Aug. 15, 1933. C. G. JOHNSON ET AL 1,922,370

DOOR CONSTRUCTION

Filed Aug. 4, 1931 2 Sheets-Sheet 1

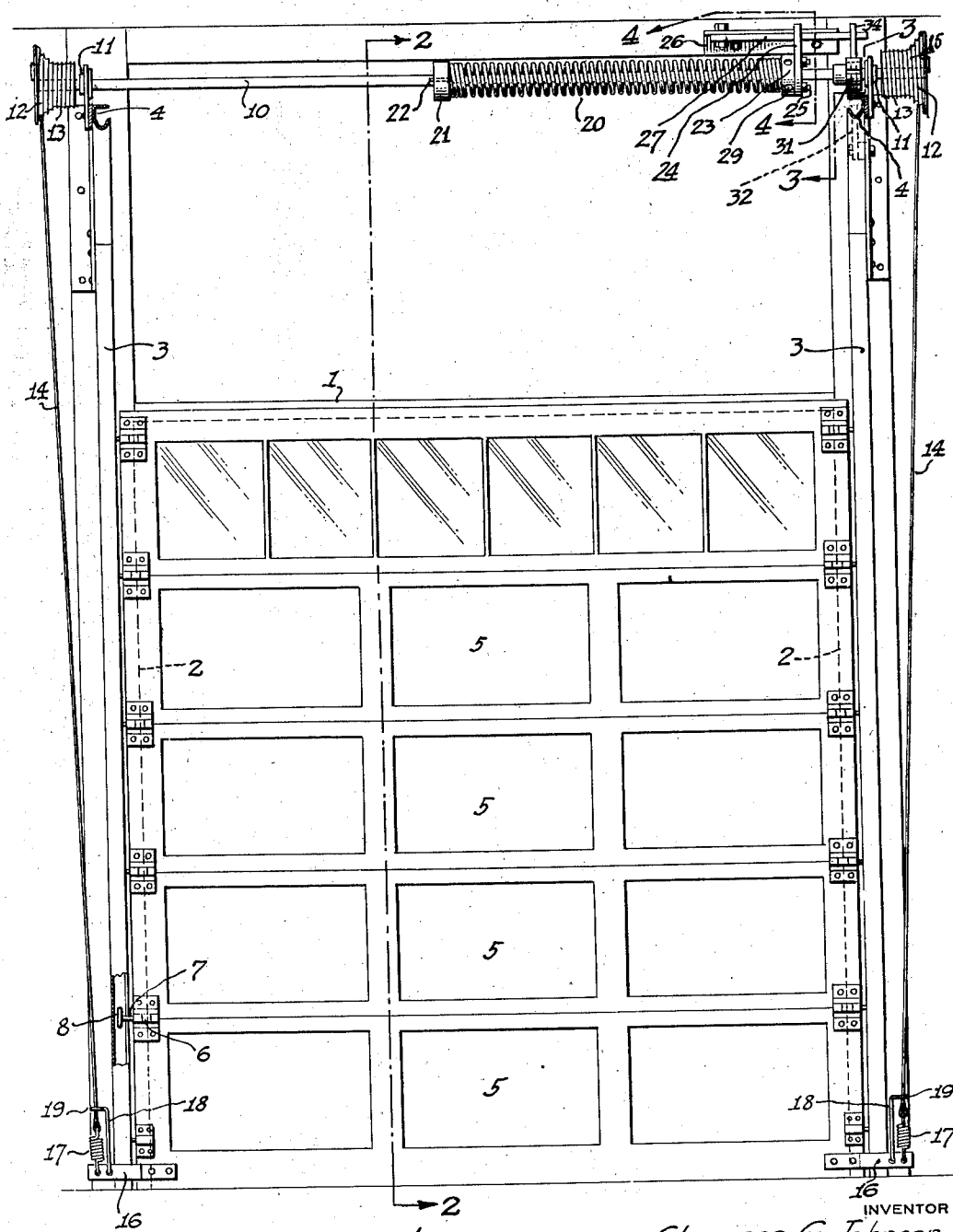


Fig. 1.

INVENTOR

Clarence G. Johnson
Herbert C. Blodgett,

BY

Burhett & Burhett

ATTORNEYS

Aug. 15, 1933. C. G. JOHNSON ET AL 1,922,370

DOOR CONSTRUCTION

Filed Aug. 4, 1931 2 Sheets-Sheet 2

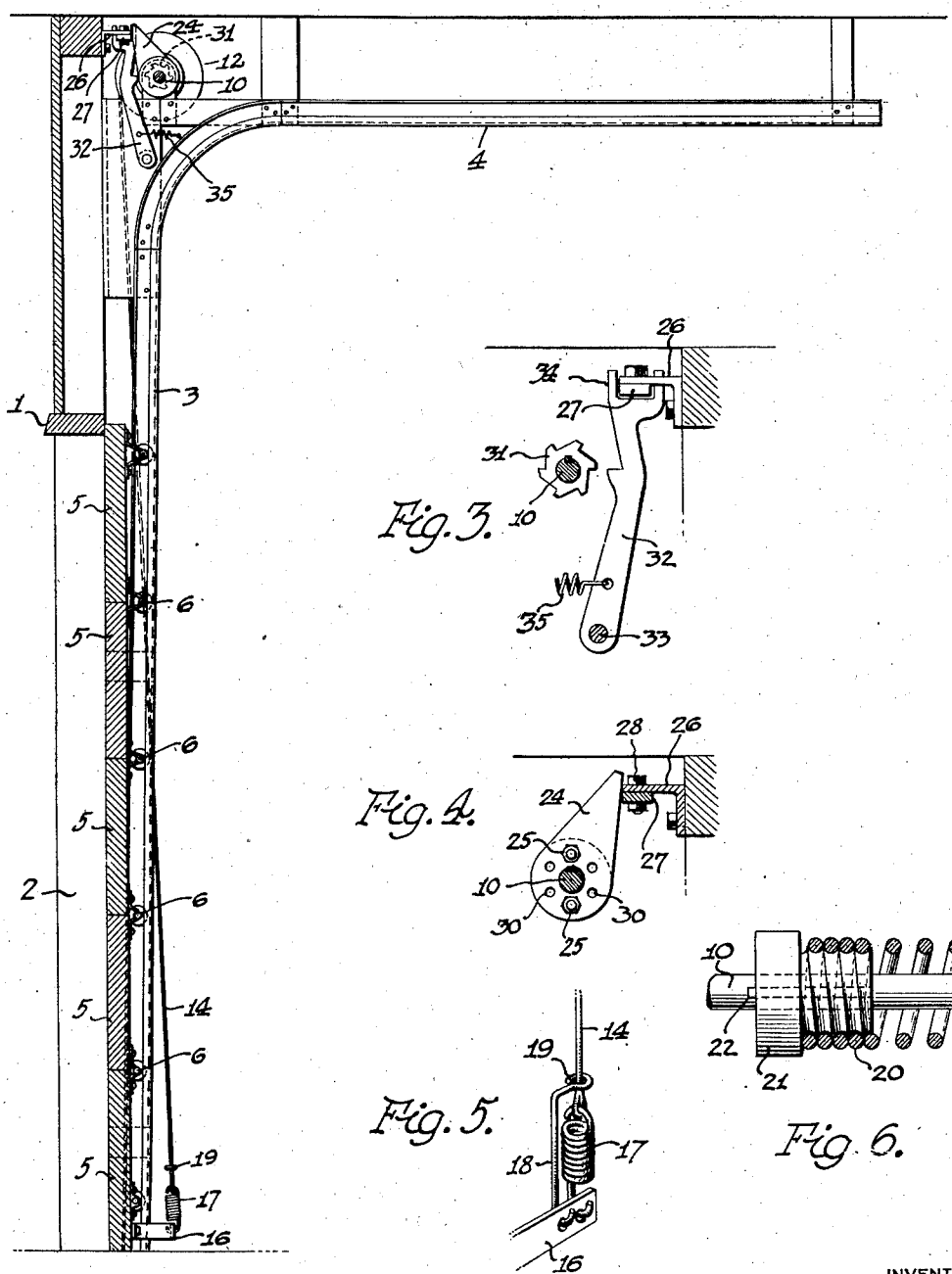


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

INVENTOR

Clarence G. Johnson,
Herbert C. Blodgett,

BY

ATTORNEYS

Patented Aug. 15, 1933

1,922,370

UNITED STATES PATENT OFFICE

1,922,370

DOOR CONSTRUCTION

Clarence G. Johnson and Herbert C. Blodgett, Hartford City, Ind., assignors to Overhead Door Corporation, Hartford City, Ind., a Corporation of Indiana

Application August 4, 1931. Serial No. 555,108

10 Claims. (Class 20—20)

The present invention pertains to a novel counterbalancing system for sliding doors particularly of the type wherein the door in opening moves first along a vertical track section and then onto a horizontal track section.

The principal object of the invention is to provide a device of this character especially applicable to installations where the vertical track section extends a considerable distance over the top of the door opening, or in other words, where the clear space to the ceiling must be considerably higher than the door opening. A structure of this type may, for example, be a greasing station or repair shop where the automobile is lifted off the floor.

In installations where the vertical track section is substantially as high as the door opening, the problem of counterbalancing the door is comparatively simple, inasmuch as the effective weight of the door commences to diminish immediately it is raised and the tension of the counterbalanced spring also commences to diminish at the same time. However, in cases where the vertical track section is higher than the door opening, the door does not commence to lose its effective weight immediately but only when it begins to ride on the horizontal track section, while the tension of the counterbalance spring on the other hand begins to diminish immediately.

The object of the invention, specifically, is to provide a counterbalancing system which meets this difficulty or in other words, maintains a substantially constant relation between the counterbalance spring and the effective weight of the door at all times. This object is accomplished generally by the use of cables wound on drums carried by a spring-tensioned shaft, the drums having a combination of conical and cylindrical portions so related that the effective radius of the conical portion varies while the door is entirely in the vertical track section, thereby compensating for the constantly changing tension of the spring although the unsupported weight of the door does not change.

A further object of the invention is to provide a compensating device which does away with the necessity of accurately winding the cables on their respective drums. Still another object is to provide safety means to prevent dropping of the door under its own weight in the event that the counterbalance spring should break.

The invention is fully disclosed in the following description, by way of example, and in the accompanying drawings in which—

Figure 1 is an inside elevation of the door construction according to the invention;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Figs. 3 and 4 are detail sections on the lines 3—3 and 4—4 respectively of Fig. 1;

Fig. 5 is a detail perspective view showing the attachment of the cable to the door, and

Fig. 6 is a detail sectional view at one end of the torsional spring.

Reference to these views will now be had by use of like characters which are employed to designate corresponding parts throughout.

A door frame 1 is built in any desired manner in a garage or other structure and presents a door opening 2 to be closed by a door of the hinged panel type. It will be seen that the building structure is considerably higher than the door opening. A track consisting of a pair of rails is provided at the door opening, and each rail has a substantially vertical portion 3 extending considerably above the door opening and a substantially horizontal portion 4 extending rearwardly or inwardly from the upper end of the vertical portion. The door consists of superimposed panels 5 joined together by hinges 6 on horizontal axes. The hinge pintles 7 carry rollers 8 riding in the tracks in the manner now well known in the art.

In the opening of the door, the latter first rides completely on the vertical portions 3 until the upper panel moves onto the horizontal portion 4. Thus, the unsupported weight of the door remains constant until the door commences to ride on the horizontal portion 4, after which the unsupported weight gradually diminishes. This type of construction is suitable especially for buildings having a comparatively large height, as already indicated, and one example of such a structure is a garage or repair shop in which an automobile is lifted off the floor for service or repair work thereon. The height of the door opening 2 is slightly greater than that of an automobile.

A shaft 10 for carrying a counterbalancing means and cable drums for the door is rotatably supported in a convenient position, preferably directly over the door opening and parallel to the upper edge of the door, in bearings 11. The ends of the shaft carry drums, each having a conical portion 12 and a cylindrical portion 13 for a purpose which will presently be described. The drums have cables 14 wound thereon, preferably in thread grooves 15 provided for the purpose of ensuring uniform winding and unwinding.

Each cable has its free end connected to a bracket 16 at the lower corner of the door, preferably through the medium of a coil spring 17. To each bracket is secured a stop member 18 looped as at 19 around the adjacent cable and directly over the corresponding spring 17. The loop or eye 19 is of such size that the spring 17 cannot pass therethrough in case that it should break, so that the free end of the cable is nevertheless retained by the stop member if such breakage of the spring should occur.

A torsional spring 20 surrounds the shaft 10 and has a plug 21 threaded into one end thereof and keyed as at 22 to the shaft. The other end is free of the shaft but has a similar plug 23 threaded therein and equipped with a stop finger 24 secured thereto by bolts 25. Adjacent this end of the spring, a bracket 26 is secured to the structure 1 and has an arm 27 pivoted thereto by a stud 28. This arm is engaged by the stop finger 24 under the tension of the spring. It will be seen that the arm 27 is of considerable length so that the finger may slide along the same as the spring contracts or elongates on lowering or raising of the door. The spring may be adjustably tensioned for properly counterbalancing the door by detaching the finger 24 and turning the plug 23 by a suitable tool inserted in apertures 29 formed in the plug. For the same purpose of adjustment, the finger 24 has a series of bolt holes 30 for connecting the finger 24 in various angular relations to the plug.

The cables 14 are connected to the door in such a manner as to wind first on the conical portions and then on the cylindrical portions as the door is raised. It has already been stated that the effective weight of the door is constant until the door reaches the horizontal portion 4 of the track. Nevertheless, the counterbalanced spring 20 gradually loses its tension from the time the lifting movement is commenced. During the initial lifting movement of the door, however, the effective radius or leverage of each drum is diminished as the cable winds towards the cylindrical portion. The conical portion of each drum is so dimensioned that the diminishing effective radius compensates the diminishing tension of the spring, whereby the spring maintains a proper counterbalancing relation to the door until the latter reaches the horiontal portion 4 of the track.

As the door commences to ride on the horizontal portion of the track, its effective or unsupported weight gradually diminishes. It will also be recalled that the tension of the spring gradually diminishes. Consequently, the conical portion of each drum is constructed to function only until the door reaches the horizontal track section. In other words, the cable-thread of each conical portion has a developed length substantially equal to the difference between the height of the vertical track portion 3 and the height of the door. As the door commences to ride on the horizontal track section, the cables wind on the cylindrical parts of the drums, so that there is no variation in the effective radii of the drums. The spring 20 is so constructed that it loses its tension in proportion to the rate at which the door loses its effective or unsupported weight as it rides over the horizontal track section.

As the door is closed or lowered, it will be evident that these conditions are relatively reversed, although the balancing action of the spring 20 with respect to the unsupported weight of the door remains substantially constant.

The shaft 10 carries a ratchet 31 near the free end of the arm 27, and adjacent the ratchet is a pawl 32 pivotally attached at 33 to the fixed door structure. The upper or free end of the pawl has a fork 34 straddling the arm 27 whereby the ratchet is normally held out of engagement with the pawl. A spring 35 tends to throw the pawl towards the ratchet but is resisted by the tension of the spring 20 acting on the arm 27 through the medium of the finger 24. In the event that the spring 20 should break, the spring 35 is rendered free to throw the pawl into engagement with the ratchet, although swinging the pivoted arm 27 which is now unresisted. Thus, the door is prevented from dropping under its own weight in the event that the spring 20 breaks. The door is also rendered safe against breakage of the spring 17 by the stops 18 and eye 19 as previously described.

With reference again to the drums, it will be evident that the cables must ordinarily be accurately wound thereon, for otherwise one cable would be on the conical portion while the other would be on the cylindrical portion, as a result of which one cable would be fed or wound at a greater rate than the other cable, thereby tending to move the ends of the door at different rates and consequently tilting the door to bind it in its track. The spring 17 however overcomes the necessity for such accurate setting of the cables. Any unequal winding or feeding of the cables under the conditions described causes a stretching of the spring 17 at the end of the door which tends to be pulled upwardly with respect to the other end, whereby the effect of the unequal winding or unwinding is at least substantially overcome.

Although a specific embodiment of the invention has been illustrated and described, it will be apparent that various alterations in the details of construction may be made without departing from the scope of the invention as indicated by the appended claims.

What we claim is:—

1. In combination with a vertically and horizontally slidable door, a track guiding said door and having a vertical portion longer than the height of the door and a substantially horizontal portion extending from the upper end of the vertical portion, a rotatable shaft, a torsional spring surrounding said shaft and having one end secured to the shaft, stop means for the other end of said spring, a drum on said shaft having a conical portion and a cylindrical portion, and a cable extending from said drum and secured to said door and positioned to wind first on the conical portion and then on the cylindrical portion as the door is raised.

2. In combination with a vertically and horizontally slidable door, a track guiding said door and having a vertical portion longer than the height of the door and a substantially horizontal portion extending from the upper and of the vertical portion, a rotatable shaft, a torsional spring surrounding said shaft and having one end secured to the shaft, stop means for the other end of said spring, a drum on said shaft having a conical portion and a cylindrical portion, and a cable extending from said drum and secured to said door and positioned to wind first on the conical portion and then on the cylindrical portion as the door is raised, said conical portion being so dimensioned that the cable and wind-

ing passes therefrom to the cylindrical portion when the upper edge of the door commences to travel on the horizontal portion of said track.

3. In combination with a vertically and horizontally slidable door, a track guiding said door and having a vertical portion longer than the height of the door and a substantially horizontal portion extending from the upper end of the vertical portion, a rotatable shaft, a torsional spring surrounding said shaft and having one end secured to the shaft, stop means for the other end of said spring, a drum on said shaft having a conical portion and a cylindrical portion, and a cable extending from said drum and secured to said door and positioned to wind first on the conical portion and then on the cylindrical portion as the door is raised, the cable-thread on the conical portion having a developed length substantially equal to the difference between the length of the vertical portion of the track and the height of said door.

4. In combination with a vertically and horizontally slidable door, a track guiding said door and having a vertical portion longer than the height of the door and a substantially horizontal portion extending from the upper end of the vertical portion, a rotatable shaft, a torsional spring surrounding said shaft and having one end secured to the shaft, stop means for the other end of said spring, a drum on said shaft having a conical portion and a cylindrical portion at the smaller end of the conical portion, and a cable extending from said drum and secured to said door and positioned to wind first on the conical portion and then on the cylindrical portion as the door is raised.

5. In combination with a vertically and horizontally slidable door, a track guiding said door and having a vertical portion longer than the height of the door and a substantially horizontal portion extending from the upper end of the vertical portion, a rotatable shaft, a torsional spring surrounding said shaft and having one end secured to the shaft, stop means for the other end of said spring, a drum on said shaft having a conical portion and a cylindrical portion at the smaller end of the conical portion, and a cable extending from said drum and secured to said door and positioned to wind first on the conical portion and then on the cylindrical portion as the door is raised, the cable-thread on the conical portion having a developed length substantially equal to the difference between the length of the vertical portion of the track and the height of said door.

6. In combination with a vertically slidable door, a shaft parallel to the upper edge of said door, a single counterbalance means acting on said shaft, drums on the ends of said shaft, cables wound on said drums and connected to said door, and springs inserted in said cables.

7. In combination with a vertically slidable door, a shaft parallel to the upper edge of said door, a single counterbalance means acting on said shaft, drums on the ends of said shaft, cables wound on said drums, springs connecting said cables to said door and stop members carried by said door and having eyes looped around said cables adjacent said springs, said springs being too large to pass through said eyes.

8. In combination with a vertically slidable door, a shaft parallel to the upper edge of said door, a counterbalance torsional spring having one end secured to said shaft, an arm pivotally mounted adjacent said torsional spring, a finger extending from the remaining end of said spring and engaging said arm under spring tension, a ratchet on said shaft, a pawl pivotally mounted adjacent said ratchet and held by said arm away from said ratchet, and means tending to throw said pawl into engagement with said ratchet and operative on release of said arm by breaking of said spring.

9. In combination with a vertically slidable door, a shaft parallel to the upper edge of said door, a counterbalance torsional spring having one end secured to said shaft, an arm pivotally mounted adjacent said torsional spring, a stop finger secured to the remaining end of said spring for angular adjustment relatively thereto and engageable with said arm, a ratchet on said shaft, a pawl pivotally mounted adjacent said ratchet and held by said arm away from said ratchet, and means tending to throw said pawl into engagement with said ratchet and operative on release of said arm by breaking of said spring.

10. In combination with a vertically slidable door, counterbalancing means, cables adapted to be drawn by said means, springs connecting said cables to said door and stop members carried by said door and having eyes looped around said cables adjacent said springs, said springs being too large to pass through said eyes.

CLARENCE G. JOHNSON.
HERBERT C. BLODGETT.