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OVERHEAD DOOR CONSTRUCTION

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Fig. 1

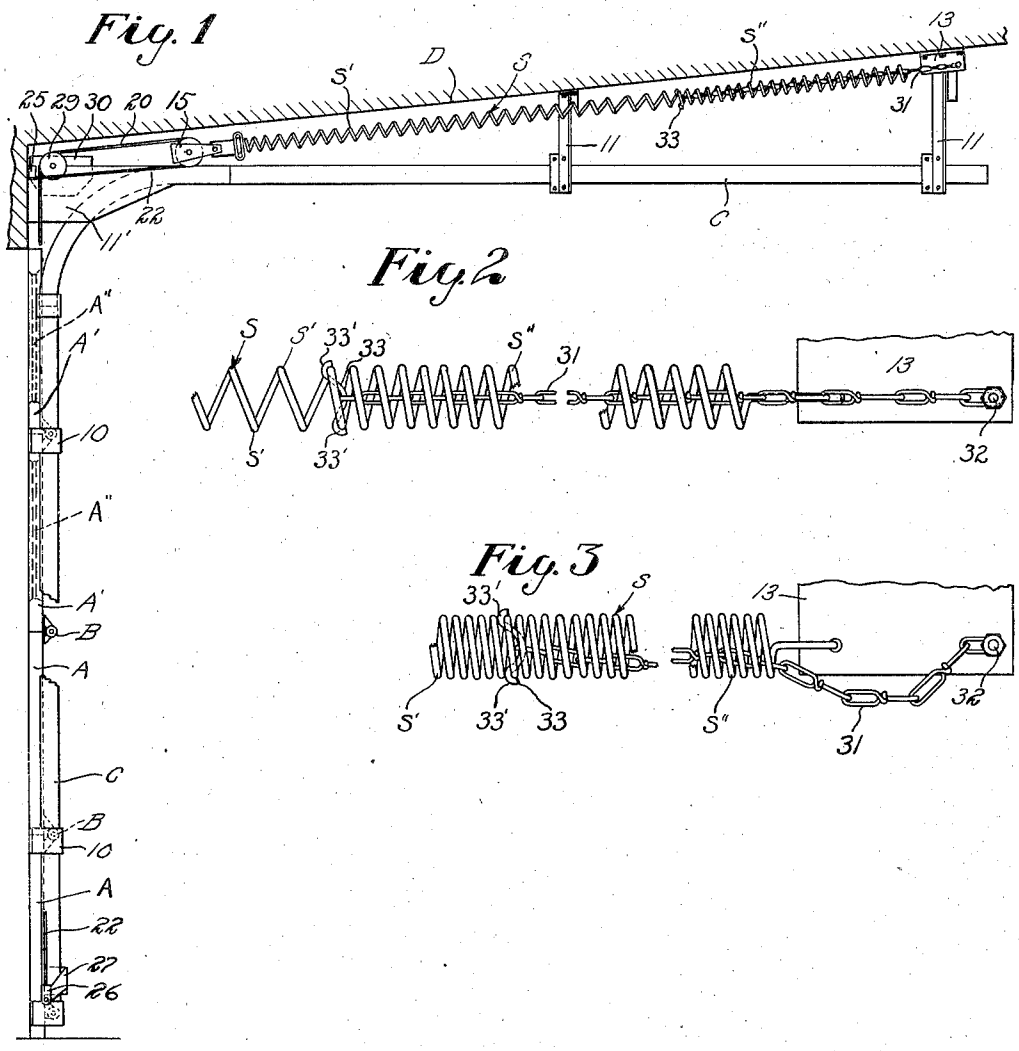


Fig. 2




Fig. 3




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## OVERHEAD DOOR CONSTRUCTION

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9 Claims. (Cl. 20—20)

This invention relates to overhead doors and, more particularly, to a means for counterbalancing an articulated type of top heavy door composed of a plurality of panels or sections and adapted to be slidably moved in a track from a horizontally disposed overhead open position to a vertical closed position.

Heretofore, articulated doors of the overhead type have been counterbalanced so that they could be manually shifted to a vertical closed position and to a horizontal open position. Many doors of this type are provided with windows in their upper panels making these upper panels very much heavier than the other door panels and resulting in a top heavy door. During the final closing and initial opening movements of a door of this type, the upper panels shift from a horizontal to a vertical position, and vice versa, with the result that the effective weight of the door does not proportionately change but suddenly changes through a great extent, providing an unbalanced condition and requiring a large amount of additional manual effort to initially open the door and causing the door to slam shut in its final closing movement.

It is, therefore, the aim of my invention to provide means for a top heavy door of the vertical and overhead sliding type which substantially uniformly counterbalances the door at all times irrespective of the position of the door.

A further aim of the invention resides in the provision, in an overhead door construction of the character described, of a unitary resilient spring at each side of a top heavy door which uniformly counterbalances the door at all times.

A further object of this invention resides in the provision of springs for a door of the character described which are effectively controlled in their operative characteristics in response to predetermined positions of the door during its closing and opening movement.

A still further object of my invention resides in the provision of a very simple and economical yet effective counterbalancing mechanism for a top heavy door, and the adjustment of which to properly perform its function may be readily determined; the characteristics of the proposed door installation being known, while, at the same time, permitting of ready adjustment at the time of installation so as to meet conditions which may arise in the field.

With these and other objects in view, my invention resides in the unique construction and the combination of members hereinafter fully described, illustrated in the accompanying drawing, and referred to in the claims appended hereto; it being understood, of course, that various changes in the general form, proportion, and size, as well as other minor details of construction lying within the scope of the claims, may be resorted to without departing from the spirit of the invention or sacrificing any of its advantages.

In the drawing illustrating one embodiment which the present invention may take and wherein like numerals indicate like parts:

Figure 1 is a side elevation showing one application of my invention to an articulated overhead sliding door;

Fig. 2 shows the extended position of a door balancing spring when the door is in a vertical closed position; and

Fig. 3 shows the retracted position of the same spring when the door is in an overhead open position.

In accordance with my invention, I have provided a sliding articulated overhead type of door construction, and, more particularly, a sliding door having horizontally disposed lower panels or sections A and one or more upper panels or sections A' hinged at their abutting edges and provided with guide rollers B at the sides of the door movable in tracks C respectively located at each side of the doorway. Panels A' preferably have windows A'' therein making these panels much heavier than the lower panels A and resulting in a top heavy door construction. In accordance with usual construction, the tracks each have a vertical portion to guide the door into a closed position in the wall of a building and a horizontal overhead portion connected to the top of the vertical portion by a curved track section to guide the door into an open position. If desired, this construction may be generally similar to the showing in my prior Patent No. 2,045,101 issued on June 23, 1936. The vertical track portions are suitably secured in position as by brackets 10 secured thereto and to the wall of the building, and the horizontal track portion is fastened to the lower end of the brackets 11 secured at their upper ends to the ceiling D. The curved track portion is suitably supported as by a bracket 11' secured to the wall of the building.

For the purpose of counterbalancing the door, there is provided a tension spring S which may be located as desired. By preference, there are two such springs, one at each side of the door, and these springs may be horizontally disposed as shown or may be vertically disposed along the side of the door opening. The spring is anchored at one end, as, for example, to an anchor plate 13

secured to the ceiling, and the other end of the spring is pivotally connected to a traveling pulley 15 about which passes a cable 20, one end of which is anchored to the building, as at 25, and the other end of which is anchored, as at 26, to a bracket 27 secured to the lower edge of the door. The cable passes over a sheave 29 supported on a bracket 30.

In the operation described, if the upper panels A' of the doors were generally similar in weight to the lower panels A, the springs could be utilized throughout their entire effective lengths to uniformly counterbalance the door throughout its entire extent of movement from a horizontal to a vertical position, and vice versa. However, in the illustrated construction, the upper door panels A' are provided with the plate glass windows A'', making these upper panels very heavy in proportion to the rest of the door panels and providing a top heavy door, with the result that during the closing movement of the door the effective weight of the door is suddenly and rapidly increased as the panels A' pass over the curved sections of the track and into the vertical track. Similarly, the effective weight of the door suddenly decreases during the opening movement of the door while the upper panels A' pass over the curved sections of the track and into the horizontal track sections. In the instance of closing such a top heavy door, the door would close with a bang and considerable manual effort would be necessary to open the door to a position where the spring could again counterbalance the door as it is moved to a full open position.

In accordance with the present invention, I have provided an improved arrangement for a top heavy door whereby the springs throughout their entire effective lengths are operative to counterbalance the door during its closing movement and until the heavy door section or sections start to pass over the curved track portions and also to counterbalance the door in its opening movement after the top heavy sections have passed into horizontal position, and whereby a more limited length of the springs is effective for counterbalancing the door during the remainder of its opening and closing movements. In effect, the arrangement provides each spring S with two portions S' and S'', both portions being simultaneously operative when the effective weight of the door is less than a predetermined amount and only portion S' being operative when the effective weight of the door exceeds that amount. More particularly, referring to the drawing, I provide an improved arrangement for rendering the rear portions S'' of the spring ineffective when the door has reached a point where the top heavy section is located on the curved portions of the track. This means, in the present illustrated disclosure, is in the form of a chain 31 anchored, as at 32, to the angle plate 13 and secured at its forward end to a clip 33 adapted to be adjustably anchored to the spring intermediate of its ends.

In the present instance, the clip is in the form of a yoke having curved fingers 33' receiving the convolutions of the spring. It is clear that the clip may be adjusted longitudinally of the spring and along the convolutions thereof by merely turning the clip with respect to the axis of the spring. It will be appreciated that during the installation of my overhead door construction with the weights of the door sections and the characteristics of spring S known, it will be a simple matter to calculate the required position of the clip on the spring. The clip will not tend to move out of its preadjusted position during door movement since the spring convolutions will clamp thereagainst when the door is open, and when the door is closed the spring will extend and be frictionally engaged by the clip.

It will thus be noted that as the door is initially moved from an open to a closed position, each chain 31 will be slack as shown in Fig. 3, permitting the entire effective lengths of spring S to counterbalance this initial door movement. When the top heavy sections of the door start to descend around the curved track onto the vertical track portion, the door will suddenly increase in weight and at a much faster rate than when the lighter sections were passing around the curve. To counteract this sudden increased rate of additional door weight, the chains become taut at this time, causing the rearward portions S'' of springs S to become inactive. As the door now moves further towards a closed position, the forward spring portions S' which are not restrained by the chains and clips will cooperatively stretch at an increasing rate since there will be less coils now actively pulling on the door. In view of the fact that there are fewer coils operative at this time, the pull per inch of spring elongation will increase at a faster rate and thus compensate for the increased rate at which the door gains weight when the heavy sections thereof enter into the vertical plane. When the door is opened, the forward portions S' of the springs counterbalance the door until the heavy sections A' pass around the curved track portions at which time springs S have contracted sufficiently to release the tension on chains 31 so that the entire effective lengths of the springs will again serve to counterbalance the remaining door sections.

It is apparent that in case of very heavy large doors, more than one spring may be employed at each side of the door. It is also apparent that the springs need not necessarily be positioned in a general horizontal plane, and each spring may be of more than one part.

I claim as my invention:

1. In an overhead door construction, a door, tracks guiding the door movement from a vertical closed position to a substantially overhead open position, spring means counterbalancing the door, and restraining means engaging the spring means intermediate the ends thereof and reducing the effective operative portion of said spring means after the door reaches a predetermined position in its movement.

2. In an overhead door construction, an articulated door, tracks guiding the door movement from a vertical closed position to a substantially overhead open position, coiled tension spring restraining means counterbalancing the door, and means operatively connected to a portion of said spring means intermediate the ends thereof reducing the effective length of said spring means when the door reaches a predetermined position in its movement.

3. In an overhead door construction, tracks having a vertical portion and a horizontal portion interconnected by a curved portion, an articulated door having a plurality of pivotally connected sections guided by said tracks from a vertical closed position to a substantially overhead open position, a coiled tension spring anchored at one end and having its other end connected to the door, and means associated with the coil of the spring and intermediate the ends thereof and reducing the effective operating por-

tion of said spring after it has become expanded to a predetermined extent.

4. In an overhead door construction, a pair of tracks each having a vertical section, a horizontal section and an interconnecting curved portion; an articulated door having a plurality of pivotally interconnected sections guided by said tracks and movable therein to a horizontal overhead position and to a vertical closed position, and counterbalancing means including a spring fixed at one end and connected at its other end to said door, restraining means fixed at one end and connected at its other end to said spring intermediate of the ends thereof for rendering a portion of the fixed end of said spring ineffective after the door reaches a predetermined position in its closing movement, and means to adjustably regulate said ineffective spring length.

5. In an overhead door construction, a pair of tracks each having a vertical section and a substantially horizontal section interconnected by a curved portion, an articulated door having a plurality of pivotally connected sections guided by said tracks and movable from an overhead, substantially horizontal open position to a vertically closed position, and counterbalancing means including a pair of cooperating coiled tension springs respectively fixed at one end and connected at their other ends to support the door, said door having an upper section heavier than said other sections and making the door top heavy, and means effectively limiting the operative lengths of each spring when said heavy section enters the vertical tracks, thus causing the tension of the effective portion of the springs to increase at a faster rate to compensate for the sudden additional weight of the door.

6. In an overhead door construction, a pair of tracks each having a vertical section and a substantially horizontal section interconnected by a curved portion, an articulated door having a plurality of pivotally connected sections guided by said tracks and movable from an overhead, substantially horizontal open position to a vertical closed position, counterbalancing means including coiled tension springs respectively disposed adjacent the tracks and fixed at one end, said springs being respectively connected at their other ends to the side edges of the door to counterbalance the weight of the door, said door having an upper section heavier than the other sections, means limiting the operative length of the springs to a predetermined extent when the heavy section enters the vertical tracks and suddenly increases the weight of the door, and means to adjustably control the extent of each operative spring length whereby the resilient tension of the springs will increase at a sufficiently faster rate to continue to counterbalance the sudden increased weight of the door in its downward movement.

7. In an overhead door construction, a pair of tracks each having a vertical section, a horizontal section, and an interconnecting curved portion; an articulated door having a plurality of pivotally interconnected sections guided by said tracks and movable therein to a horizontal overhead position and to a vertical closed position, a counterbalancing spring located adjacent each horizontal track section, means rigidly securing each of said spring ends, flexible connections between the other ends of said springs and a lower side portion of the door, and means limiting the extent of expansion of a portion of each spring whereby the load of the door will be supported by a predetermined and shorter effective spring length, causing a greater spring resistance after the door reaches a predetermined position in its downward movement.

8. In an overhead door construction, a pair of tracks disposed to the side edges of a door and each having a vertical section interconnected with an overhead horizontal section by a curved portion, said door having articulated pivotally connected sections guided by said tracks to a horizontal overhead position and to a vertical closed position, a counterbalancing coiled tension spring associated with each side edge of the door, said springs being respectively fixed at their rearward ends and connected to the lower side edges of the door at their forward ends, clips respectively engageable within the convolutions of said springs intermediate of their ends, and chains respectively extending through a portion of said springs and connected at one end to said clips and fixed at their opposite ends, said chains and clips serving to restrain the rearward ends of said springs from expansion beyond a predetermined extent whereby the door will be supported by the tensioned resistance of the forward ends of said springs after it reaches a predetermined position in its downward movement.

9. In an overhead door construction, a pair of tracks having vertical sections and substantially horizontal sections, an articulated door having a plurality of pivotally connected sections guided by said tracks from an overhead substantially horizontally open position to a vertically closed position, a set of counterbalancing coiled tension springs at each side of the door, each set of springs being respectively fixed at one end and connected at the other end to resist closing movement of the door, said door being provided with an upper top-heavy section, and means limiting the extent of operative portions of each of said sets of springs when the top-heavy section starts its downward movement, causing the tension of said effective spring portions to suddenly increase and counterbalance the sudden additional weight of the door.

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