by means of an electrical motor 45 which is mounted, in this instance, upon a ceiling bracket plate 46 proximate to one end of the shaft 17, thereby providing a short driving connection therewith. The armature shaft 47 of the motor 45 carries a worm 48 fitted to the extremity thereof (Figure 10) to mesh with a worm wheel 49 journalled on a sleeve 50 for connection thereto by a clutch mechanism. The clutch mechanism comprises a disc 51 formed integrally with the sleeve 50, there being a ring bushing 52 interposed between the worm wheel 49 and sleeve 50 to minimize the friction and consequent wear thereon. As shown, the sleeve 50 is in turn journalled on a stub shaft 53 integrally or otherwise associated with one of the end hubs 23 of the shaft 17. It is to be noted that the sleeve 50 which carries a clutch disc 51 in frictional contact with the worm wheel 49, is splined to the shaft 53 in the usual manner by a key 54, thereby turning the disc 51 in unison with the shaft 53. Another clutch element, in this instance a disc 55 having an elongated sleeve 56 formed thereon, is splined to the sleeve 50 by means of a key 57 to enable the axial movement thereof relative to the confronting disc 51 with the worm wheel 49 disposed therebetween. The disc 55 with its sleeve 56 in concentric association with the sleeve 50 of the disc 51, is supported by a bracket plate 58 fixed relative to the hanger plate 18 in any suitable manner as commercial practice may dictate. A ring 59 envelops the sleeve 57 in spaced relation with the plate 58 to receive a thrust bearing 60 therebetween. A spiral spring 61 encircles the sleeve 57 between the disc 55 and the ring 59 so as to normally effect the approach of the discs 51 and 55 with such tension as to establish a frictional driving connection between the worm wheel 49 and shaft 53 to drive the shaft 17 in either direction responsive to the rotation of the motor 45. A stud 62 extends through the ring 59 to secure it with respect to the shaft 53, it projecting through a slot 64 in the sleeve 57 of the disc 55 for threaded engagement with the sleeve 50 to enable relative axial movement therebetween.

A manual clutch control 65 comprising a peripheral member with laterally projecting teeth 66 formed thereon, is journalled on the sleeve between the bracket plate 58 and a ball bearing raceway 67 maintained thereon by a sleeve 68 held in position by means of a threaded stud 69. The teeth 66 on the peripheral member 65 are complemental to similarly shaped teeth 70 formed on the plate 58 in confronting relation therewith to enable the clutch element 55 to be moved out of frictional engagement with the worm wheel 49 by imparting slight rotary movement thereto to cause the teeth 66 and 70 to slide past each other. This is effected, in this instance, by ropes 71 which are tied or otherwise secured to the lower extremities 72 of radially extending arms 73 formed on the control sleeve 65, thereby affording manual disengagement of the clutch elements 51 and 55 from the worm wheel 49 to lower or elevate the door by hand should there be a failure of the motor 45 or other instrumentalities in operative connection therewith. Should a fire occur the worm wheel 49 is automatically disengaged by a bar 74 which slides in bracket 75 so that the flanged edge 76 thereof will engage the arm 73 responsive to a bell crank lever 77. The lever 77 is pivoted to a bracket 78 as at 79, with the extremity thereof pivoted to the bar 74 as at 80. A weight 81 constituting a part of the lever 77, will ordinarily effect the gravitation thereof in a clockwise direction to impart slidable movement to the bar 74 (towards the right Figure 10) thereby disengaging the worm wheel 49 responsive to clockwise movement of the bell crank lever 77 occasioned by the release of the weight 81. The weight 81 is normally held against movement by means of a wire 82 secured thereto for extension over a pulley 83 journaled in a furcated ceiling bracket 84. The wire 82 has a thermal fuse link 85 (Figure 11) interposed therein so that the free extremity of the wire 82 may be secured to the ceiling of the structure. In consequence thereof, the automatic clutch release bar 74 is held inactive until such a time as the thermal fuse 85 is melted by the existence of a fire or a dangerous elevated temperature.

To reduce the required power of the motor 45 in effecting the elevation of the door 12, one or more spiral springs 87 is confined within the tubular shaft 17 to furnish a turning effort in harmony with the motor 45. To this end, a polygonal rod 88 extends through the end hubs 23 of the shaft 17, there being ball bearings 89 for movement in raceways 90 provided in the hubs 23. Annular rings 91, complemental to the hubs 23 are held in position adjacent thereto within the shaft 17 by the sprocket studs 26 to hold the ball bearings in position. As shown, one extremity of the spring 87 is secured to a member

92 which in turn is secured to and held against movement by the rod 88 while the other spring extremity 93 is secured to an annular member 94 fixed interiorly of the shaft 17 immediately below the intermediate sprockets 27 for attachment thereto by its studs 28. In the present embodiment, the members 94 are provided in pairs to receive a ball bearing raceway 96 therein so as to enable the rod 88 to serve as an intermediate support below the sprockets 27. It is to be noted that the shaft 17 may be of sectional construction for joinder by the intermediate sprockets 27 which confront the interior annular members 94 in engagement therewith by their studs 28. Any number of spring elements 87 may be provided within the shaft 17 intermediate the end sprockets 25 and intermediate sprockets 27 so as to wind the springs 87 incident to the descent of the door 12. With the ascent thereof, the springs 87 unwind to the extent of assisting the motor in effecting the elevated movement thereof while the weight of the door 12 in conjunction with the motor 45 causes its descent, thereby affording a balanced construction which is conducive to economical and efficient operation.

In the event of fire causing disengagement of the gear 49 from its driving connection with the stud shaft 53, the door 12 is assisted in its descent by a weight 98 which is suspended by a wire 99 passing over a pulley 100 journaled in a ceiling bracket 101. The wire 99 passes through a bracekt 102 fixed to the stop element 13 of the door 12 by means of fasteners 103 (Figure 12). A stop, in this instance, a spherical member 104 is fixed to the end of the wire 99 to normally engage a lever 105 pivoted to a ceiling bracket 106 as at 107. The lever 105 is provided with a slot 108 along a vertical median line thereof to receive a wire 99 pass therethrough. The wire 99 terminates in an attached spherical member 104 for rest in the arcuate portion of the lever 105 against normal removal therefrom in its extreme counter-clockwise position (viewed from Figure 12). The lever 105 is so held by the wire 110 having one end thereof secured thereto with the other end anchored to a hook 111 in the ceiling 40 of the building structure. A fuse 112 is interposed between the extremities of the wire 110 to release the lever 105 in the event of a fire, thereby permitting the spherical member 104 to drop therefrom to engage the bracket 102 in initiating and effecting the descent of the door 12 through the influence of the weight 98.

Another expedient of effecting the descent of the door 12 in the event of a fire, may comprise a weight 113 which is suspended by a cord 114 wound around the drum 115. The drum 115 has a reduced hub 116 formed thereon to enable its attachment to the rod 88 by means of a pin 117 fixed thereto beyond the bearing cap to cooperate with a pawl 119 pivoted to a supporting plate 120 as at 121. A bell crank lever 122 is pivoted to a bracket 123 carried by the plate 120, it being pivotally connected to a pawl 119 through a link 124. A weight 125 is integrally or otherwise associated with the bell crank lever 122 to normally urge the pawl 119 in a clockwise direction (viewed from Figure 9) out of the path of the ratchet teeth 118 so as to release the weight 118, thereby causing the descent of the door 12 through the medium of the springs 87 establishing a connection with the shaft 17. The cord 126 is secured to the weight 125 for passage over a pulley 127 journaled in a ceiling bracket 128. The cord 126 may be provided with a fuse therein intermediate the extremities thereof prior to its attachment to the ceiling 40 of the building structure in a manner more specifically described in connection with the fuse link 85 which controls the clutch member 55. It is altogether possible to secure the cord 126 to the fuse link 85 so that the clutch 55 and pawl 119 will be released simultaneously.

While one form of door construction has been described in connection with the preferred embodiment of the invention, other forms may be employed. In Figure 6, the door comprises plate 13′ having complemental interengaging flanges 14′ and 15′ along the edges thereof to receive rods 16′ therethrough to effect a connection therebetween. With this construction, rollers 43′ may be journaled on the rods 16′ to fit in correspondingly shaped cutout portions 18′ provided in the flanges of the slats 13′. Lugs 31′ fit into the interior of the slats 13′ in the path of the sprockets 25 and 27 on the driving shaft 17 to mesh therewith in a manner described in connection with the previous embodiment. Another form of door construction is disclosed in Figure 7 wherein the door elements 13″ are provide with flanges 14″ and 15″ in much the same manner as described in connection with the structure disclosed in Figure 3; however rods 16″ are disposed through the complemental flanges thereof to effect a more substantial connection therebetwen. Brackets 32″ are fitted to the door slats 13″ in the usual manner with a continuous strip of composite material 17″ such as raybestos therebetween to lessen the vibration and dampen the noise as well as creating a more uniform flexing between the door elements or slats 13″, this being capable of variation as commercial practice may dictate.

In order to limit the movement of the door 12 to its maximum open and closed positions, a lug or trip 130 is secured thereto near the bottom 131 thereof for movement therewith in the path of limit switches 132 and 133. The limit switches 132 and 133 are fixed, in this instance, to one of the angle-irons 35 proximate to its lower and upper

ends, respectively, to cooperate with the trip 130 in its lowermost and extreme elevated positions corresponding to complete closure and removal of the door 12 with respect to the opening 11. The limit switches 132 and 133 are provided with levers 134 pivoted thereto for removing and effecting contact between the terminals depending upon the rotative position thereof. The levers 134 carry rollers 135 which normally are disposed in the path of the trip 130 to control the opening and closing of the circuits leading to the motor 45. These limit switches operate in the customary manner so that a further and more detailed description thereof is thought to be unnecessary.

As shown, the limit switches 132 and 133 are in series with coils 134′ and 135′ which constitute the operating elements of electromagnetic switches 136 and 137, respectively. The switches 136 and 137 automatically connect and disconnect the three phase line 138 which is in circuit with the electrical source to energize or de-energize the three phase motor 45 connected thereto by means of wires 139. In consequence thereof, contact between the trip 130 and either of the limit switches 132 and 133 will open the circuit to automatically de-energize the motor 45 to bring the door 12 to a dead stop, there being a magnetic brake 140 connected to the line for automatic operation responsive to the de-energization of the motor 45 to bring the door 12 to a dead stop. An emergency hand trip 141 (Figure 14) which is normally closed may be and preferably is supported in the circuit so as to arrest the movement of the door 12 in any other position responsive to opening the switch 141, thereby de-energizing the motor 45. It will be noted that in elevator installations, the manual car control 142 of standard construction is provided within convenient range of the attendant. This may be connected to the door electrical circuit just described to enable the operation of the doors 12 leading to the elevator shaft either from an independent control or automatically responsive to the starting and stopping of the elevator car at any landing.

In this connection, the circuit thus far described may be hooked up and employed in conjunction with an elevator motor circuit in a manner so that the control lever 143 constitutes a part of any elevator control mechanism with its usual function for elevator operation. To this end three wall electrical sliding contacts 144, 145 and 146 are fixed to the elevator car in confronting relation to similarly mounted contacts 147, 148 and 149, respectively, fixed in the elevator shaft at each landing where doors 12 are provided. The sliding terminal contacts 144, 145 and 146 are connected to contacts 150, 151 and 152 confined within the control casing 142 so that the pivoted lever 143 thereof may be rotated to make contact therewith incidental to the actuation thereof for operating the elevator car in either direction or bringing it to a stop corresponding with its alignment with the terminal 152. In consequence thereof, the elevator will be brought to a stop, and should this occur at a landing where doors are positioned to enable ingress and egress between the floor and the elevator, contact will be established between terminals 144, 145, and 146 and terminals 147, 148, 149, respectively. Coincident therewith, the motor 45 will be energized to elevate the door, while the movement of the control lever 143 to any other position in either direction will initiate the movement of the elevator and immediately prior thereto close the doors 12, thereby rendering the doors 12 responsive to the operation of the elevator car.

Where door installations are made in warehouses and other industrial buildings, the doors 12 may be operated responsive to a button switch of standard construction simulating in all respects the controls for automatic elevators. These may be connected to the circuit in direct contact with or in substitution of the terminals 147, 148 and 149, thereby controlling the position of the doors 12, although the movement thereof is arrested automatically by the limit switches 132 and 133 in identically the same manner as described supra.

Various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any advantages thereof as defined in the appended claims.

I claim:—

1. In a high speed closure, the combination with a rotatable shaft, of spaced vertical tracks leading to said shaft, spaced horizontal tracks extending from said shaft, a flexible door mounted for movement in said tracks past said shaft, interengaging means on said shaft and door, means for driving said shaft in either direction to slide said door in said tracks, and rollers carried by said interengaging means to establish a rolling contact between said door, tracks and shaft.

2. In a high speed closure, the combination with a door opening, of aligned tracks fixed to the sides of said opening, a shaft journalled transversely in said door opening, proximate to the top thereof, horizontal confronting tracks extending from said shaft, a flexible door mounted for slidable movement in said tracks past said shaft, sprockets on said shaft, and independently mounted lugs carried by said door in alignment with said sprockets to mesh therewith.

3. In a high speed closure, the combination with a door opening, of aligned tracks fixed to the sides of said opening, a shaft journalled transversely in said door opening proximate to the top thereof, horizontal con-

fronting tracks extending from said shaft, a plurality of pivotally connected slats comprising a flexible door mounted for slidable movement in said tracks past said shaft, sprockets on said shaft, lugs independently carried by said slats in alignment with said sprockets to mesh therewith, rollers carried by said lugs to sustain said door in said tracks and over said shaft, and power means operatively connected to said shaft to slide said door along said tracks.

4. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a substantially rectilinear path, a rotatable transverse shaft disposed in parallel spaced relation with said shaft, interengaging means on said shaft and each of said slats, and power means for driving said shaft to elevate or lower said closure.

5. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a rectilinear path, a rotatable shaft, lugs mounted independently in alignment on each of said slats, sprockets on said shaft for meshing engagement of said lugs, and power means for rotating said shaft for elevating or lowering said closure.

6. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a rectilinear path, a rotatable shaft, lugs mounted independently in alignment on each of said slats, sprockets on said shaft for meshing engagement of said lugs, anti-friction means mounted on a lateral surface of said slats for contact with said guiding means and shaft, and power means for rotating said shaft for elevating or lowering said closure.

7. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a rectilinear path, a rotatable shaft, furcated lugs mounted independently in alignment on each of said slats, sprockets on said shaft for meshing engagement of said lugs, anti-friction means carried by said furcated lugs for contact with said guiding means and shaft, and power means for rotating said shaft for elevating or lowering said closure.

8. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a rectilinear path, a rotatable shaft, furcated lugs mounted independently in alignment on each of said slats, sprockets on said shaft for meshing engagement of said lugs, anti-friction means carried by said furcated lugs, there being annular peripheral grooves in said sprockets to receive said anti-friction means contacting therewith and said guide means, and power means for rotating said shaft to elevate or lower said closure.

9. In a high speed closure, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection along the entire length thereof to comprise a continuous flexible closure, means for guiding the traverse of said closure along a rectilinear path, a rotatable shaft, furcated lugs mounted independently in alignment on each of said slats, sprockets on said shaft for meshing engagement of said lugs, anti-friction means carried by said furcated lugs, there being annular peripheral grooves in said sprockets to receive said anti-friction means contacting therewith and said guide means, power means for rotating said shaft to elevate or lower said closure, limit switches associated with said guiding means, and stops on said closure for operating said limit switches to control the movement of said closure in its extreme open and closed positions.

10. The combination with a rotatable shaft, of a flexible door mounted for sliding movement relative to said shaft, cooperating means on said door and shaft to establish a driving connection therebetween, motor power means for rotating said shaft to elevate or lower said door, and transversely spaced longitudinal series of anti-friction means disposed between and along said door and shaft to effect the support of said door intermediate the edges thereof.

11. In a device of the character described, the combination with a transverse series of adjacently disposed metallic slats, of complemental flanges formed on the adjacent edges of said slats for pivotal connection to comprise a flexible closure, means for guiding the traverse of said closure along a substantially rectilinear path, a shaft mounted transversely in parallel spaced relation with said closure for substantially the entire

length thereof, interengaging means on said shaft and closure for establishing an operative driving connection therebetween substantially along and intermediate the extreme vertical edges of said closure for substantially the entire length thereof, and motor power means for rotating said shaft for elevating or lowering said closure.

In witness whereof, I subscribe my name.

WALTER H. KENDALL.