

July 23, 1929.

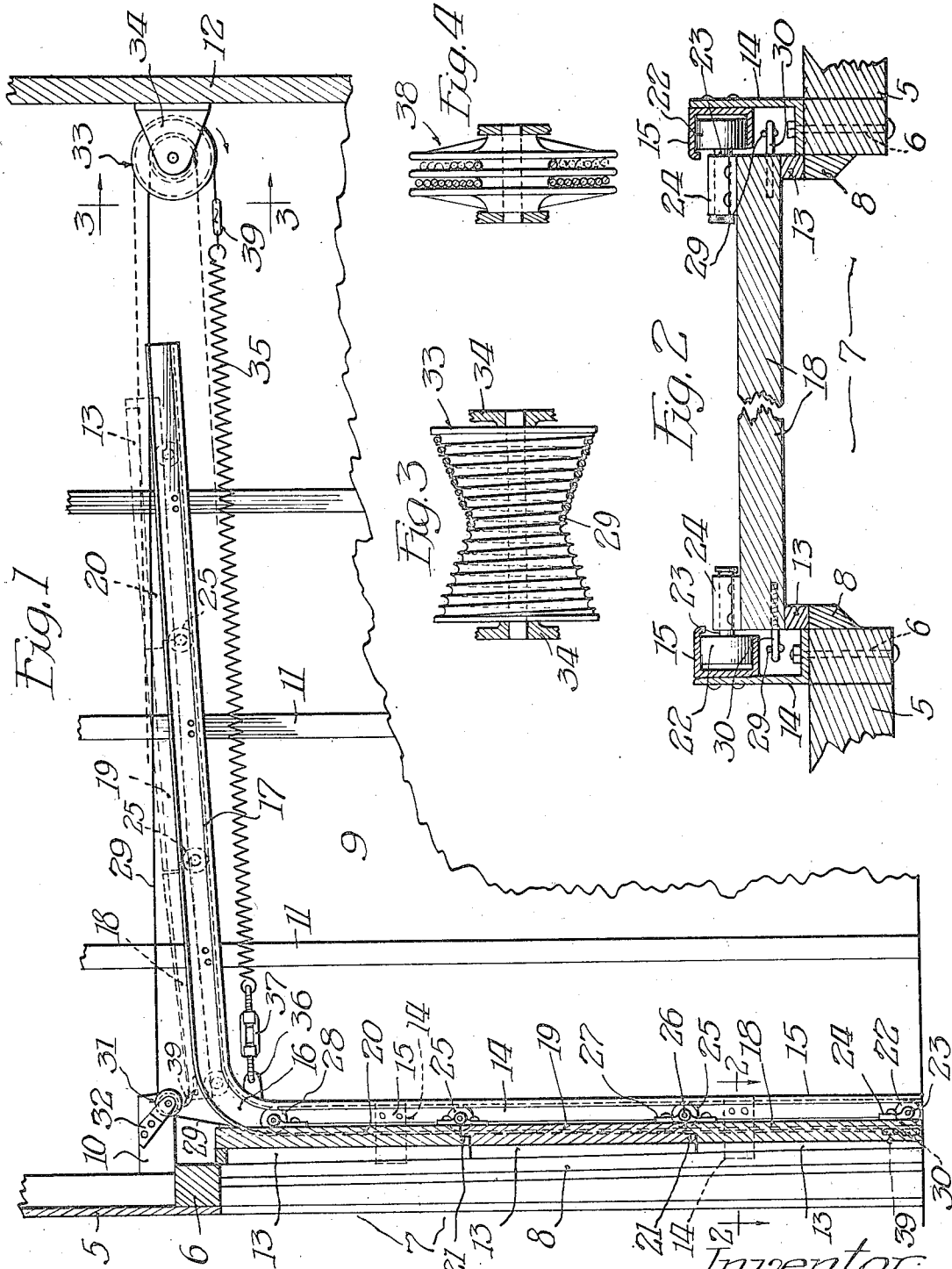
J. H. McKEE

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OVERHEAD GARAGE DOOR

Filed June 28, 1926

2 Sheets-Sheet 1



Inventor:
James H. McKee,

by Fisher, Torle, Clapp & Soans, Attys.

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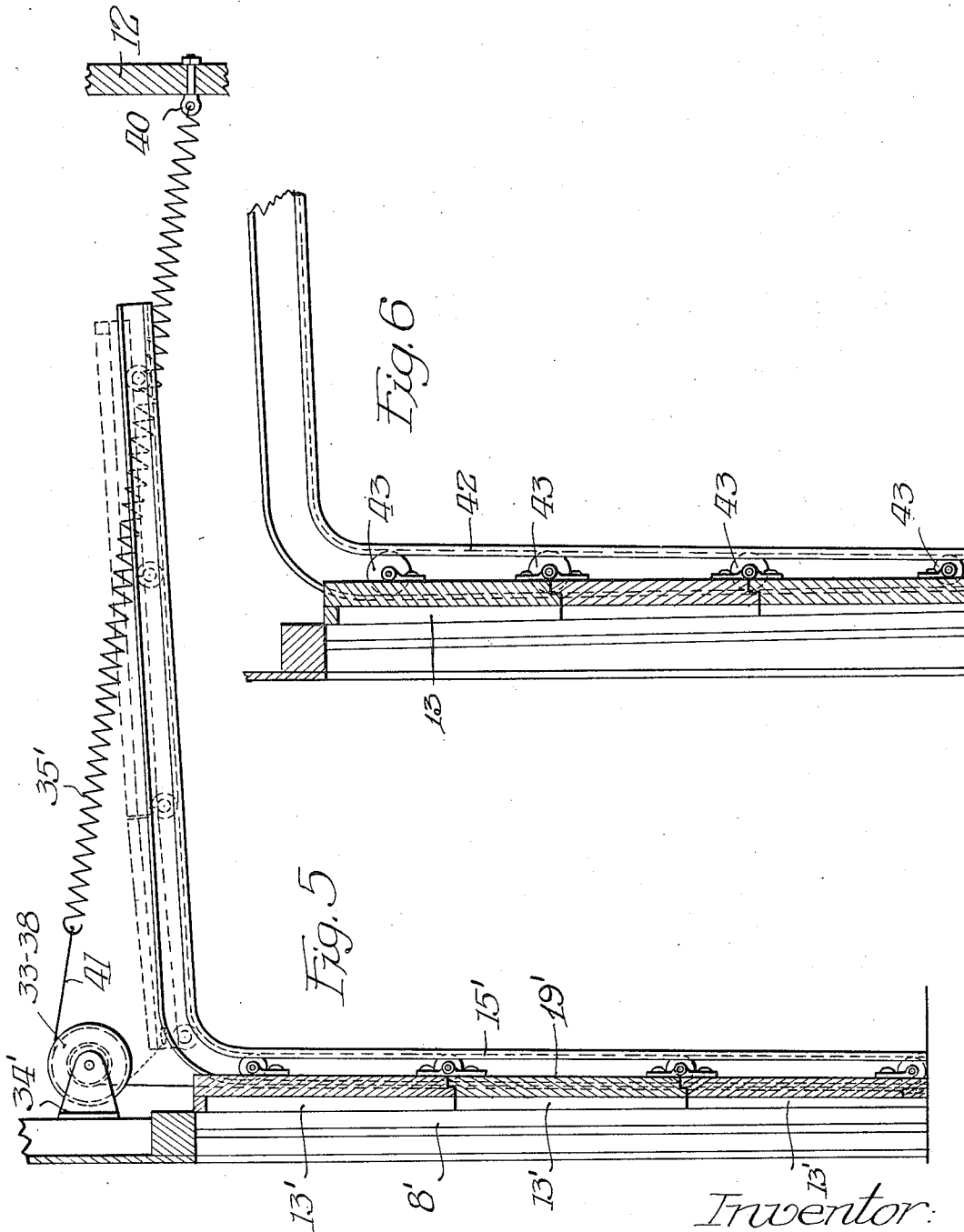
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UNITED STATES PATENT OFFICE.

JAMES H. McKEE, OF HARVEY, ILLINOIS.

OVERHEAD GARAGE DOOR.

Application filed June 28, 1926. Serial No. 118,878.

My invention relates to doors for garages and the like and more especially to a construction of overhead door that is adapted to be disposed overhead in the garage or building when open and to move from a vertical to a substantially horizontal position slightly inclined toward the doorway when moved from a closed to an open position, thereby occupying the upper space in the garage or building which is not used for any particular purpose and greatly economizing in space, as well as clearing the doorway and road or entrance-way for the garage and overcome the many difficulties and objections to ordinary hinged and horizontally sliding or track-hung doors.

By reason of its construction the effective weight of my door is progressively more fully sustained by overhead and substantially horizontal tracks as the door is moved to its open position, and inversely the unsustained load or effective weight of the door progressively increases as it is moved to a closed position at which time no appreciable support for its weight is afforded by my vertical tracks. The principal object of my invention is therefore to provide novel and effective compensating and counterbalancing means whereby the force exerted by said means to sustain the weight of the door in either its open or closed position, or in any intermediate position of the door between its open or closed position, varies in direct proportion to the extent of the load it is called upon to sustain for easy and proper operation of the door. In general terms there are three variable quantities entering into the operation of my door. These are: first, the variable effective load, or effective weight of the door; second, the variable pull exerted by a spring compensating device used in the assembly of the counterbalancing means, and; third the variable leverage exerted by novel and unique sheaves which constitute the controlling equalizing factor between the turning movement of the variable load of the door, and the turning movement of the variable pull or variable tension of the spring. In its broad aspect, the combination and relative cooperation of these three important elements constitutes the principal embodiment of my present invention.

It is of course to be understood that reference to a counterweighting or counterbalancing means shown in the form of a spring embraces a weight, or other counterbalancing means may be employed.

By the term "leverage" is meant the dis-

tance measured from the center of the sheave (or axis of rotation of the sheave) to the center of the cable leading to the door or to the spring.

It is understood, of course, that the tension of the spring is so designed relative to the weight of the door that the desired turning moments of the spring and the door are maintained throughout the opening and closing movement of the door. The determination of these turning moments as the door moves from closed to open position concerns itself with the decreasing load of the door, the decreasing tension of the spring, the increasing leverage of the door and the decreasing leverage of the spring. The design between the elements referred to above, however, is such that the turning moments of the door and the spring are maintained substantially uniform to properly counterbalance the door throughout all points in its travel.

Among the other objects of the invention are to provide a novel counterbalancing or counterweighting means which will uniformly graduate or vary according to the position of the door so that it will act to relieve the operator of excessive strain in opening and closing the door, and especially the former, by providing the greatest leverage or counterbalancing effect for opening the door when the door is closed and the least leverage when the door is open, the leverage uniformly decreasing as the door is raised to open the same and uniformly increasing as the door is lowered to close the same, so that the weight of the door will at all times be sustained and the uniformly variable leverages co-act so that the door will move easily to its open position and easily and quietly to its closed position without slamming or requiring restraint in its closing movement.

Other objects of the invention are to provide a garage or building door which is bodily raised to open the same and is placed in a substantially horizontal overhead position but slightly inclined towards the door opening, to facilitate its opening and closing movements on suitable side tracks or guide rails; to provide a door composed of articulated sections i. e. panels or slats, counterbalanced as described, to readily assume its different positions; to provide means on the sections co-operating with the guide rails or tracks for guiding the door in its movements; to provide means for tightly holding the door when closed to avoid gapping or rattling, as

well as to provide for the operation of the door as a fire-door or automatic closing of the door, preferably of steel or other fire-proof character, in case of fire; to provide a counterweighting means such as counterweights or springs, preferably springs, to counterbalance or sustain the weight of the door accurately and positively; to assist in the lifting or opening thereof, and to prevent sudden dropping or closing of the door, so that it may be easily operated, this counterbalancing means or springs being connected to the door, preferably at opposite sides and the cables caused to operate over compensating drums or pulleys adapted to produce the greatest leverage, i. e. pulling or lifting and restraining force on the door in connection with the counterweighting or counterbalancing means, when the door is closed or nearly closed, and the least counterbalancing effect or effort when the door is open or nearly open, this force gradually and uniformly or regularly reducing or decreasing from its maximum when the door is closed, to its minimum as the door moves up to its open position, and vice versa or from the latter minimum to its maximum as the door moves down to its closed position, thereby evenly and uniformly sustaining the weight of the door and giving the greatest leverage or counterbalancing effect when needed and the least when less is required, graduating to a minimum. This result is preferably produced in connection with the same cable which supports the door and on which the counterbalancing means operates, thereby eliminating separate cables for the counterbalancing means and the door, simplifying the construction, reducing cost, and providing a door leverage which automatically varies or compensates for the load, according to the position of the door, gradually and uniformly decreasing as the door moves upwardly and similarly increasing as the door moves downwardly.

Heretofore, it has been common to provide a variable leverage on the balancing weight, but no one, to my knowledge, has combined in a door balancing or lifting mechanism the idea of varying the leverage of the counterbalancing means and also varying the leverage of the door, that is, combining the two variable leverages, namely, that of the door and that of the weights or springs so that, as the weight of the door is decreasing, the pull of the counterbalancing means formed by the springs or weights is also decreasing and as the door is closed and the effective weight thereof increased the leverage or lever arm of the door is decreased and the leverage of the counterbalancing means comprised by the weights or springs, is increased to properly sustain the weight of the door. In this manner it is possible to have the counterbalancing means substantially equalize the weight of the door at all times and to eliminate the dif-

ferent leverages heretofore present in devices employing pulleys or drums of uniform diameters for the respective cables of the door and counterbalancing means such as disclosed in the patents of the prior art.

A further object of my invention is to provide new and novel means in connection with an overhead door and guiding track for the same, whereby a strip at the top of the door and bevel strips at the sides of the door are employed for making the door opening tight when the door is closed. Should the track be set vertically and the door close down vertically, then the door jamb, frame, or door stops should be set slightly at a forward or outward angle or inclination on the inner face toward the top to match or fit the bevel strips attached to the sides of the door, or if the door jamb, frame, or door stops are set vertically, then the track should set at a slight inward or rearward angle with said door jamb, frame, or door stop and the door close at a slight angle with said door jamb, frame, or door stop, thus permitting the door to pass to its closed position in a free manner without any rubbing or dragging and when the door reaches its closed position the bevel strips will press against the door jamb, frame, or door stops, this making a tight fit and one that easily frees itself when the door is opened.

It is also an object of the invention to generally improve and simplify the mounting of the counterbalancing means and the construction of doors of the type referred to.

Further objects will be apparent as the description proceeds.

In the accompanying drawing:—

Fig. 1 is a longitudinal vertical sectional view of a portion of a garage or other building provided with an overhead door and counterbalancing means constructed in accordance with my invention, the door being shown in closed position in solid lines and in open position in dotted lines.

Fig. 2 is an enlarged fragmentary horizontal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a sectional elevation showing a double sheave or disk wheel adapted to be employed in lieu of the compensating drum shown in Fig. 3.

Fig. 5 is a view similar to Fig. 1 of a modified form of drum and spring mounting, and door tightening means, and

Fig. 6 is a sectional elevation of another door guiding and tightening means.

Referring to the drawings in detail, a garage or other building is shown having a front wall 5 equipped with door frame or jambs 6 providing a doorway 7 which has a door stop 8. The side walls of the garage or building are designated at 9 and may be con-

connected by suitable joints, girders, or rafters and ties. 10 is a bracket or supporting piece, and 11 is either side studding, brackets, or supports hung from the joist, purlins, or ties, while the rear wall or a suitable vertical support arranged at a proper distance from the front wall 5 and at about the same elevation as the top of the doorway 7, is designated at 12. These constructional features of the garage or building form no part of the novelty of the invention and may be varied according to the particular requirements.

Arranged against stops 8 at the inside are sectional tapered closing strips 13, fastened to the door, these strips being thickest at the top and tapering downwardly to the bottom of the front of the garage or door, as clearly seen in the drawings. Disposed inwardly with respect to the door frame and the strips 13 are brackets 14 and guide rails or tracks 15 which extend vertically at the sides 9 and may be of right-angular, channel, grooved, or of other construction. The guide rails or tracks 15 have curved portions 16 at the top extending upwardly and rearwardly into substantially horizontal upper portions 17, which, however, are preferably slightly inclined toward the doorway to give slight impetus to the closing of the door and for fire purposes in the automatic closing thereof, as will be more fully described hereinafter.

The door is preferably of the paneled or slatted type, being composed of a plurality of sections, preferably three in number and indicated at 18, 19, and 20. These sections have co-acting rabbeted edges 21 interfitting to provide a weather-tight joint while allowing the necessary angular movements of the sections relatively in moving from a vertical to a horizontal position or vice versa, owing to the angular movements required in passing over the curved portions 16 of the guide rails or tracks. Anti-friction rollers 22 are provided at the sides and lower edges of the lower section 18, these rollers having their shafts 23 journaled in brackets 24 secured to the inner face of this section of the door and the rollers engaging the retainers or track 15. Similar rollers 25 are mounted on the pivots 26 of hinges 27 connecting the sections 18 and 19 and the sections 19 and 20, the pivots being in line with the edges of the sections so that the wheels will travel in contact with the retaining flanges of the guide rails at the side of the garage or building without shifting of the centers thereof, such as will happen if the pivots were out of alignment with the edges or center of the arcs in which the section swung relatively when the door is moved over the curved portions 16 from a closed to a open position or an open to a closed position. At the same time these rollers permit the door to be moved without undue friction and cause it to press the tapered closing strips 13 against the jamb 6 and stops 8 at the sides

and top of the doorway, whereby the doors are maintained tight when closed, thus giving a desirable weather-tight joint and avoiding gapping or rattling which is so prevalent in ordinary garage or similar doors. A similar roller or track wheel 28 is provided near the upper edge of the upper section 20 but, preferably, in a position adjacent the inwardly curved portions 16 of the tracks or guide rails when the door is closed, as shown especially in Figure 1.

The counterbalancing mechanism includes flexible members or cables 29 which extend down along the side edges of the door and are anchored near the bottom thereof in any suitable manner, as indicated at 30. These cables extend upwardly and are trained over sheave wheels or pulleys 31 journaled in suitable brackets 32 carried by the support 10 or otherwise suitably mounted. These cables are then trained over double compensating drums 33 journaled in brackets 34 secured to the vertical support or rear wall 12 of the garage and have their ends connected to retractile coil springs or other suitable counterbalancing or counterweighting means 35 which have their opposite ends anchored to the front wall of the garage at the frame of the doorway or to the tracks adjacent the curved portions thereof as indicated at 36, preferably with interposed turnbuckle connections 37, although it is to be understood that any other suitable form of adjustable connection may be employed to vary the tension of the springs and to conveniently make the connections.

As will be seen from Figure 1, the double conical compensating drum 33 tapers in opposite directions from the center and the cable 29 is wound thereon to occupy about one-half the length thereof or of its grooved convolutions so that when the door is closed, the cable 29 adjacent the end of the spring 35, which is expanded in this position, will extend around the largest portion of the drum at one end while the cable leading to the door will extend to the smallest or central portion of the drum. Thus as one end winds, the other end will unwind, when, due to the opening of the door from the solid line position shown in Figure 1 to the dotted line position, assisted by the action of the springs 35, the cables from the action of the springs 35 will be trained around the smallest portions of the drums 33 and the cables leading to the door will extend to the largest portions of the drums, two being preferably provided for each door and at each side of the garage or building. Consequently as the leverage exerted by the door—that is, the effective weight of the door itself decreases as it is raised due to the supporting of the panels of the door by the substantially horizontal overhead tracks the balancing force composed of counterweights or springs is likewise varied in order that the two will more

nearly equalize each other in operation—that is, the spring is exerting its greatest counterbalancing effect when the door is closed to equalize and compensate for the weight of the door when it is exerting its greatest weight i. e., when it is in its vertical position with no load sustained by the tracks. This counterbalancing force decreases as the door is raised or opened so that the spring is exerting less force as the effective weight of the door decreases when moved to its elevated position and vice versa. This variation in the effective weight of the door and the counterbalancing or counterweighting effect of the springs is gradual and uniform, this regular graduating variation being compensated for whether gradually and uniformly increasing as the door moves upwardly and the cable moves to the larger portion of the drum, or similarly decreasing as the door moves downwardly and the cable moves to the smaller portion of the drum. This construction causes the door to move uniformly and evenly, so that it may be easily opened or closed and will move quietly to its closed position without slamming.

While I have shown a double conical concave compensating drum, it is to be understood that any suitable compensating variable ratio single or double drum may be employed, two drums being employed where single drums are used and made either spiral or plain, or convex in lieu of a concave drum as shown and described, while instead of having grooved concave or convex faces, said drums may have straight faces. Also, as shown in Figure 4, compensating sheaves or drums may be used, as indicated at 38, one end of the cable or flexible connection winding in one of the sheaves or pulleys of this double disk wheel while the other is unwinding, in order to give the same effect as the double conical or compensating drum 33 just described. If desired, a plurality of fusible links 39 may be positioned in the length of each cable 29 which in conjunction with the inclined upper portions of the tracks will serve to permit the door to automatically close especially where a steel or other fireproof door is used, owing to the breaking of the suspension cable when one of the links melts to permit the door to automatically roll down and close. This construction may be used in various buildings other than garages, such as fireproof warehouses, pier sheds, etc.

It will also be apparent that the device combines two variable leverages, namely, that of the door and that of the balancing means or force provided by the springs so that when the door is closed and the effective weight thereof exerted thereby is greatest, the springs are acting in a large circle or leverage which is geared down to its connection with the door owing to the cables operating on the small portions of the drums or when unwound

from the corresponding portions of the disk wheels where the cables lead off over the guide sheaves or pulleys 31 to the door. As the door is raised and its weight supported on the overhead tracks the load becomes less, the cables leading therefrom are operating on the larger portions of the drum or in larger circles due to the winding thereof on one another with their respective turns on the disk wheels and the leverage of the springs is less by reason of the cables extending therefrom operating on the smaller portions or circles of the drums or disk wheels on unwinding.

It is also to be understood that the cables are continuous from the points of connection to the door to the points of connection with the springs constituting the counterweighting or balancing forces, both as to the drums and the double sheaves or disk wheels. In connection with the latter, a convenient means is to extend the cable across or through the middle flange of the double disk wheel. The action of the device is facilitated by the slight inclination of the upper portions of the tracks which extend to positions slightly below the top of the doorway and door when closed, adjacent to the door, to positions slightly above the doorway at their inner ends. Of course, the cables may be in two sections between the door and drums and anchored to the latter to give the same results. Where the doors are very large, the drums may be power or motor driven to open and close the door, instead of the door being manually moved. Also, any suitable fastening and locking means may be provided for the door as is common in the art.

In the form of the invention shown in Figure 5, instead of having the door stop 8 set at an angle or forward inclination and with the tracks 15 at the sides of the doorway disposed vertically together with the tapered strips 13 for tightening the door when closed, the door stop 8' is set vertically while the track 15' is set at an angle or inclination inwardly or rearwardly and the door 19' follows this track so that the closing strips 13' will tighten the door when closed in the same manner as heretofore described. Furthermore, instead of having the drum mounted on a support 12 at or near the rear of the garage, either the drum 33 or double sheave 38 may be mounted on a bracket 34' at the front of the garage and the spring 35' is anchored to the support 12 as indicated at 40 and connected to the cable 41 which extends around the drums or sheaves and is anchored to the sides of the door near the bottom in the same manner as heretofore described.

In either instance the door will be guided in its movements by the tracks or guide rails and by means of the strip at the top of the door and the beveled strips at the side thereof made in lengths or sections to correspond with the sections of the door, the door will be tightly closed against the door frame or stops with-

out any rubbing or dragging and when the door reaches its closed position it will be held tight by the beveled strips at the side pressing against the door jamb, frame, or stops, thus producing a tight fit and one that will easily free itself when the door is open.

In Fig. 6 of the drawings either of the constructions heretofore described may be employed with or without the stops, but preferably the tapered strips are omitted and the tracks or guide rails 42 are of tapered or funnel-shaped formation, while the rollers 43 are gradually increased in diameter toward the top so as to give a tightening effect where- by the door is forced against its seat or stops when in closed position.

While I have shown and described my invention in a preferred form, I am aware that various modifications and changes may be made without departing from the principles of the invention, the scope of which is to be determined by reference to the appended claims.

I claim as my invention:

1. In a device of the class described, a movable door, supporting means for the door becoming gradually more effective to sustain the weight of the door as the door is moved from its closed position to its open position, counterbalancing means, a connection between the door and counterbalancing means, said counterbalancing means formed to gradually exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating sheave, said connection wound about said sheave, said sheave being so constructed that as the door moves from closed to open position that portion of the connection leading from the door is wound upon a greater diameter relative to the center of the sheave while that portion of the connection leading to the counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the sheave thereby to vary the leverages through which the door and counterbalancing means act upon each other to maintain substantial equilibrium between the two.

2. In a device of the class described, a movable door, a track for the door having substantially vertical and horizontal portions and becoming gradually more effective to sustain the weight of the door as the door is moved from its closed position to its open position, counterbalancing means, a cable connecting the door with the counterbalancing means, said counterbalancing means formed to gradually exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating sheave, said cable wound about said sheave, said sheave having varying diameters upon which the cable is wound so that the portion of the cable leading from the door is wound upon a greater diameter relative to the cen-

ter of the sheave while that portion of the cable leading to the counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the sheave thereby to vary the leverages through which the door and counterbalancing means act upon each other to maintain substantial equilibrium between the two.

3. In a device of the class described, a door movable from a substantially vertical position when closed to an overhead substantially horizontal position when open, a track for the door having substantially vertical and horizontal portions and becoming gradually more effective to sustain the weight of the door as the door is moved from its closed position to its open position, spring counterbalancing means, a cable connecting the door with the spring counterbalancing means, said spring counterbalancing means formed to gradually exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating sheave, said cable wound about said sheave, said sheave being so constructed that as the door moves from closed to open position that portion of the cable leading from the door is wound upon a greater diameter relative to the center of the sheave while that portion of the connection leading to the counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the sheave thereby to vary the leverages through which the door and counterbalancing means act upon each other to maintain substantial equilibrium between the two.

4. In a device of the class described, a door movable from a substantially vertical position when closed to an overhead substantially horizontal position when open, supporting means for the door becoming gradually more effective to sustain the weight of the door as the door is moved from its closed position to its open position, spring counterbalancing means, a connection from the door to the spring counterbalancing means, said spring means formed to gradually exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating device, said connection wound about said compensating device, said device being so constructed that as the door moves from closed to open position that portion of the connection leading from the door is wound upon a greater diameter relative to the center of the device while that portion of the connection leading to the spring counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the device thereby to vary the leverages through which the door and the counterbalancing spring act upon each other to maintain substantial equilibrium between the two.

5. In an overhead garage door, a supporting track becoming gradually more effective

to sustain the weight of the door as the door is moved from the closed to the open position, a spring counterbalance, a cable from the door to the spring, said spring formed to exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating sheave having a central portion of least diameter and gradually increasing in diameter toward its ends, said cable wound about the sheave, with the portion thereof leading from the door wound upon the greater diameter when the door moved from closed to open position, while the portion leading to the spring is correspondingly unwound therefrom to the smaller diameter thereby to vary the leverages through which the door and spring act on each other to maintain a substantial equilibrium between the two.

6. In a device of the class described, an overhead garage door formed with hinged sections, and movable from a substantially vertical position when closed to a substantially horizontal, overhead position when open, a track for supporting the door and becoming gradually more effective to sustain the weight of the door as it is moved to its open position, and each of said sections having inclined strips at their edges adapted to align to form an inclined or weighing strip on each side of the door when the door is in its vertical closed position thereby to maintain a tight fit between the door and its jamb.

7. In a device of the class described, an overhead garage door formed with relatively movable sections, a track for supporting the door, and complementary inclined strips at each side of each section and adapted to align with each other to form a uniformly inclined strip on each side of the door when the door is in closed position thereby to wedge the door and provide a tight fit between the door and its jamb.

8. In a device of the class described, a movable door, supporting means for the door becoming gradually more effective to sustain the weight of the door as the door is moved from its closed position to its open position, counterbalancing means, a cable connecting the door with the counterbalancing means, said counterbalancing means formed to gradually exert its greatest effect in sustaining the weight of the door as the door is moved from its open to its closed position, a compensating drum, said cable wound around said drum, said drum being so constructed that as the door moves from closed to open position that portion of the cable leading from the door is wound upon a greater diameter relative to the center of the drum, while that portion of the cable leading to the counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the drum thereby

to vary the leverages through which the door and counterbalancing means act upon each other to maintain substantial equilibrium between the two.

9. In an overhead door of the class described, a sectional door, substantially vertical tracks for guiding the door in its open and closed positions and having substantially horizontal upper portions to substantially support the door when open, the effective load or weight of the door being progressively more fully sustained by the substantially horizontal track portions as the door is moved to its open position and inversely the unsustained load or weight of the door progressively increasing as the door is moved to a closed position, and counterbalancing means for the door including cables connecting the same to the door and drums on which the cables are reversely wound or unwound, at least one of said drums being so constructed that as the door moves from closed to open position, that portion of the cable leading from the door is wound upon a greater diameter relative to the center of the drum, while that portion of the cable leading to the counterbalancing means is correspondingly unwound therefrom to a smaller diameter relative to the drum thereby providing a reversely and gradually variable lever arm for its cable.

10. In an overhead garage door, a sectional door, tracks having substantially vertical portions and slightly inclined upper portions with curved portions connecting the same, said tracks adapted for guiding the door to open and closed positions, so that the door will be engaged in the vertical portions when closed and partially supported by the slightly inclined upper portions when opened, the effective weight of the door being progressively more fully sustained as the door is moved to its open position and the unsustained weight of the door progressively increasing as the door is moved to a closed position, counterbalancing means for the door, cables connected to the door, drums on which the cables are reversely wound or unwound, at least one of said drums being so constructed that as the door moves from closed to open position, those portions of the cables leading from the door are wound upon a greater diameter relative to the axes of the drums, while those portions of the cables leading to the counterbalancing means are correspondingly unwound therefrom to a smaller diameter, thereby providing reversely and gradually variable lever arms for the cables.

11. In an overhead garage door, a sectional door, tracks having substantially vertical portions and slightly inclined upper portions with curved portions connecting the same, said tracks adapted for guiding the door to open and closed positions, so that the door

will be engaged in the vertical portions when closed and partially supported by the slightly inclined upper portions when opened, the effective weight of the door being progressively more fully sustained as the door is moved to its open position and the unsustained weight of the door progressively increasing as the door is moved to a closed position, counterbalancing means for the door, cables connected to the door, drums on which the cables are reversely wound or unwound, at least one of said drums being so constructed that as the door moves from closed to open position, those portions of the cables leading from the door are wound upon a greater diameter relative to the axes of the drums, while those portions of the cables leading to the counterbalancing means are correspondingly unwound therefrom to a smaller diameter, thereby providing reversely and gradually variable lever arms for the cables, and guide pulleys for the cables connected to the door, said pulleys being supported above and set back or inwardly from the door to cause the door to clear the door opening when raised to an open position.

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