Sept. 3, 1940. J. T. ST. JOHN, JR 2,213,230

OVERHEAD DOOR

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FIG. 1

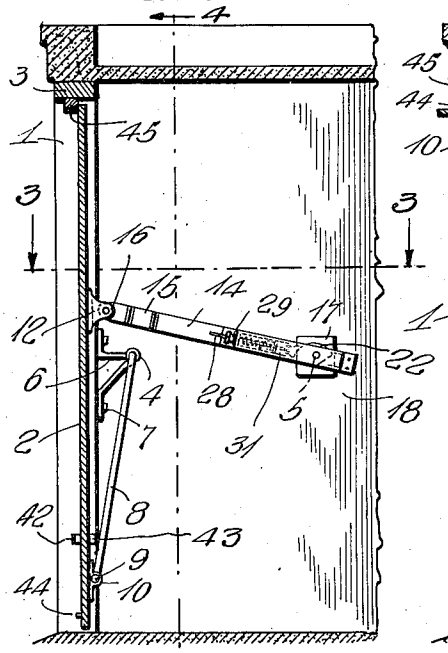
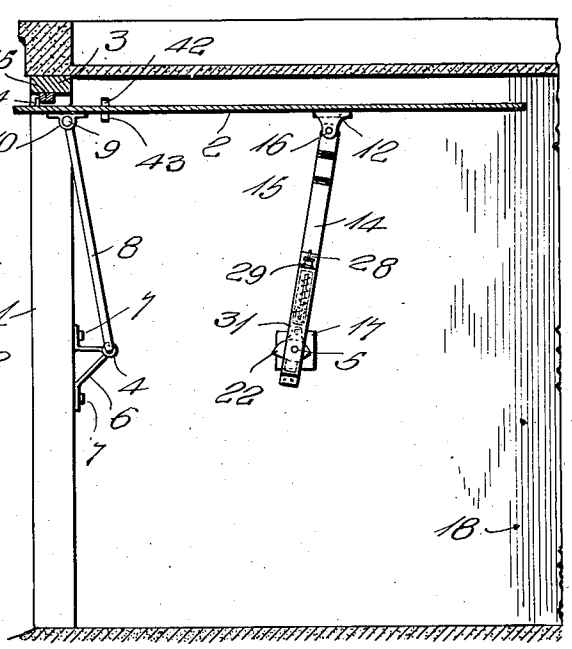


FIG. 2



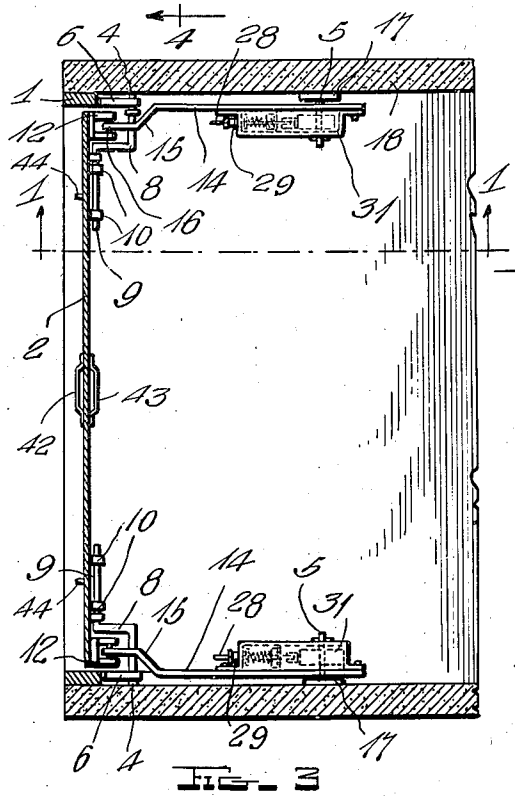


FIG. 3

FIG. 9

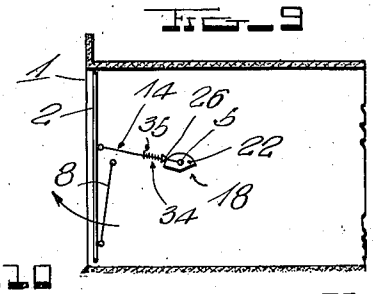


FIG. 10

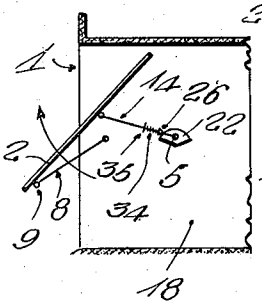
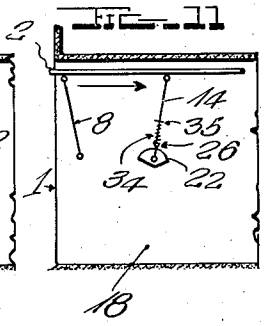


FIG. 11



INVENTOR.

John T. St. John, Jr

BY

John Q. Brady

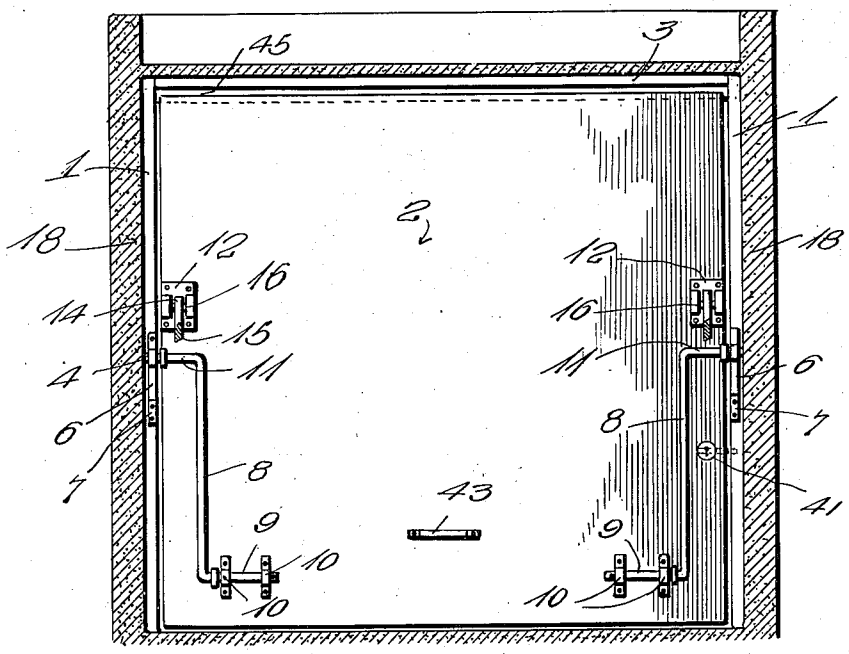
ATTORNEY.

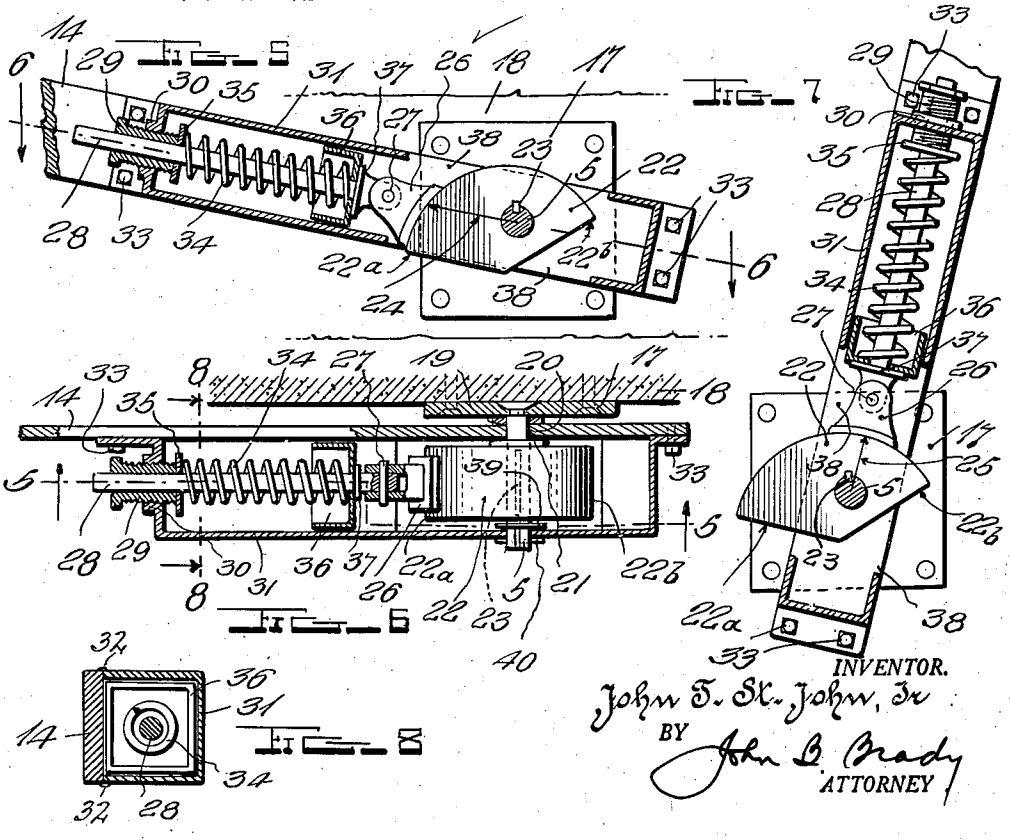
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FIG. 4





INVENTOR.
John T. St. John, Jr.
BY John B. Brady
ATTORNEY

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2,213,230

OVERHEAD DOOR

John T. St. John, Jr., Minneapolis, Minn., assignor to John B. Brady, Washington, D. C.

Application December 30, 1938, Serial No. 248,595

4 Claims. (Cl. 20—16)

My invention relates broadly to doors and more particularly to a lifting and swinging door particularly adapted for garages.

One of the objects of my invention is to provide a construction of lifting and swinging door for garages in which minimum clearance is required for the installation and operation of the door.

Another object of my invention is to provide an arrangement for suspension of the garage door whereby the mass of the door itself serves to substantially balance the door throughout its path of lifting and swinging movement in combination with spring means for overcoming the weight of the door and facilitating movement of the door to open position.

Still another object of my invention is to provide a simplified form of mechanism for actuating a lifting and swinging door in which a compressible spring is employed for facilitating the lifting and swinging movement of the door and wherein the spring is enclosed and thus prevented from becoming a source of danger in the event of breakage which has been the case as a result of the snapping and projecting of a part of broken spring in doors employing an exposed spring device.

A further object of my invention is to provide a construction of lifting and swinging door mechanism which may be readily adjusted with minimum skill to control the rate of movement of the door.

A still further object of my invention is to provide a construction of actuator for a lifting and swinging door in which a spring device coacts with a shoe operative over a preformed surface whereby the expansion of the spring device acts upon the shoe which in turn bears upon the preformed surface for exerting a thrust which facilitates the lifting and swinging operation of the door.

Another object of my invention is to provide an arrangement of two-point spaced suspension system for a door structure by which a door structure may be lifted from a substantially vertical position to a substantially horizontal position while remaining in a state of balanced equilibrium with the movement thereof facilitated by the operation of spring means and without the employment of tracks or guide members adjacent the periphery of the door structure.

Other and further objects of my invention reside in a door structure which may be manufactured inexpensively on a quantity production basis and quickly installed embodying structural details set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 is a vertical sectional view taken through a door structure embodying my invention and illustrated in closed position with reference to the front of a garage, with parts illustrated in elevation, the view being taken on line 1—1 of Fig. 3; Fig. 2 is a view similar to the view of Fig. 1 showing the door in open position; Fig. 3 is a horizontal sectional view through the door on line 3—3 of Fig. 1 and illustrating the actuating parts in top plan view; Fig. 4 is a vertical sectional view taken on line 4—4 of Fig. 1 with certain of the actuating means illustrated in cross section; Fig. 5 is an enlarged fragmentary view taken through one of the spring mechanisms with certain of the parts shown in elevation, the view illustrating the position of the spring actuator for a closed position of the door, the view being taken substantially on line 5—5 of Fig. 6; Fig. 6 is a longitudinal sectional view through the spring actuating mechanism taken substantially on line 6—6 of Fig. 5; Fig. 7 shows a view of the spring actuating mechanism which corresponds to the open position of the garage door; Fig. 8 is a transverse sectional view taken on line 8—8 of Fig. 6; Fig. 9 is a theoretical view showing the relationship of the two-point spaced suspension means for the door with reference to the cam device located at one of the suspension points; Fig. 10 is a similar theoretical view showing the door in the process of movement from a substantially vertical position to a substantially horizontal position; and Fig. 11 is a similar theoretical view showing the garage door in open position and the position assumed by the suspension means and spring actuating mechanism when the door is in open position.

My invention is directed to a construction of garage door which does not require the customary tracks or guides for installation and operation thereof in garages and the like. I have devised a construction of door in which the mass of the door is so distributed with respect to two suspension points adjacent opposite edges of the door that the door is continuously maintained in a state of balanced equilibrium throughout its path of movement from a closed position to an open position and from an open position to its original closed position. I do not require counterweights ordinarily necessary in garage door structures as the mass of the door itself is employed as its own balancing means. To facilitate the movement of the door from a substantially vertical

closed position to a substantially horizontal open position, I provide a spring actuating mechanism adjacent horizontally aligned points of pivotal support for the door. The spring actuating mechanism includes an enclosed compressible coil spring which may be adjusted with respect to a shoe which slidably engages a preformed cam-like surface of a member mounted in fixed position adjacent horizontally aligned points of pivotal support for the suspension means. The cam-like surface is so shaped that for the closed position of the door, the coaction of the slidable shoe and the cam-like surface is such that the coil spring is compressed, thereby storing energy therein which is expended as the door is lifted from a substantially vertical position and moved in a swinging path to a substantially horizontal position, thereby facilitating the opening of the door. The door is readily restored to closed position by swinging the door about the two-point pivotal support adjacent each of the edges thereof. The tension of the coil spring is readily adjustable externally of a closed casing and by reason of the arrangement of the closed casing, the coil spring is confined and thus danger arising out of possible breakage or snapping of the spring and the normal tendency of the broken spring to be projected as an injurious missile eliminated.

Referring to the drawings in detail, reference character 1 designates the door jam or frame within which the lifting and swinging door 2 is arranged to operate. The door frame or jam 1 including the transversely extending member 3 may closely conform with the over-all width and heighth of the garage or other structure with respect to which the lifting and swinging door is mounted. Only a limited space is required for installation of the door as there are no tracks or guideways engageable with the peripheral edges of the door. The door is pivotally mounted adjacent opposite edges at two fixed positions which I have indicated at 4 and 5. The pivotal mountings 4 are constituted by brackets 6 which are secured by suitable means indicated generally at 7 to the inner edge of the door frame or jam 1. Bell crank levers 8 are disposed in opposite positions with respect to each other and have aligned extensions 9 journaled in bracket members 10 adjacent the lower horizontal edge of the door 1. The opposite ends of the bell cranks 8 project as arms 11 in opposite directions and are journaled at 4 in brackets 6 as described. Above the center line of the door 2 I secure bracket members 12 horizontally aligned adjacent opposite edges of the door. Lever arms 14 have their ends off-set inwardly as represented at 15 and aligned with and pivotally engaged in the brackets 12 as indicated at 16. The lever arms 14 are pivotally mounted as heretofore explained at 5. The pivotal mountings 5 are constituted by pins which project inwardly from plates 17 suitably secured to the side walls of the building structure or garage designated generally at 18. The inwardly projecting pins 5 are fixed to plates 17 and each are adapted to receive thereon the spacing washers 19 and the apertured end portion 20 of lever arm 14 which is free to swing about the pin 5. Another spacing washer 21 is placed over pin 5 and bears against the flat surface of lever arm 14. A cam-like member 22 is next secured over each of the members 5 and fixedly keyed with respect thereto by means of key represented at 23. The radius of curvature of cam-like member 22 is constant so that shoe 26 fits the curved surface through its entire path of travel. The axis 5 about which arm 14 pivots is eccentric with respect to the center of curvature of cam-like member 22 so that in effect the cam-like member 22 increases from a relatively long radius indicated at 24 in Fig. 5 to a relatively shorter radius indicated at 25 in Fig. 7. That is to say, the surface of the cam-like member 22 in effect, tapers from a maximum at the end 22*a* of the cam-like member 22 to a minimum at the end 22*b* of the cam-like member 22, the radius of curvature being constant. The curved surface of cam-like member 22 provides a guide for the shoe 26 which is pivotally mounted at 27 on a control rod 28 which is supported with respect to lever member 14 through the screw threaded adjustable sleeve 29. The screw threaded adjustable sleeve 29 is engaged in the screw threaded end portion 30 of a longitudinally extending casing 31. The longitudinally extending casing 31 is secured to lever member 14 in any suitable manner such as by a welding process along the junctions 32 indicated in Fig. 8 supplemented if desired by bolt members 33 indicated in Figs. 5, 6 and 7. The slidable member 28 provides a support for the compressible coil spring 34. The compressible coil spring 34 is disposed between washer member 35 against which adjustable sleeve 29 bears and the guide member 36 which is secured over the longitudinally extending member 28 which bears against the abutment 37 immediately adjacent the end of member 28 to which the shoe 26 is pivotally secured as indicated at 27. Coil spring 34 continuously exerts a thrust against shoe 26 to press shoe 26 against the surface of cam-like member 22. Thus as lever members 14 shift through an acute angle around pivots formed by members 5, spring 34 tends to press shoe 26 inwardly toward the surface of cam-like member 22. This continuously yielding force establishes a force component which assists in lifting of the door. The shoe 26 fits against the curved surface of cam-like member 22 under force of spring 34 inasmuch as the radius of curvature of cam-like member 22 is constant. Because the axis 5 about which arm 14 pivots is eccentric with respect to the center of curvature of cam-like member 22, the effective radius of cam-like member 22 decreases from a maximum for the closed position of the door to a minimum for the open position of the door. The spring 34 tends to move shoe 26 to its maximum position of projection and in doing so develops a force component which aids in the lifting of the door and in the swinging of the door to open position indicated in Fig. 11. The casing or housing 31 is suitably apertured on opposite sides as indicated at 38 to allow the lever member 14 and the associated parts to be swung around the fixed cam-like member 22, the cam-like member 22 projecting outside of the side walls of the casing 31 in the course of angular movement of the lever member 14. The casing 31 is spaced from the cam-like member 22 by a washer member 39. When the casing 31 is placed in position, pin 5 projects therefrom. A suitable cotter pin 40 may extend through the pin 5 for securing the wall of casing 31 in position. Suitable tension may be applied to coil spring 34 by adjusting screw threaded sleeve 29 from the exterior of casing 31, using a suitable tool for this purpose.

When the door is swung to closed position, the door may be locked in closed position by means of a suitable lock which I have indicated at 41 in

Fig. 4 coacting with the jam or door frame 1. The door is provided with a handle 42 adjacent the lower edge of the front thereof and another handle 43 on the rear thereof which may be used for swinging the door to closed position. A short length of rope may be attached to handle 43 for pulling the door from open position to closed position. In order to limit the swinging movement of the door, I provide stop members 44 adjacent the lower edge of the door which engage and abut with transversely extending member 45 erected beneath the top portion of the door jam indicated at 3.

In order to decrease friction losses, all of the journals may be provided with ball races and ball bearings. The shoe 26 may be replaced with rollers which engage the cam-like surface of the cam 22 and roll down the cam surface in effecting an opening operation of the door.

The shape of the guide member 36 is such that slidable member 28 is continuously centered throughout the path of movement of shoe 26.

While I have represented one alternative manner of joining casing 31 to lever 14 by a process of welding along seams 32, such methods are only resorted to where ease of repair is not required, for in all normal installations, casing 31 is detachably secured by bolts 33 to lever member 14 so that the casing is readily removable for making repairs and replacements of parts.

In certain installations, a certain amount of friction is desirable between shoe 26 and the surface of cam-like member 22 for introducing a sufficient degree of braking force between shoe 26 and the surface of cam-like member 22 for controlling the rate of movement of the door either during the opening operation or during the closing operation.

While I have described my invention in one of its preferred forms which has proven highly practical in manufacture, production and use, I desire that it be understood that modifications may be made and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A door structure comprising in combination with a frame, a door, a pair of lever members located adjacent each opposite edge of said door, said lever members being pivoted at spaced fixed positions with respect to said door frame and journaled at spaced positions on said door for suspending said door with respect to said door frame under conditions of substantially balanced equilibrium, guide members located adjacent the pivotal mounting of certain of said levers, a coil spring carried by said last mentioned lever members, a movable member engaged by each of said coil springs and operative against the cam-like surface of said guide means for developing a force component which facilitates the movement of said door to open position.

2. A door structure comprising in combination with a frame, a door, a pair of lever members located adjacent each opposite edge of said door, said lever members being pivoted at spaced fixed positions with respect to said door frame and journaled at spaced positions on said door for suspending said door with respect to said door frame under conditions of substantially balanced equilibrium, guide members located adjacent the pivotal mounting of certain of said levers, a casing carried by the ends of said last mentioned levers and apertured on opposite sides for the passage of said guide means, a movable member extending longitudinally through said casing, a shoe carried by said movable member and slidably engageable with said guide means, and a coil spring concentrically positioned about said movable member for continuously urging said shoe in engagement with the surface of said guide members.

3. A door structure comprising in combination with a frame, a door, a pair of lever members located adjacent each opposite edge of said door, said lever members being pivoted at spaced fixed positions with respect to said door frame and journaled at spaced positions on said door for suspending said door with respect to said door frame under conditions of substantially balanced equilibrium, guide members located adjacent the pivotal mounting of certain of said levers, a casing carried by the ends of said last mentioned levers and apertured on opposite sides for the passage of said guide means, a movable member extending longitudinally through said casing, a shoe carried by said movable member and slidably engageable with said guide means, a coil spring concentrically positioned about said movable member for continuously urging said shoe in engagement with the surface of said guide means, and means slidably positioned interiorly of said casing and surrounding said movable member for centering said movable member within said casing throughout the path of travel of the movable member.

4. A door structure comprising in combination with a frame, a door, a pair of lever members located adjacent each opposite edge of said door, said lever members being pivoted at spaced fixed positions with respect to said door frame and journaled at spaced positions on said door for suspending said door with respect to said door frame under conditions of substantially balanced equilibrium, guide members located adjacent the pivotal mounting of certain of said levers, a casing carried by the ends of said last mentioned levers and apertured on opposite sides for the passage of said guide means, a movable member extending longitudinally through said casing, a shoe carried by said movable member and slidably engageable with said guide means, and a screw threaded sleeve extending through said casing and surrounding said movable member, said sleeve abutting with means engageable with said coil spring and being adjustable from the exterior of said casing for controlling the tension of said coil spring with respect to said movable member.

JOHN T. ST. JOHN, JR.