

[54] **DRAWER SLIDE ASSEMBLY FOR SELF-CLOSING DRAWER**

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[22] Filed: **July 6, 1971**

[21] Appl. No.: **160,008**

[52] U.S. Cl. .... **308/3.8, 312/348**

[51] Int. Cl. .... **F16c 21/00**

[58] Field of Search ... **308/3.8, 6; 312/341, 343, 346, 312/347, 350, 349, 348; 85/41; 108/102, 143; 211/162**

[56] **References Cited**

**UNITED STATES PATENTS**

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**FOREIGN PATENTS OR APPLICATIONS**

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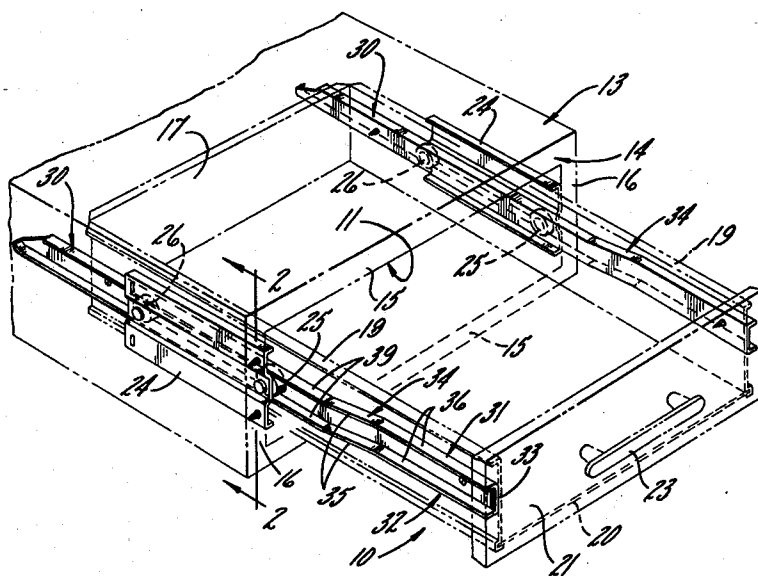
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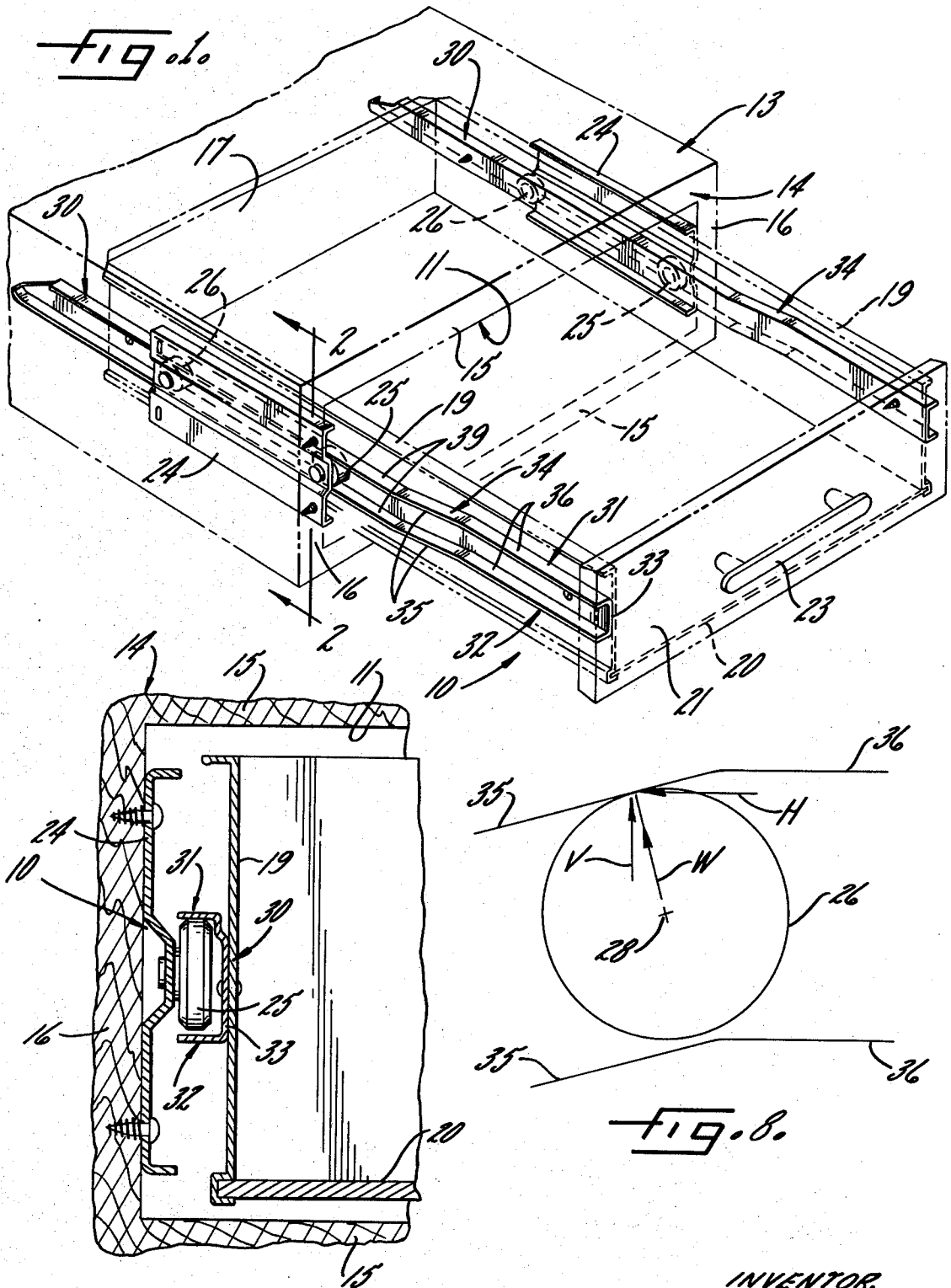
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[57] **ABSTRACT**

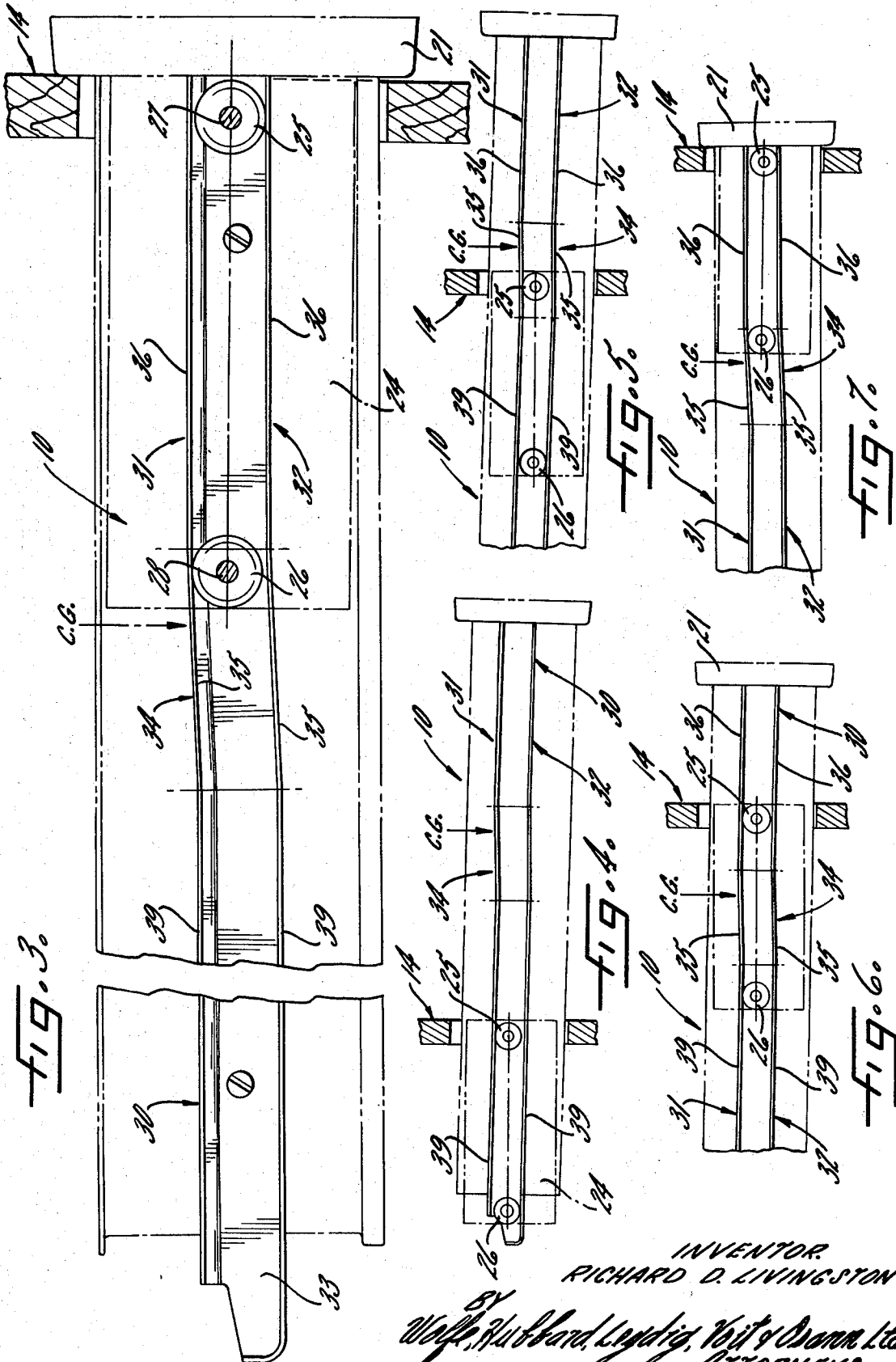
Tracks are secured to the sides of a drawer and ride along sets of front and rear rollers at the front of a cabinet to guide the drawer for back and forth sliding in the cabinet. Downwardly inclined ramps are formed intermediate the ends of the tracks and act upon the rear rollers to cause the drawer to pivot about the front rollers to close the drawer automatically with an improved and more positive self-closing action.

**7 Claims, 8 Drawing Figures**





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## DRAWER SLIDE ASSEMBLY FOR SELF-CLOSING DRAWER

### BACKGROUND OF THE INVENTION

This invention relates to a drawer slide assembly for supporting and guiding a drawer for back and forth sliding in an opening in a cabinet and, more particularly, to an assembly of the type which effects automatic closing of the drawer as the latter approaches its closed position and which also tends to hold the drawer in the closed position. The invention has even more specific reference to a front suspension assembly of the type in which pairs of front and rear anti-friction rollers are attached to the front of the cabinet adjacent the opening therein and serve to guide elongated tracks secured to opposite sides of the drawer, the tracks being formed with so-called "down ramps" which act in conjunction with the weight of the drawer to cause self closing of the drawer. Drawer slide assemblies somewhat similar to that under consideration herein are disclosed in U.S. Pat. Nos. 3,104,142; 3,574,421 and 3,574,437.

### SUMMARY OF THE INVENTION

The primary aim of the present invention is to provide a new and relatively simple front suspension drawer slide assembly of the above character which, when compared with prior assemblies of the same general type, effects better automatic closing of the drawer and which causes positive self closing even when the weight of the drawer and its contents are concentrated near the front of the drawer.

A more detailed object is to achieve the foregoing by uniquely locating the down ramps intermediate the ends of the tracks in such a position that the down ramps act on the rear guide rollers and cause the rear of the drawer to pivot downwardly about the front rollers as an incident to closing thereby to enable the weight of the drawer to act through a longer moment arm and to be used more effectively to move the drawer to a completely closed position.

These and other objects and advantages of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view of a cabinet and a drawer equipped with a new and improved drawer slide assembly embodying the novel features of the present invention.

FIG. 2 is an enlarged fragmentary cross section taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is an enlarged vertical cross section taken longitudinally of the drawer and showing the latter in a closed position.

FIGS. 4 to 7 are diagrammatic views showing successive positions occupied by the drawer in moving from a nearly fully open position to a fully closed position.

FIG. 8 is a diagrammatic view showing the reaction force exerted by one of the rear rollers on the track in the closed position of the drawer.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration, the invention is embodied in a drawer 10 which is supported for back and forth sliding within an opening 11 in a cabinet 13, the opening being defined by a face frame 14 attached to the front of the cabinet and having top and bottom members 15 and opposed vertical side members 16. In this instance, the drawer includes a rear panel 17 (FIG. 1) and integral side panels 19 formed of aluminum, a bottom panel 20 made of imitation wood, and a decorative front panel 21 made of comparatively heavy natural wood and equipped with a metal pull 23.

To support the drawer 10 for back and forth sliding within the cabinet 13, brackets 24 are attached to the inner edges of the vertical face frame members 16 and each journals a pair of front and rear anti-friction rollers 25 and 26 for turning about horizontal axes 27 and 28 (FIG. 3) disposed in a common plane which is generally horizontal although, in certain instances, the rear rollers may be spaced just slightly downwardly from the front rollers. Elongated tracks 30 are secured to the side panels 19 of the drawer and ride along the rollers as the drawer is moved back and forth. Each track is of outwardly opening U-shaped cross section and defines a channel within which the rollers fit, the track including upper and lower outwardly projecting flanges 31 and 32 (FIGS. 2 and 3) bridged by a upright plate 33. The vertical spacing between the flanges is approximately fifteen-sixteenths inch in this particular instance and is about one-sixteenth inch greater than the diameter of the rollers so that the tracks may ride along the rollers without binding.

Each track 30 is formed with a downwardly inclined portion 34 (FIGS. 1 and 3) commonly called a "down ramp." The purpose of the down ramps 34 is to cause the drawer 10 to close automatically (i.e., to self close) upon being pushed a predetermined distance into the cabinet 13 and also to retard free opening of the drawer so that the latter will tend to remain in its closed position. Acting in conjunction with the weight of the drawer and its contents, the down ramps cause the rear of the drawer to pivot downwardly as the drawer approaches its closed position and such pivoting enables gravity to move the drawer the remaining distance toward the closed position.

The present invention is based upon my discovery that more effective and positive self closing of the drawer 10 can be achieved by spacing the down ramps 34 a predetermined distance from the front ends of the tracks 30 so that, as the ramps pass rearwardly across the rear rollers 26, the rear end of the drawer will drop and pivot downwardly about the front rollers 25 to create a force for moving the drawer to its closed position. As a result of locating the down ramps to cause the drawer to pivot about the front rollers, an increase is effected in the length of the moment arm through which the weight of the drawer acts to pivot the drawer downwardly and draw the drawer closed. Accordingly, the weight of the drawer is utilized more effectively to create a positive closing force of greater magnitude than has been possible heretofore with prior arrangements and effective self closing of the drawer is achieved even when the weight thereof is concentrated well toward the front.

More specifically, each down ramp 34 herein is formed by downwardly and rearwardly inclining approximately 3-inch lengths of intermediate sections 35 (FIG. 3) of the flanges 31 and 32 through an angle of slightly less than 2° from the horizontal so as to effect a drop of about three thirty-seconds inch from the front to the rear of the intermediate sections 35. The flanges also include front horizontal sections 36 which are disposed forwardly of the inclined intermediate sections 35 and which are approximately 6 inches in length when the tracks are used with rollers 25 and 26 whose axes 27 and 28 are spaced horizontally from one another by a distance of 5¼ inches. In the closed position of the drawer 10, the front edges of the front rollers 25 are located at the extreme front of the front horizontal sections 36 while the axes 28 of the rear rollers 26 are located at the inclined intermediate sections 35 and are spaced rearwardly from the rear of the front horizontal sections by a distance of about seven thirty-seconds inch. It should be further pointed out that the front portions of the inclined intermediate sections 35 described herein are located just forwardly of the center of gravity CG (FIG. 3) of the unloaded drawer 10, the center of gravity being located forwardly of the geometrical center of the drawer because of the added weight imposed on the front of the drawer by the comparatively heavy front panel 21 and the pull 23.

Rearwardly of the intermediate sections 35, the flanges 31 and 32 include rear horizontal sections 39 (FIG. 3) which, by virtue of the incline of the intermediate sections, are spaced below the front horizontal sections 36 by three thirty-seconds inch. In this particular instance, the rear horizontal sections 39 have a length of approximately 12 inches but their length may vary considerably depending upon the length of the drawer 10. Also, it will be appreciated that the other dimensions set forth above have been given primarily by way of example.

Successive positions occupied by the drawer 10 in moving from a nearly fully open position to a completely closed position are shown in FIGS. 4 to 7. For simplicity, these positions have been illustrated with the assumption that the drawer is empty and that its center of gravity in fact lies at the point CG. In a loaded drawer, however, the center of gravity will often lie forwardly or rearwardly of the point CG and, in any given position, the drawer may be tilted either at a different angle than shown in FIGS. 4 to 7 or, in extreme cases, in a different direction. Also, the angle through which the drawer is tilted has been exaggerated considerably in FIGS. 4 to 7 for clarity of illustration.

In FIG. 4, the drawer is shown almost fully extended and thus the rollers 25 and 26 are disposed in the rear horizontal sections 39 of the tracks 30. When the drawer is fully extended, the front end thereof in most instances will be tilted just slightly downwardly (as permitted by the vertical clearance between the rollers 25 and 26 and the flanges 31 and 32) because the center of gravity of the drawer will lie well forwardly of the front rollers 25 unless, of course, the extreme rear portion of the drawer is loaded very heavily as compared to the loading at the front of the drawer. Accordingly, with the front end of the drawer tilted downwardly, the upper flanges 31 bear downwardly on the forward rollers 25 while the lower flanges 32 bear upwardly on the rear rollers 26.

As the drawer 10 is pushed rearwardly, the center of gravity thereof may pass between the front and rear rollers 25 and 26 so that, as long as the rear horizontal sections 39 are riding along the rollers, the drawer is held horizontal with the upper flanges 31 tending to bear downwardly on both the front and rear rollers. Thereafter, the center of gravity of the drawer may pass rearwardly across the rear rollers 26 to create a force tending to pivot the rear of the drawer downwardly so that the lower flanges 32 are brought upwardly into bearing engagement with the front rollers 25 while the upper flanges 31 continue to bear downwardly on the rear rollers 26. Of course, the force transitions will occur at different points during the closing stroke of the drawer depending upon the distribution of the weight of the contents of the drawer. When the present drawer is empty, its center of gravity CG lies just rearwardly of the position occupied by the axes 28 of the rear rollers 26 when the drawer is fully closed. If the drawer is loaded very heavily near its front end, the center of gravity might never pass the rear rollers 26 as the drawer is closed. In almost all cases, however, the center of gravity will pass rearwardly of the front rollers 25 during the final 3 or 4 inches of the closing stroke of the drawer.

When the drawer 10 approaches to within about nine inches of its fully closed position, the rear ends of the down ramps 34 formed by the downwardly inclined intermediate flange sections 35 encounter the front rollers 25 (see FIG. 5). At this time, the center of gravity of the drawer will, in almost all instances, be located ahead of the rear rollers 26. As the down ramps 34 pass across the front rollers 25, the front of the drawer may pivot very slightly downwardly about the rear rollers 26 as a result of the weight of the drawer when the instantaneous location of the center of gravity is forwardly of the rear rollers or, in those cases where the center of gravity might be located rearwardly of the rear rollers, as a result of a slight camming action produced as the lower inclined flange sections 35 ride across the front rollers. Such pivoting, however, is almost imperceptible because of the very slight inclination of the down ramps 34 and because the moment arm between the rear rollers and the instantaneous location of the center of gravity is comparatively short in most instances at the time the down ramps encounter the front rollers.

Upon further closing of the drawer 10, the down ramps 34 pass by the front rollers 25 and begin to approach the rear rollers 26 so that, for a very short interval, the front rollers are positioned along the front horizontal flange sections 36 while the rear rollers are positioned along the rear horizontal flange sections 39 (see FIG. 6). In this condition, the front of the drawer is tilted very slightly downwardly because of the vertically spaced relation between the front and rear horizontal flange sections. The directions, however, in which the flanges 31 and 32 tend to bear against the rollers 25 and 26 depend upon the instantaneous location of the center of gravity of the drawer. If the center of gravity is still located forwardly of the front rollers 25, the upper flanges 31 will tend to bear against the front rollers and the lower flanges 32 will tend to bear against the rear rollers 26. If the center of gravity has moved between the rollers, the upper flanges 31 will tend to bear downwardly against both the front and rear rollers

and, if the center of gravity has moved rearwardly of the rear rollers, the upper flanges will tend to bear against the rear rollers while the lower flanges 32 tend to bear against the front rollers.

As the drawer 10 approaches the last 3 inches of its closing stroke, the rear ends of the downwardly inclined sections 35 approach the rear rollers 26. In some instances, the center of gravity of the drawer will by this time have shifted rearwardly of the rear rollers and thus the upper rear horizontal flange sections 39 will be bearing downwardly against such rollers. Accordingly, as the downwardly inclined sections 35 of the upper flanges 31 encounter the rear rollers 26, the weight of the drawer pivots the rear end of the drawer downwardly and the front end upwardly about the front rollers 25 as permitted by the progressively vertically increasing slope established across the rear rollers by the upper inclined flange sections 35. Such pivoting, in conjunction with the weight of the drawer, causes the rear of the drawer in effect to go "downhill" and thus move automatically to the fully closed position (see FIG. 7). The self-closing action is quite positive because, with the center of gravity located rearwardly of the rear rollers 26, the moment arm between such center of gravity and the pivot defined by the front rollers 25 is comparatively long.

If the drawer 10 is rather heavily loaded at its front, the center of gravity may not have passed the rear rollers 26 by the time the rear ends of the downwardly inclined flange sections 35 move by the rear rollers. Indeed, under very extreme conditions of heavy loading at the front of the drawer, the center of gravity may not have even passed the front rollers 25 by the time the downwardly inclined flange sections 35 first encounter the rear rollers 26. However, shortly after the beginning of the final three inches of the closing stroke, the center of gravity will move past the rear rollers 26 under conditions of heavy front loading or, under conditions of extremely heavy front loading, will at least move past the front rollers 25. In either case, the shift of the center of gravity rearwardly of the front rollers 25 causes the upper downwardly inclined flange sections 35 to bear against the rear rollers 26. Because of the increasing slope afforded as a result of the incline of the upper flange sections 35, the rear of the drawer pivots downwardly about the front rollers 25 under the influence of its own weight and the drawer thus moves automatically to its closed position.

Accordingly, even though the drawer 10 may be very heavily loaded at the front, self-closing is still achieved because the down ramps 34 are located to the rear of the pivots defined by the front rollers 25 and thus the center of gravity always at least passes between the pivots and the down ramps to effect the automatic closing. Of course, when the drawer is loaded in a more normal manner and the center of gravity passes the rear rollers 26, there is made available a self-closing force of greater magnitude than has been possible heretofore because of the relatively long moment arm established between the center of gravity and the pivots defined by the front rollers 25.

In the closed position of the drawer 10, the front ends of the downwardly inclined flange sections 35 lie just forwardly of the rear rollers 26 as shown in FIGS. 3 and 7. Accordingly, the weight of the drawer and the

upper inclined flange sections 35 keep the rear end of the drawer tilted downwardly and retard opening of the drawer thereby to hold the latter closed. As shown diagrammatically and on an exaggerated scale in FIG. 8, the weight of the drawer produces a reaction force  $W$  which is exerted by each rear roller 26 on the respective upper inclined flange section 35 along a line perpendicular to such section, the force  $W$  having a vertical vector component  $V$  and a horizontal vector component  $H$ . The latter provides resistance against opening of the drawer and also provides a force for moving the drawer rearwardly to its closed position when the upper inclined sections 35 ride across the rear rollers.

From the foregoing, it will be apparent that the present invention brings to the art a new and improved front suspension drawer slide assembly capable of effecting better self closing of the drawer 10 as a result of the down ramps 34 being formed intermediate the ends of the tracks 30. The self-closing action produced by the intermediately located down ramps is more positive than that possible with prior arrangements used with front suspended drawers and also is more effective when the front of the drawer is loaded heavily.

I claim as my invention:

1. A drawer slide assembly for mounting a drawer for forward and rearward sliding between open and closed positions within an opening in a cabinet, said assembly comprising bracket means adapted to be supported on said cabinet adjacent said opening, front and rear rollers journaled on said bracket means on opposite sides of said opening and adjacent the front portion thereof to turn about generally horizontal axes, tracks adapted to be secured to the sides of said drawer and each having a fore-and-aft extending flange rideable on said rollers to support said drawer for sliding between said positions, each of said flanges having (a) a front generally horizontal section extending rearwardly from the forward end portion of the track to a point adjacent the position occupied by the axis of the respective rear roller when said drawer is in said closed position, (b) a rear generally horizontal section spaced below said front horizontal section and extending forwardly from the rear end portion of said track, and (c) an intermediate section inclined downwardly from said front section to said rear section thereby to coact with said rear roller to cause the rear end of said drawer to pivot downwardly and close automatically upon approaching said closed position.

2. A drawer slide assembly as defined in claim 1 in which the rear end of the front horizontal section of each track terminates just forwardly of the position occupied by the axis of the respective rear roller when said drawer is in said closed position.

3. A drawer slide assembly as defined in claim 1 in which the inclined intermediate section of each flange rests on the respective rear roller when said drawer is in said closed position and retards forward movement of the drawer from such position.

4. A drawer slide assembly as defined in claim 1 in which each of said flanges is an upper flange, each track further including a lower flange having front, intermediate and rear sections paralleling the respective sections of the upper flange.

5. A cabinet having opposed upright members defining an opening and having a drawer slidable forwardly

and rearwardly within said opening between open and closed positions, brackets supported on said members adjacent said opening, and front and rear rollers journaled on each of said brackets to turn about generally horizontal axes, the improvement comprising, a track secured to each side of said drawer and having outwardly projecting and fore-and-aft extending upper and lower flanges rideable on said rollers to support said drawer for sliding between said positions, each of said flanges having (a) a front generally horizontal section extending rearwardly from the forward end portion of the track to a point just short of the position occupied by the axis of the respective rear roller when said drawer is in said closed position, (b) a rear generally horizontal section spaced below said front horizontal section and extending forwardly from the rear end portion of said track, and (c) an intermediate section disposed between said front and rear sections and inclined downwardly from said front section to said rear section thereby to coact with the rear roller to cause the rear of said drawer to pivot downwardly about the front roller and close automatically upon approaching said closed position.

6. A drawer slide assembly for mounting a drawer for forward and rearward sliding between open and closed positions within an opening in a cabinet, said assembly comprising bracket means adapted to be supported on said cabinet adjacent said opening, front and rear rollers journaled on said bracket means on opposite sides of said opening and adjacent the front portion thereof to turn about generally horizontal axes, tracks adapted to be secured to the sides of said drawer and each hav-

ing a fore-and-aft extending flange rideable on said rollers to support said drawer for sliding between said positions, and each of said flanges having a downwardly and rearwardly inclined ramp disposed intermediate its ends and located to engage the respective rear roller in the closed position of the drawer.

7. A drawer slide assembly for mounting a drawer member for forward and rearward sliding between open and closed positions within an opening in a cabinet member, said assembly comprising first and second brackets adapted to be attached to one of said members and located on opposite sides of said opening, front and rear rollers journaled on each of said brackets to turn about generally horizontal axes, first and second elongated tracks associated with the rollers on the respective brackets and adapted to be supported on the other of said members, each of said tracks having a laterally projecting and fore-and-aft extending flange upon which said rollers ride to support said drawer for sliding between said positions, each of said flanges having (a) a front generally horizontal section extending rearwardly from the forward end portion of said track, (b) a rear generally horizontal section extending forwardly from the rear end portion of the track and spaced below said front horizontal section, and (c) a downwardly and rearwardly inclined intermediate section disposed between said front and rear sections and located to engage one of the associated rollers and then the other roller as the drawer is moved toward said closed position and to remain in engagement with the latter roller when the drawer is in the closed position.

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