

July 4, 1933.

E. R. BEEMAN ET AL

1,916,651

DOOR ACTUATING MECHANISM

Filed May 16, 1930

2 Sheets-Sheet 1

Fig. 1

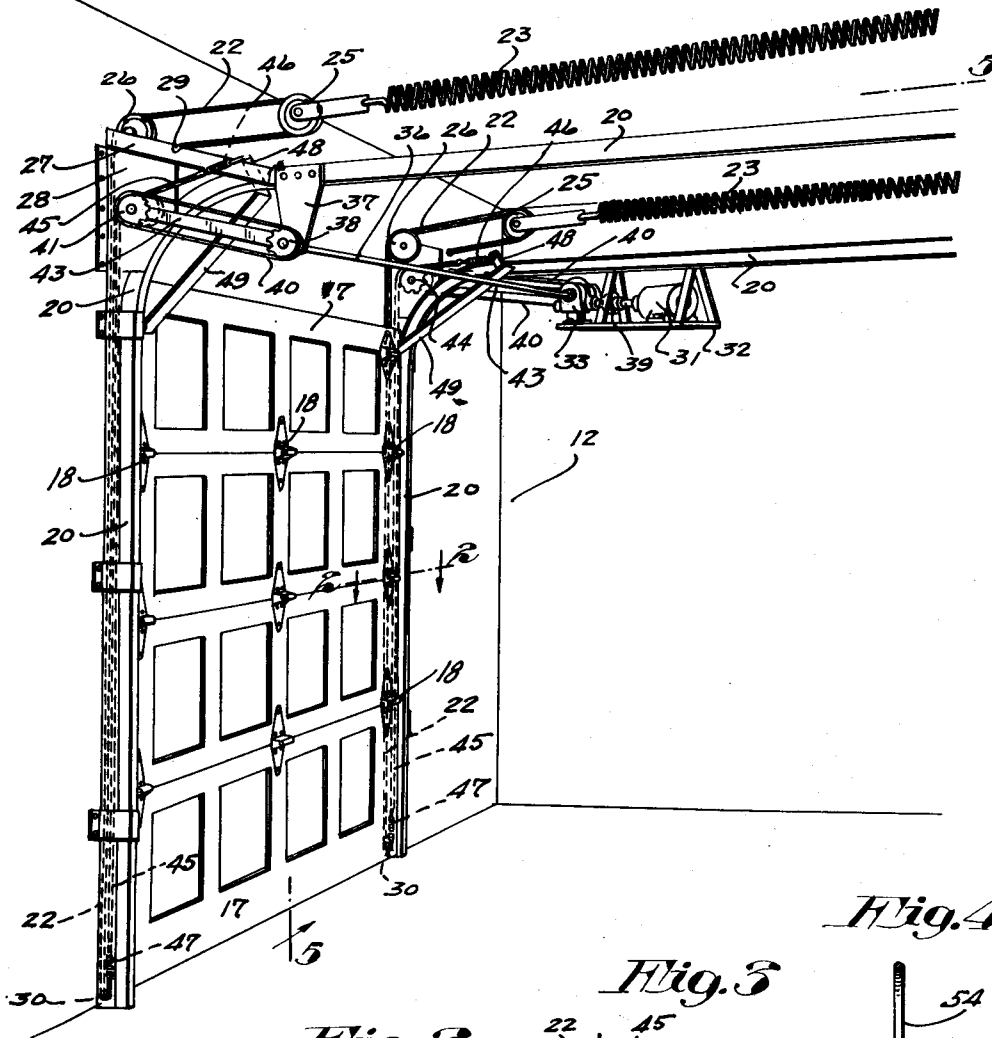


Fig. 4

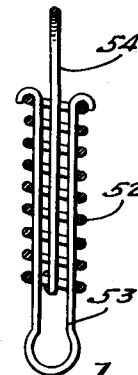


Fig. 3

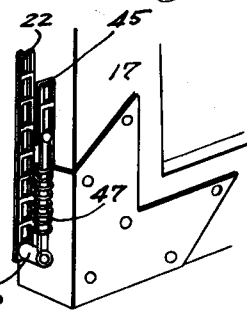
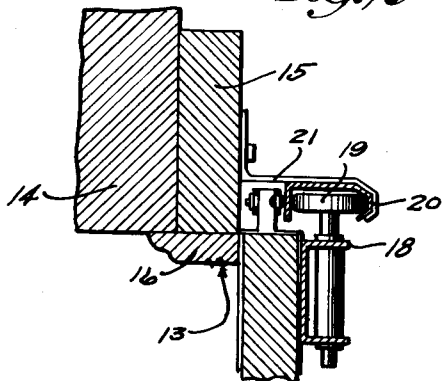


Fig. 2



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July 4, 1933.

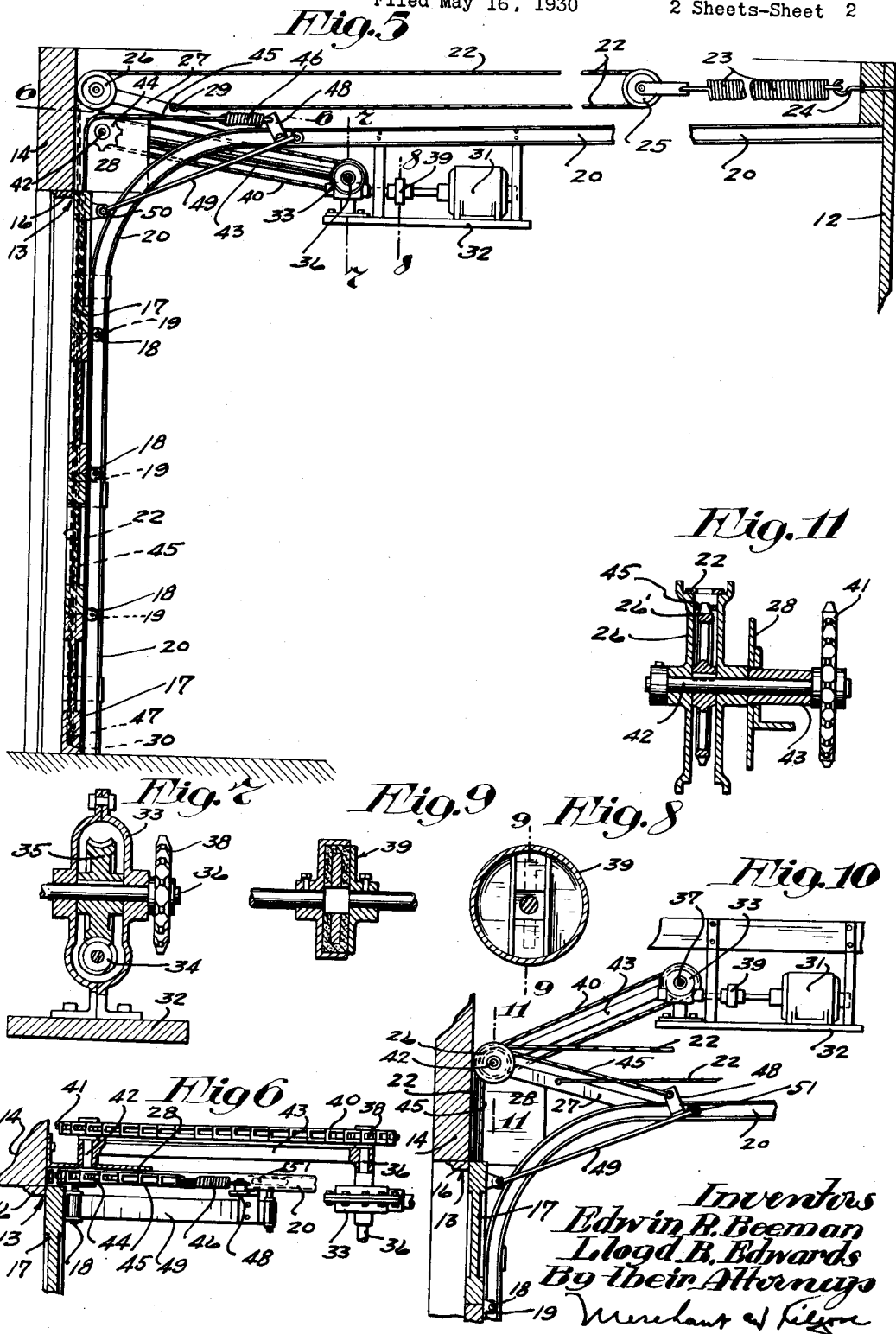
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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DOOR ACTUATING MECHANISM

Application filed May 16, 1930. Serial No. 452,925.

This invention relates to multisection sliding doors and has for its object to provide simple and highly efficient actuating mechanism therefor.

To the above end, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a fragmentary perspective view showing an overhead multisection sliding door and the actuating mechanism therefor;

Fig. 2 is a fragmentary detail view with some parts sectioned on the line 2—2 of Fig. 1, on an enlarged scale;

Fig. 3 is a fragmentary perspective view of the lower left hand corner of the door, on an enlarged scale;

Fig. 4 is a detail view, with some parts sectioned, of one of the compensating devices, on an enlarged scale;

Fig. 5 is a view partly in side elevation and partly in vertical section taken on the line 5—5 of Fig. 1;

Fig. 6 is a fragmentary detail view partly in plan and partly in horizontal section taken on the line 6—6 of Fig. 5;

Fig. 7 is a detail view principally in section taken on the line 7—7 of Fig. 5, on an enlarged scale;

Fig. 8 is a detail view with a part sectioned on the line 8—8 of Fig. 5, on an enlarged scale;

Fig. 9 is a detail view with some parts sectioned on the line 9—9 of Fig. 8;

Fig. 10 is a fragmentary view showing a slight modification of the actuating mechanism; and

Fig. 11 is a view partly in elevation and partly in section taken on the line 11—11 of Fig. 10, on an enlarged scale.

The numeral 12 indicates a garage or other building having a door opening 13 between door posts 14 on the inner faces of which is a casing 15 and stops 16 are secured to the posts 14 and casing 15 within the door opening 13.

A door 17 for the door opening 13 includes a plurality of horizontal panels connected by hinges 18 certain of which have rollers 19 arranged to run in a pair of channel track rails 20 comprising upright sections secured by brackets 21 to the casing 15 and overhead or horizontal sections, the rear ends of which are supported, as shown in Fig. 5. The intermediate portions of the track rails 20 which connect the upright and overhead sections thereof are curved, as best shown in Fig. 5. Obviously, these track rails 20 change the direction of travel of the door 17 during its opening and closing movements from a vertical position, in which it closes the door opening 13, to an open horizontal position in which it is above said door opening.

The door 17 is counterbalanced, so that it may be opened and closed with very little effort, by a pair of counterbalancing devices, each of which, as shown, includes a sprocket chain 22 and a long coiled spring 23. Said counterbalancing springs 23 extend parallel to and above the horizontal sections of the track rails 20 and their rear ends are anchored at 24 to the rear wall of the building 12, see Fig. 5. Flanged wheels 25 are attached to the front ends of the counterbalancing springs 23 to turn about horizontal axes.

The intermediate portions of the sprocket chains 22 extend horizontally and run over the flanged wheels 25 and like wheels 26 the journals of which are mounted in bars 27 secured to the overhead sections of the track rails 20 and brackets 28 on the header for the door opening 13. From the wheels 25 the respective end portions of the chains 22 extend horizontally forward under the upper sections thereof and are anchored at 29 to the bars 27. The other end portions of the sprocket chains 22 hang vertically downward from the wheels 26 at the vertical edges of the door 17 and are secured at 30 to the lower corners thereof.

The actuating mechanism for the door 17 is designed to lift said door at its lowermost panel from a closed position to an open position and to push said door at its uppermost panel from an open position to a closed position, thus relieving the hinges connecting the

several panels of said door from all strains and to cause said door to move freely and easily to and from a closed position. This mechanism includes a reversible electric motor 31 of any well known make mounted on a bed 32 suspended from the overhead section of the right hand track rail 20, in respect to Fig. 1, and the shaft of said motor extends forward substantially parallel to said track section. The outer end portion of the shaft of the motor 31 is journaled in a housing 33 on the bed 32 and has keyed thereto, a worm 34 meshing with a worm gear 35 within said housing and which gear is keyed to the right hand end of a long horizontal shaft 36 which extends parallel to the door 17 with its left hand end journaled in a depending bracket 37 on the overhead section of the left hand track rail 20.

A pair of sprocket wheels 38 are keyed to the ends of the shaft 36, the one outward of the housing 33 and the other outward of the bracket 37. An overrunning clutch 39 is interposed in the shaft of the motor 31 which comprises two axially spaced sections. As this clutch 39 is of well known commercial form, it is not thought necessary to describe the same except to state that it permits one section of said shaft to turn in respect to the other.

A pair of sprocket chains 40 run over the sprocket wheels 38 and sprocket wheels 41 keyed to the outer ends of a pair of short axially aligned shafts 42 which extend parallel to the shaft 36. These shafts 42 are journaled intermediate of their ends in bearings on the outer ends of a pair of brace bars 43 turnably mounted on the shaft 36. The bearings on the brace bars 43, in which the shafts 42 are journaled, are mounted at their inner ends in seats in the brackets 37 and thereby support the outer ends of said bars, see Figs. 1 and 6. The purpose of the brace bars 43 is to resist torque in the shafts 36 and 42. Sprocket wheels 44 are keyed to the inner ends of the shafts 42.

The pairs of sprocket wheels 41 and 44 hold the shafts 42 against axial movement in the bearings therefor on the brace bars 43. Sprocket chains 45 run over the sprocket wheels 44 and have on each of their ends upper and lower compensating devices 46 and 47, respectively. The upper compensating devices 46 are attached to short upstanding crank-acting extensions 48 on the outer ends of a pair of arms 49 hingedly attached at 50 to the upper panel of the door 17 for vertical swinging movement. The arms 49 are guided during the opening and closing movements of the door 17 by rollers 51 journaled on the outer ends of said arms and arranged to run in the track rails 20. The crank-acting extensions 48 on the arms 49 and the sprocket wheels 44 hold the upper sections of the sprocket chains 45 above the

overhead sections of the track rails 20 and out of contact with the upper panels of the door 17 during the opening and closing movements thereof.

The lower compensating devices 47 are attached by connections 30 to the lower corners of the door 17. The sprocket wheels 44 hold the upper sections of the sprocket chains 45 substantially parallel to the upper sections of the track rails 20 and the lower sections of said chains substantially parallel to the upright sections of said track rails. Each compensating device 46—47 includes a coiled spring 52, a U-shaped rod 53 and a rod 54. The legs of the rod 53 extend through the spring 52 and have on their free ends a spring seat for one end of said spring and the rod 54 extends axially through the spring 52 from the opposite end thereof and is attached to the opposite end thereof from said spring seat. The transverse portions of the rods 53 are attached either to the connections 30 or the crank-acting extensions 48 depending on the location of the compensating devices 46—47 and the outer ends of the rods 54 are attached to the ends of the sprocket chains 45.

From the above description it is evident that the door actuating mechanism from the motor 31 to the sprocket wheels 44 simultaneously operate the same and alternately change the direction of rotation thereof with the reversing of the motor 31. This door actuating mechanism rotates the sprocket wheels 44 in a direction to feed the lower sections of the sprocket chains 45 upward and thereby lift the door 17 from its two lower corners and at which points the counterbalancing devices 22—23 are also active so that said door is lifted entirely from its lower panel without any strain on the upper panels or hinges connecting the same. During the lifting or opening of the door the upper sections of the sprocket chains 45 are carried by the arms 49 horizontally rearward in advance of said door.

To close the door 17 the motor 31 is reversed and the upper sections of the sprocket chains 45 are fed forward by the sprocket wheels 44 and thereby pull the arms 49 forward which, in turn, acting on the two upper corners of the door 17 push the same to a closed position. During the closing of the door 17 the counterbalancing devices 22—23 and the upright sections of the sprocket chains 45 acting on the lower corners of the door 17 supports said door so as to relieve the hinges and lower panels of the door from all strains resulting from their attachment to the upper panel of the door which is being operated to close the door 17. During the final closing movement of the door 17 the arms 49 assume oblique positions resulting from the movement of the upper corners of the door 17 below the horizontal sections of the track rails 20 and at which time the pull-

ing action of the upper sections of the sprocket chains 45 on the crank-acting extensions 48 produce a thrust on the arms 49 which not only presses the door 17 downward to a complete closed position but presses the same laterally outward against the stops 16 so as to form a tight joint therewith.

The compensating devices 46 and 47 keep the sprocket chains 45 taut while the door 17 is being opened or closed and at which time the distance between the upper and lower corners of the door 17 varies when measured longitudinally of the sprocket chains 45. These compensating devices 46 and 47 also absorb all shocks during initial opening and closing movements of the door 17 produced by the door actuating mechanism. When the door 17 is fully closed the tension on the springs of the lower compensating devices 47 is released and the springs of the upper compensating devices 46 are under tension and when the door 17 is open the action of these compensating devices is the reverse.

The overrunning clutch 39 permits slippage of the driven section of the armature shaft of the motor 31 at the completion of the closing or opening movements of the door 17. The motor 31 may be either manually or automatically stopped at the completion of the opening or closing movements of the door but for the purpose of this case, it is not thought necessary to show the circuit for the motor 31. The mounting of the motor 31 and door actuating mechanism, as shown in Figs. 1 to 9, inclusive, is for a building having very little head room above the door opening 13.

Where there is considerable head room over the door opening 13 the motor 31 the door actuating mechanism may be arranged, as shown in Figs. 10 and 11 and the construction is the same as that shown in Figs. 1 to 9, inclusive, with the exception that the guide wheels 26 are mounted on the shafts 42 concentric with the sprocket wheels 44 and identified by the reference character 26'. All other parts shown in Figs. 10 and 11 have the same reference characters, as shown in Figs. 1 to 9, inclusive.

The guide wheels 26' are made in two circumferentially divided sections mounted on the shafts 42 with the sprocket wheels 41 therebetween, one of which is shown in Fig. 11. This concentric arrangement of the guide wheels 26' and the sprocket wheels 41 permits the mounting of the counterbalancing devices 22-23 and the sprocket chains 45 in the same vertical plane on each side of the door opening 13 which is the same in Figs. 1 to 9, inclusive, and makes a very compact arrangement of the door actuating mechanism.

What we claim is:

1. A sliding door, a track for the door arranged to change the direction of travel of the door during its opening and closing move-

ments, a traveler mounted for hinge-like movement with respect to the plane of the door and arranged to be moved by the door in advance of its opening movement, and reversible driving means operable to open the door in advance of the point of action thereon produced by said driving means and operable on the traveler to close the door in advance of the point of action thereon.

2. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, a rigid member hingedly engaging the door at its inner edge portion, a cable extending in the direction of travel of the door and having one of its ends attached to the outer end of the rigid member and its other end attached to the outer edge portion of the door, and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of the point of action thereon produced by the cable.

3. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, a traveler guided by the track and arranged to be operated by the door in advance of its opening movement, a cable extending in the direction of travel of the door and having one of its ends attached to the traveler and its other end attached to the opposite edge portion of the door, and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of the point of action thereon produced by the cable.

4. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, an arm hingedly attached to the door extending therefrom in the direction of its opening movement and having its outer end guided by the track, a cable extending in the direction of travel of the door and having one of its ends attached to the arm and its other end attached to the opposite edge portion of the door, and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of the point of action thereon produced by the cable.

5. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, an arm hingedly attached to the door and extending therefrom in the direction of its opening movement, the outer end of the arm being guided by the track and having a crank-acting extension, a cable having one of its ends attached to the crank-acting extension and its other end to the opposite edge portion of the door, and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of

the point of action thereon produced by the cable.

6. The structure defined in claim 4 in which the cable between the arm and driving means is provided with a compensating device.

7. The structure defined in claim 4 in which the cable on each side of the driving means is provided with a compensating device.

8. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, an arm hingedly attached to the door and extending therefrom in the direction of its opening movement, the outer end of the arm being guided by the track and having a crank-acting extension, a sprocket chain having one of its ends attached to the crank-acting extension and its other end attached to the opposite edge portion of the door, and reversible driving connections for operating the sprocket chain including a sprocket wheel operative on the sprocket chain intermediate of its ends and an electric motor.

9. A multisection sliding door, tracks for the door having upright and overhead sections, a pair of arms hingedly attached to the door and having their outer ends guided by the upper track sections, a pair of sprocket chains having one of their ends attached to the lower end portion of the door and their other ends to the outer ends of the arms, a pair of sprocket wheels over which the sprocket chains run, and means for driving the sprocket wheels in either direction.

10. A multisection sliding door, tracks for the door having upright and overhead sections, a pair of arms hingedly attached to the door and having their outer ends guided by the upper track sections and provided with crank-acting extensions, a pair of cables having one of their ends attached to the lower edge portion of the door and their other ends to the crank-acting extensions, and reversible means for operating the cables to open or close the door.

11. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, connections extending in the direction of travel of the door attached to opposite edge portions thereof and including a cable and a rigid member hingedly engaging the door and guided by the track, a compensating device for varying the operative length of said connections, and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of the point of action thereon produced by the connections.

12. A multisection door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, connections extending in the direction of travel of the door, attached

to opposite edge portions thereof and including a rigid member hingedly engaging the door and guided by the track, a cable and reversible driving means operable on the cable intermediate of its ends for moving the door in advance of the point of action thereon produced by the connections, said connections further including a compensating device between each end of said connections and the driving means.

13. A multisection sliding door, a track for the door arranged to change the direction of travel of the door during its opening and closing movements, a pair of cables extending in the direction of travel of the door and having their ends attached to opposite edge portions thereof, a driven shaft, a pair of brace bars turnably mounted on the driven shaft, a pair of axially aligned shafts journaled in the outer ends of the brace bars intermediate of their ends, driving connections from the driven shaft to one of the ends of the shafts of said pair and from the other ends of said shafts to the cables, and relatively fixed supports for the outer ends of the brace bars.

14. The combination with a door frame for a door opening, a multisection door for the door opening and a track for the door arranged to change its direction of travel during its opening and closing movements, of a traveler guided by the track and arranged to be operated by the door in advance of its opening movement, a cable extending in the direction of travel of the door and having one of its ends attached to the traveler and its other end to the opposite edge portion of the door, and reversible driving means operative on the cable intermediate of its ends for moving the door in advance of the action thereon produced by the cable, said traveler being arranged to impart a lateral thrust to the door during its closing movement to seat the same against the door frame.

15. A multisection sliding door, tracks for the door having upright and overhead sections, a pair of arms hingedly attached to the door and having their outer ends guided by the upper track sections, a pair of cables having one of their ends attached to the lower edge portion of the door and their other ends to the arms, and guide rollers for the cables intermediate of their ends, said guide rollers and the attachment of the cables to the arms being such as to hold the cables therebetween above the overhead sections of the track.

16. A sliding door, a rigid member hingedly engaging the door at its inner edge portion, a guide for the rigid member, a cable attached at one end to the rigid member and at its other end to the door forward of the point of action thereon by the rigid member, and power means operative on the cable intermediate of its ends to open or close the door.

17. The structure defined in claim 16 in which the guide extends at an angle to the plane of the door when closed and holds the rigid member offset therefrom.

18. The structure defined in claim 16 in which the power means includes a wheel substantially at the intersection of the planes of the door when closed and the guide and over which wheel the cable intermediate of its ends runs.

19. A track having a vertical section and a substantially horizontal section, a sliding door mounted on the track, a traveler mounted on the horizontal section of the track and hingedly engaging the door at the top thereof, a wheel substantially at the intersection of the planes of the track sections, and a cable having one of its ends attached to the door near the bottom thereof and its other end attached to the traveler.

20. A track having a vertical section and a substantially horizontal section, a sliding door mounted on the track, an arm engaging the door at the upper end thereof, the outer end of the arm being guided by the horizontal section of the track during sliding movement of the door, a cable having one of its ends attached to the door near the bottom thereof and its other end attached to the outer end of the arm, a wheel over which the cable intermediate of its ends runs, and power means for turning the wheel in either direction to open or close the door.

In testimony whereof we affix our signatures.

EDWIN R. BEEMAN.
LLOYD B. EDWARDS.

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