March 23, 1943. D. M. ROBINSON 2,314,634

SWING-UP DOOR COUNTERBALANCING MEANS

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Fig-1

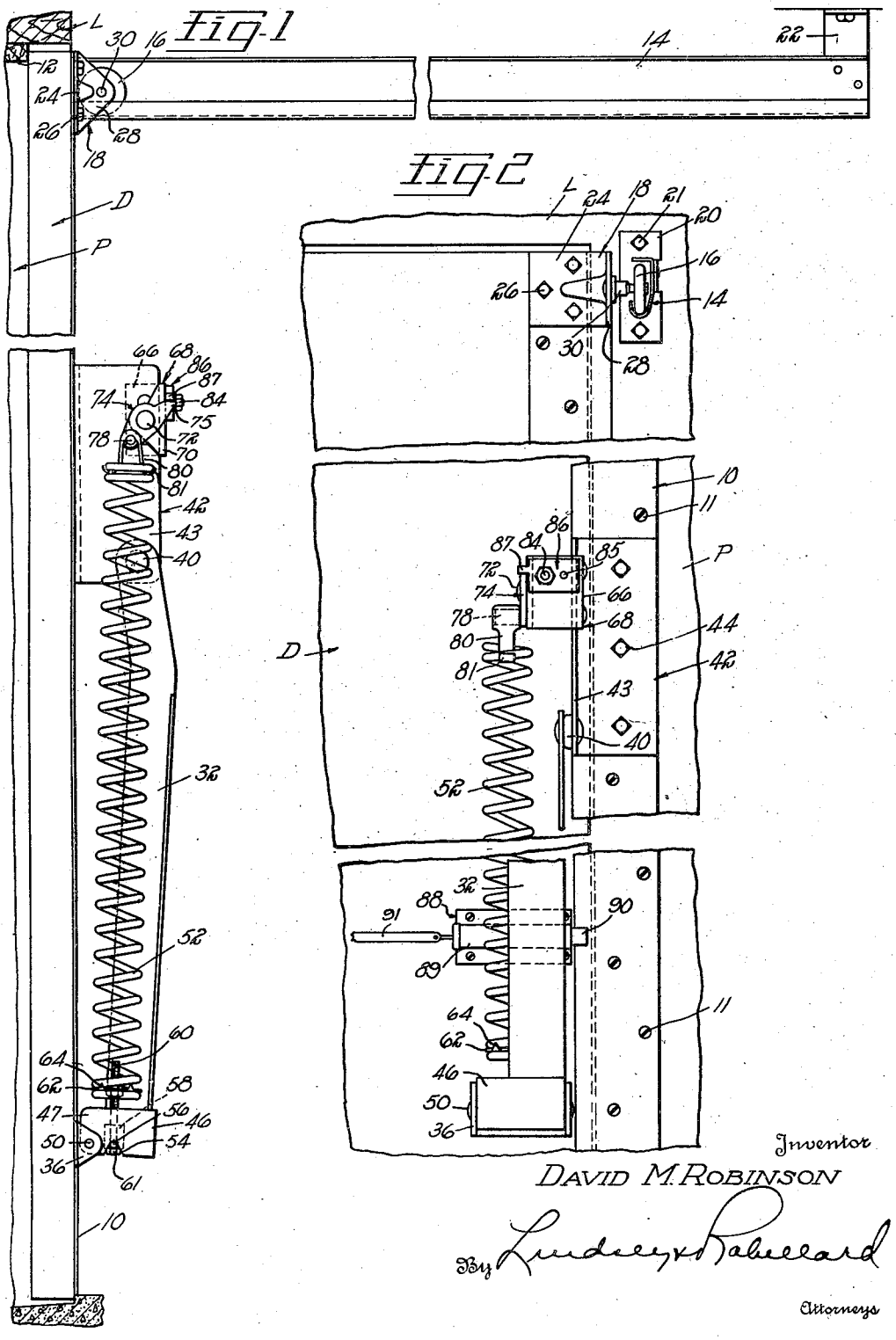


Fig-2

Inventor

DAVID M. ROBINSON

By Lindsey & Pahlard

Attorneys

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Fig. 3

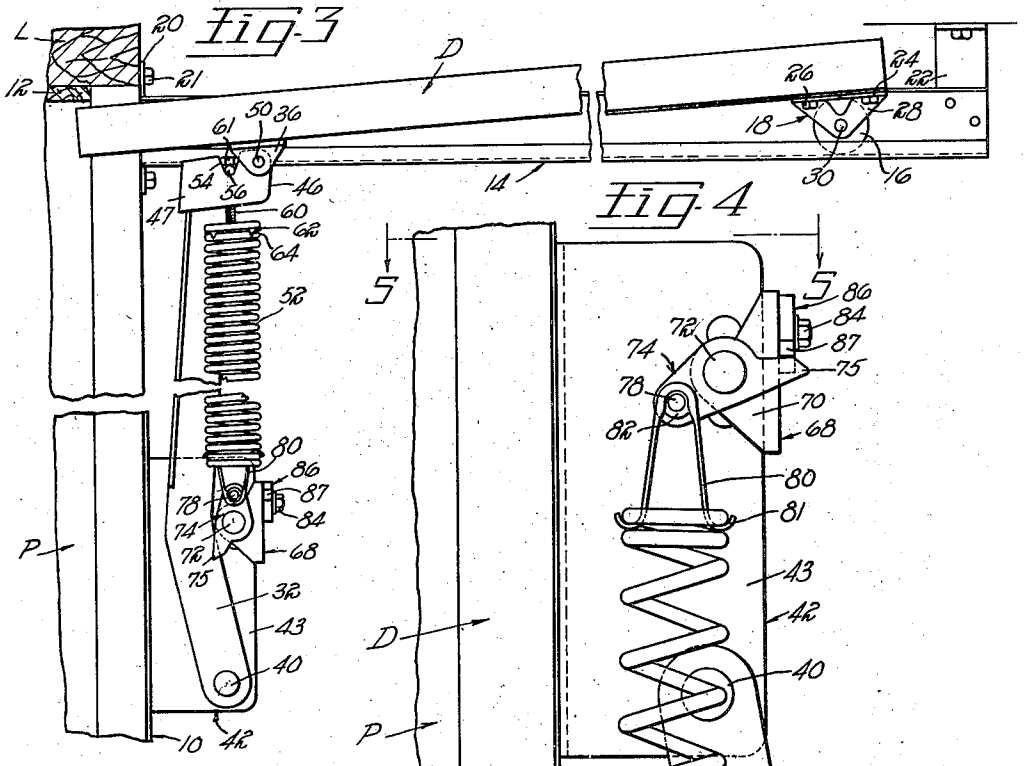
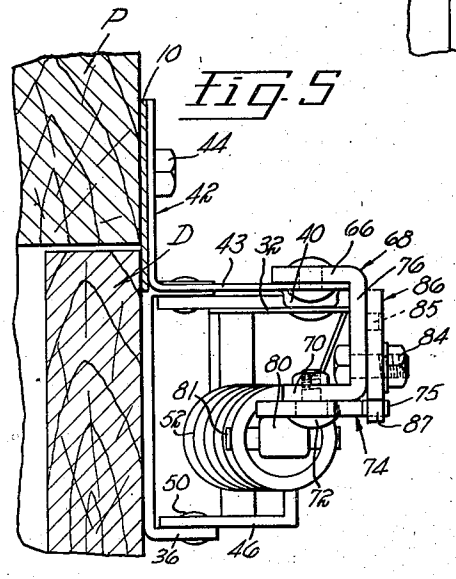


Fig. 4

Fig. 5



Inventor

DAVID M. ROBINSON

By Lindsey & Rabillard

Attorneys

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Fig. 6

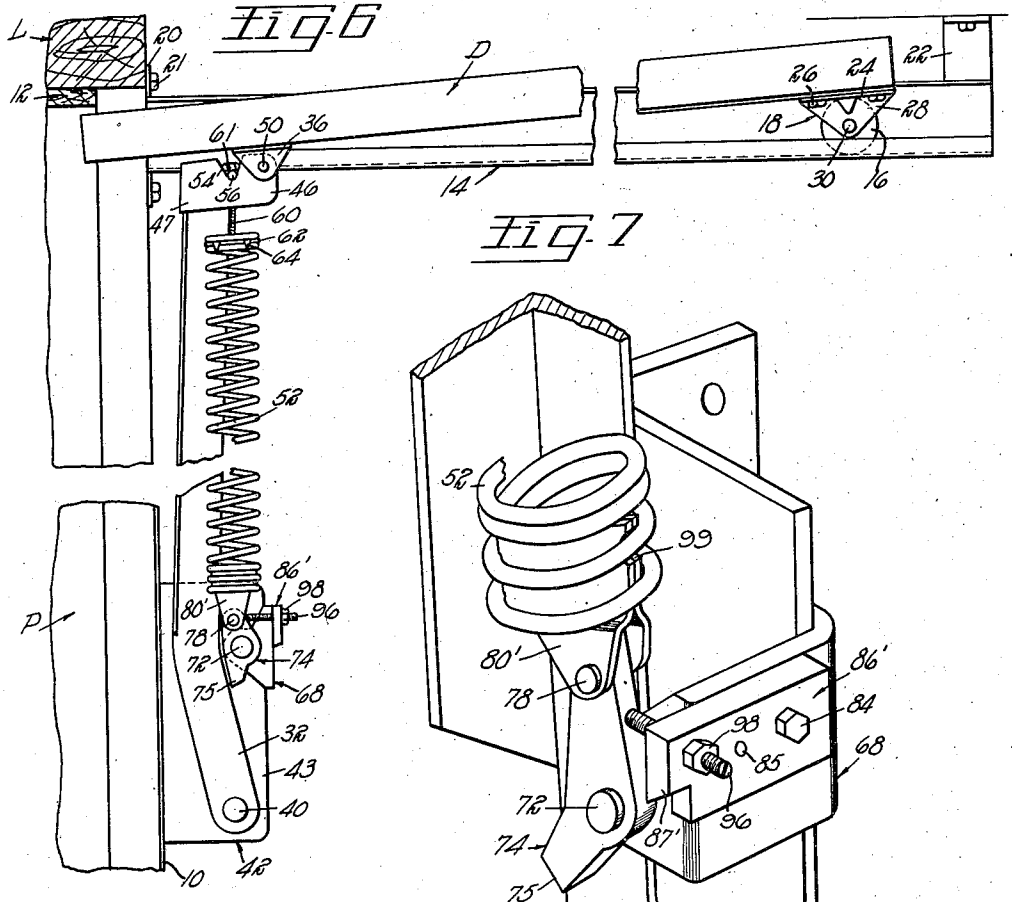


Fig. 7

Inventor

DAVID M. ROBINSON

By Ludsey & Sahlerand

Attorneys

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2,314,634

SWING-UP DOOR COUNTERBALANCING MEANS

David Malcolm Robinson, New Britain, Conn., assignor to The Stanley Works, New Britain, Conn., a corporation of Connecticut

Application March 17, 1941, Serial No. 383,879

8 Claims. (Cl. 20—19)

The present invention relates generally to counterbalancing mechanisms and more specifically to an improved spring actuated mechanism for counterbalancing the type of garage door that swings upwardly from a closed vertical position in the doorway to a horizontal position overhead.

An object of the invention is to provide a mechanism for accurately counterbalancing the door in each of its several positions so that the door travels with a smooth movement and at a steady velocity between open and closed positions.

A further object is to provide a counterbalance with which opening and closing of the door may be initiated with a minimum of effort and with which there is eliminated any abrupt jar or bang when the door reaches either of the ultimate positions.

A still further object is to provide a mechanism of the type indicated including means for predetermining the counterbalancing effect of the spring on the closed door so that upon being unlatched the door will either automatically open or alternatively will require minimum manual effort to initiate opening movement and thereafter will automatically be moved to open position and held thereat by the counterbalance.

A still further object is the provision of a counterbalance which is rugged and durable in construction and which may be easily and quickly installed without requiring the services of a skilled mechanic.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangements of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings:

Figure 1 is a profile assembly view of one of the two counterbalancing mechanisms made in accordance with the present invention and is shown operatively secured to one side of a swing-up door;

Fig. 2 is a plan view of the like counterbalancing mechanism secured to the other side of the door;

Fig. 3 is a profile view of the garage door counterbalanced in the overhead or open position by the counterbalancing mechanism;

Fig. 4 is an enlarged plan view of a portion of the counterbalancing mechanism shown in Fig. 2;

Fig. 5 is a cross-sectional view taken through line 5—5 of Fig. 4;

Fig. 6 is a profile view of a modified type of anchor for the counterbalancing mechanism; and

Fig. 7 is an enlarged perspective view of the modified counterbalance anchor shown in Fig. 6.

In Figures 1 and 2 there is shown as much of a garage or other structure as is necessary to illustrate one embodiment of the invention. The structure includes a doorway or frame comprising two side posts P and a lintel L within which a door D is operably located. Suitable jamb strips or plates 10 are attached rearwardly to the vertical posts P by screws 11 and engage the inner surface of the door so as to define the closed position thereof, and, at the same time, form a satisfactory seal against the entrance of cold air into the garage. Secured to the lintel L is a similar jamb strip 12 which engages the outer surface of the door and provides a similar seal against the entrance of cold air above the door. Adjacent the upper end of the doorway and to each side thereof are rearwardly extending horizontal tracks 14 of any suitable cross-section for supporting the rollers 16 of a pair of trolleys 18, the tracks preferably being of the cross-sectional shape shown in Figs. 1 and 2. The forward ends of these tracks are suitably secured to end brackets 20 which, in turn, are secured to the posts P of the door frame by bolts 21. Adjacent their rear ends the tracks are supported in a horizontal position by straps 22 which are secured to an overhead beam of the garage structure. In the present instance each of the trolleys 18 comprises a metal stamping having a mounting plate 24 which is secured to an upper corner of the door D by suitable bolts 26, and a flange 28 which extends at right angles therefrom and to which is secured an outwardly extending stud 30 constituting a bearing for the anti-friction roller 16 thereof.

The upper edge of the door D is pivotally supported by the pair of trolleys 18 so that as the rollers 16 travel rearwardly on the tracks the lower end of the door swings outwardly and upwardly from its vertical closed position and then inwardly to its horizontal position overhead. To effect movement of the door to the horizontal position overhead the door is supported adjacent its lower end by a pair of swinging arms 32 located at opposite sides of the door and pivotally secured at their lower ends to the door by means of suitable bearing brackets 36. The structures at opposite sides of the door are similar and therefore a description of one will apply to both.

As illustrated in Figs. 1 and 2, the arm 32 is

in the form of an angle bar which may be slightly bent adjacent its normally upper end and is pivotally supported thereat by an anti-friction bearing 40 mounted in a bearing or jamb bracket 42. The bracket 42 comprises a length of angle iron the base leg or web of which is secured to the jamb plate 10 and to the post P of the doorway by means of suitable bolts 44. The other leg or web 43 extends rearwardly therefrom and supports the anti-friction bearing 40. The lower end of the arm is secured, as by spot welding, to a fulcrum piece 46, which is in turn straddled by the bracket 36 and pivoted thereto by means of a pintle 50.

The door is counterbalanced by a pair of coiled springs 52, each interposed and tensioned between one of the fulcrum pieces 46 and an anchor carried by each bearing bracket 42 at a point above the bearing 40. More particularly, each fulcrum piece 46 includes a pair of oppositely disposed webs 47, the lower edges of which are provided with aligned notches 54, the apexes of which constitute suitable seats for the bearing stud 56 of a spring holder or anchor 58.

The anchor 58 is provided centrally with an opening through which a bolt 60 extends so that the head 61 of the bolt bears against the lower edge of the anchor. Threaded on the bolt is a clip 62 which comprises a generally disc shaped member with prongs 64 struck up from its periphery. The distance between opposed prongs is substantially equal to the external diameter of the spring so that the clip 62 may be screwed into the lower end of the spring and the prongs 64 will hold the spring in center position with respect to the bolt. It will be seen that with this arrangement the anchor 58 is pivoted relative to the fulcrum piece 46 so that wear and friction between these parts is reduced. The effective length of the spring may be changed by turning the clip 62 with respect to the spring 52 and thus bringing into operation a fewer or greater number of spring convolutions depending on the direction in which the clip is turned. The tension of the effective length of the spring may be varied by longitudinally adjusting the bolt 60 so as to shorten or increase the distance from the clip to the fulcrum pin or stud 56. The structure thus far described is substantially that illustrated and described in the present inventor's United States Patent No. 2,045,100 issued June 23, 1936, and covering "Overhead door."

According to the present invention, the counterbalancing tension of the spring 52 on the door is at all times applied in the proper direction and amount so that the door is accurately counterbalanced in its several positions and as a result the door moves with a steady velocity through its entire travel and upon reaching either the open or closed positions stops without an appreciable bang or jar and is held thereat by the spring. To accomplish this the upper end of the spring is supported relative to the bearing bracket 42 on a movable anchor located above the anti-friction bearing 40. More specifically, as shown in Figs. 4 and 5, the anchor includes a U-shaped fitting 68, one leg 66 of which is secured to the web 43 of the bracket 42, and the other leg 70 of which carries a headed stud 72 located rearwardly of the bearing 40 and adapted to pivotally support an adjustable lever 74. One end 75 of the lever extends beyond the base 76 of the U-shaped member 68 and the other end carries a stud 78. The upper end of the spring 52 is pivotally secured to this stud 78 as by a clip 80 which in the present instance is generally U-shaped with outwardly curved fingers 81 in which the uppermost convolution of the spring is secured and tensioned. To prevent wear and friction between the clip and the stud a suitable anti-friction bearing 82 is provided therebetween.

The structure thus far described accurately counterbalance and provides smooth movement of the door between the extreme positions and eliminates any tendency of the door to bang or slam into either the open or closed position. An understanding of the manner in which the present structure operates will best serve to point out the advantages of the present invention.

To pull the door from its open to its closed position it is merely necessary to start the door in its movement and thereafter permit the door to automatically swing to closed position. As the door moves from its open position to approximately its half-way open position, that is to a position where the supporting levers 32 are substantially horizontal, the anchor lever 74 pivots from the upright position shown in Figure 3 to the generally horizontal position shown in Figure 4 and, of course, during such time the tension of the springs 52 increases but not to the same extent as would be the case if the pivot 78 were fixed to the bracket 43. As the tension in the spring is increased the component of the door's weight acting against the resistance of the spring increases so that the forces are more or less counterbalanced and thereby insures the door a smooth and steady downward movement. On continued movement of the door the lever 74 reaches a fixed position shown in Figures 1 and 2, and as a result the spring pivots around the now fixed stud 78 so that the spring acts in a direction and under such tension as to cause the door to continue its downward movement at a somewhat decelerated rate and more or less gently come to closed position. Depending upon the setting of an adjustable member 86, whose structure and operation will be hereinafter described, the lever 74 can be stopped at a predetermined position so that when the door is brought to closed position the spring is tensioned in a predetermined amount and direction with respect to the arm 32. When during downward swinging movement of the door the member 86 has stopped the lever 74 in the position shown in Figure 1 the amount of tension in the spring and the forward component thereof is relatively small and the door remains in its closed position. However, a slight outward pressure at the lower end of the door causes it to open and as the door swings up its action is just the reverse of the previously described closing movement. The door will swing up with an accelerated movement and then with a decelerated movement and come to the fully opened position without undo jar or bang and thereafter the springs will hold the door open.

According to the present invention, the aforementioned adjustment plate or member 86 further provides for the setting of the counterbalance so that the door will be automatically opened thereby without the necessity of exerting manual effort on the door. In this connection it will be readily seen by reference to the drawings that the tendency of the counterbalancing spring 52 to automatically open the door is de-

termined by the amount of tension in the spring and the component thereof acting on the door in a forward direction. These factors are respectively controlled by the distance of the stud 78 from the point 56 and the amount of forward offset of the stud relative to the points 40 and 56 when the door is closed. In order to adjustably vary the lowermost angular position to which the stud 78 may move and to thereby predetermine the forward component of the spring on the closed door, there is adjustably secured to the base 76 of the U-shaped bracket 68, as by a bolt and nut 84 and a dowel pin 85 the aforementioned plate 86. The plate has a stop 87 offset from the center line of the plate which engages the outer end 75 of the lever and limits the counterclockwise rotation thereof.

As illustrated in Figs. 1 and 2, the lug 87 is in its uppermost position whereat the pin 78 is only slightly offset and, as previously described, the forward component of the spring tension is insufficient to automatically open the door. However, by repositioning the plate 86 so that the lug is disposed beneath the common center line of the holes therein, the lever can be limited to a lesser counterclockwise rotation, thereby locating the spring anchor stud 78 in the position shown in Fig. 4. In this position, the spring tension is greater and the forward component thereof is sufficient to automatically open the door when it is unlatched. A latch 88 for normally holding the door in the closed position is illustrated in Fig. 2. The latch comprises a casing 89 secured to the door by screws and a reciprocating bolt 90 engageable with the jamb strip 10 to prevent outward movement of the door. Withdrawal of the bolt as by means of the rod 91 releases the door for movement to its uppermost position.

Figs. 6 and 7 illustrate a second embodiment of the present invention. Inasmuch as this embodiment is similar to the heretofore described embodiment illustrated in Figures 1 through 5, like parts are designated by like numbers and parts which are slightly modified but serves substantially the same purpose are designated by the same numerals primed. The main distinction between the two embodiments is that the plate 86' of the second embodiment includes an adjustable stop comprising a screw 96 adapted, as the door moves to open position, to snub the lever 74 at a desired point in its clockwise rotation. The stop further includes a lock nut 98 for locking the screw in a predetermined position of adjustment. The forward end of the screw is engageable with the lever 74 to limit its clockwise rotation substantially as illustrated in the drawings. This modification of the invention is particularly applicable to heavy doors in that it provides the additional advantage of limiting the upward travel of the spring anchor pin 78 and thus provides means for resiliently snubbing the door any predetermined amount sufficient to prevent banging of the door.

It will be observed that the plate 86' must always be mounted on the bracket 68 so as to position the adjustment screw 96 in the uppermost position substantially as shown in the drawings. Thus there is only one operative position for the stop 87' and its engagement with the arm 74 cannot be varied so as to allow a choice of manual or automatic opening of the door provided for in the embodiment illustrated in Figs. 1 through 5. It will be understood however that the same or a modified adjustment might be incorporated in the plate 86' for adjustably limiting the counterclockwise rotation and lowermost position of the anchor stud 78.

In connection with the means for pivotally anchoring the spring 52 to the pin 78 it will be noted that the anchor 80' is a slightly different type than its corresponding member 80 illustrated in Figs. 1 through 5. The anchor 80' is provided with spaced notches 99 which act as an intermittent or broken thread upon which the coils of the spring 52 can be threaded. It will, of course, be understood that either type of anchor 80 or 80' can be used in either modification without departing from the scope of the invention.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. A counterbalance for a door movable from a closed vertical position in a doorway to an open horizontal position overhead, said counterbalance including a swinging arm pivotally secured at one end to the door adjacent the lower edge thereof, a fixed bearing bracket pivotally supporting the other end of the arm, an anchor stud transversely movable on the bearing bracket, a coil spring secured and tensioned between the door and the stud so that said stud is automatically moved during a portion of the travel of the door and adjustable means for limiting the movement of the stud through a predetermined portion of the travel of the door.

2. A counterbalance for a door movable from a closed vertical position in the doorway to an open horizontal position overhead, said counterbalance including an arm disposed behind the door and pivotally secured at one end to the door adjacent the lower edge thereof, a fixed bearing pivotally supporting the other end of the arm so that when the door is in the closed position the arm extends approximately vertically downward from the fixed bearing and when the door is in the fully opened position the arm extends substantially vertically upward, an anchor stud movable between a position above and rearwardly of said fixed bearing and a position forwardly and downwardly thereof, a coil spring secured and tensioned between the door and the stud, and adjustable means for predetermining the forwardmost position of the stud.

3. A counterbalance for a door movable from a closed vertical position in the doorway to an open horizontal position overhead, said counterbalance including a swinging arm pivotally secured at one end to the door adjacent the lower edge thereof, a fixed bearing bracket, a bearing mounted on said bracket for pivotally supporting the other end of said arm substantially midway of the top and bottom of the doorway, a lever pivotally mounted on said bracket above said bearing, an anchor stud carried by the lever for arcuate travel, a coil spring secured and tensioned between the door and the stud, a plate

adjustably carried by the bracket for limiting to a predetermined amount the arcuate movement of the stud during the lower portion of travel of the door.

4. A counterbalance for a door movable from a closed vertical position in a doorway to an overhead horizontal position, including a swinging arm fixedly pivoted at its upper end and pivotally connected to the door adjacent the lower edge of the latter, a counterbalancing spring connected at its lower end to the door adjacent the lower edge of the latter, and a member to which the upper end of said spring is connected, said member being stationary during a portion of the upward movement of the door and thereafter being movable to reduce the tension of the spring.

5. In an overhead door construction, a door frame having a door opening, a one-piece door adapted to close said opening and movable from a vertical closed position to an overhead horizontal position, a pair of rearwardly extending tracks adjacent the upper end of the doorway and disposed on opposite sides thereof, a carrier movable along each track, means for pivotally connecting the door adjacent its upper end to said carriers, a swinging arm disposed behind the door and fixedly pivoted at its upper end and pivotally connected at its lower end to the door adjacent the lower edge of the latter, a counterbalancing spring connected to the door adjacent the lower edge thereof, and a movable pivot for the upper end of said spring and located above the fixed pivot for said arm, said movable pivot being stationary during a portion of the upward movement of the door and being movable by said spring rearwardly of the doorway after the door has been raised to a predetermined extent.

6. A counterbalance for a door movable from a closed vertical position in a doorway to an overhead horizontal position, including a swinging arm fixedly pivoted at its upper end and pivotally connected to the door adjacent the lower edge of the latter, a counterbalancing spring connected at its lower end to the door adjacent the lower edge of the latter, and an anchor for the upper end of said spring pivoted to the frame above the fixed pivot of said arm, said anchor being stationarily positioned forwardly of the line passing through the pivot of said anchor and the point of connection of the lower end of the spring with the door during a portion of the opening movement of the door and thereafter lying on and being movable with said line as the door continues to open.

7. In an overhead door construction, a door frame having a door opening, a one-piece door adapted to close said opening and movable from a vertical closed position to an overhead horizontal position, a pair of rearwardly extending tracks adjacent the upper end of the doorway and disposed on opposite sides thereof, a carrier movable along each track, means for pivotally connecting the door adjacent its upper end to said carriers, a swinging arm disposed behind the door and fixedly pivoted at its upper end and pivotally connected at its lower end to the door adjacent the lower edge of the latter, a counterbalancing spring connected to the door adjacent the lower edge thereof, a lever pivoted to the frame above the fixed pivot of said arm, a stud carried by said lever and to which the upper end of said spring is connected, and means for limiting the arcuate movement of said lever during the lower portion of travel of the door.

8. A counterbalance for a door movable from a closed vertical position in a doorway to an overhead horizontal position, including a swinging frame fixedly pivoted at its upper end behind the doorway and pivotally connected at its lower end to the door adjacent the lower edge of the latter, a counterbalancing spring connected at its lower end to the door adjacent the pivot between said door and arm, said arm and counterbalancing spring being generally parallel when the door is in its lowermost position, a lever fixedly pivoted above the fixed pivot for said arm and having an offset stud to which the upper end of said spring is connected, and means for holding said lever against pivotal movement with said stud spaced forwardly from a line passing through the pivotal point of said lever and the point of connection between the spring and the door during the lower portion of the swinging movement of the door.

DAVID MALCOLM ROBINSON.