March 4, 1969 J. PIPE 3,431,042

CANTILEVER LOADING EXTENSIBLE DRAWER RAIL

Filed Oct. 18, 1965 Sheet 1 of 2

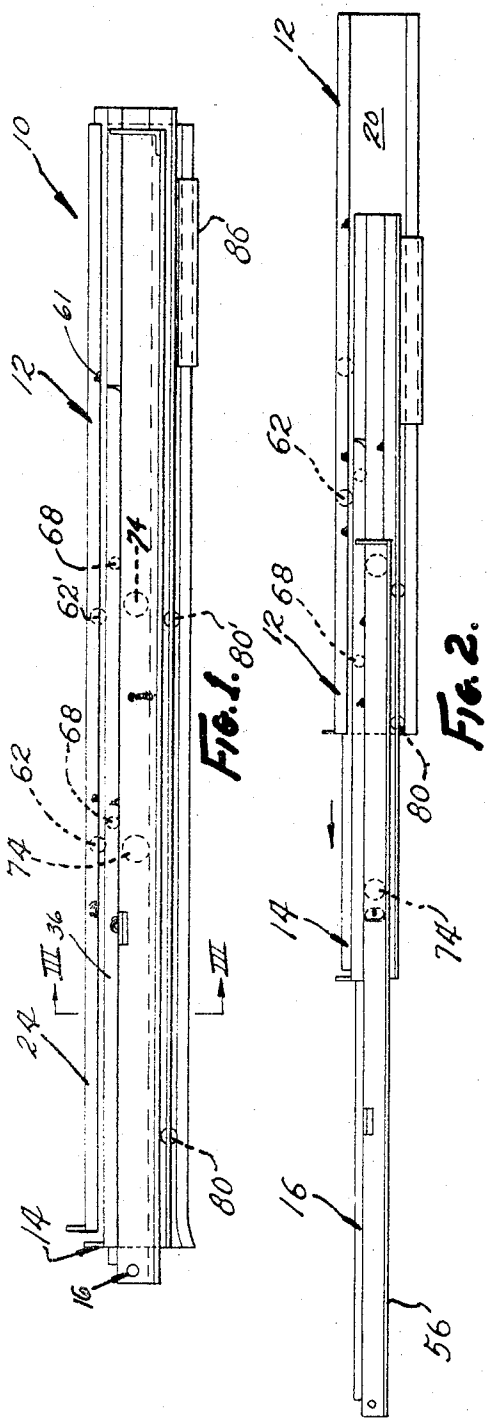


FIG. 1.



FIG. 2.

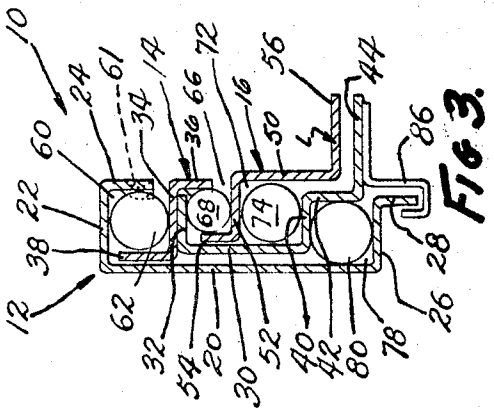


FIG. 3.

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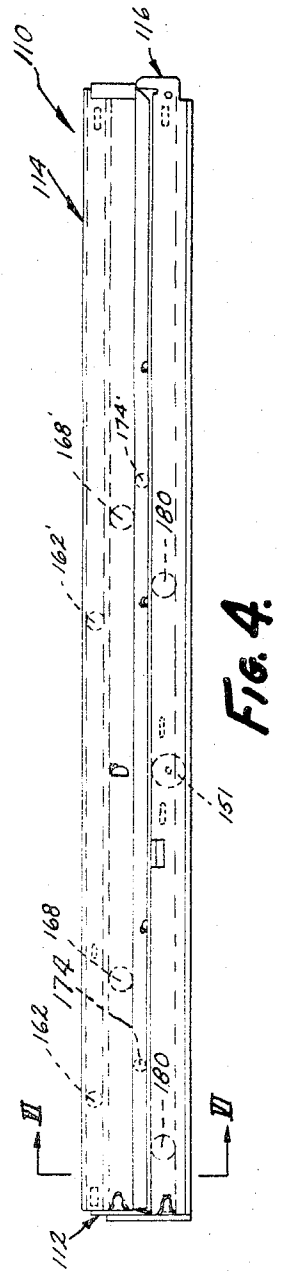



FIG. 4.

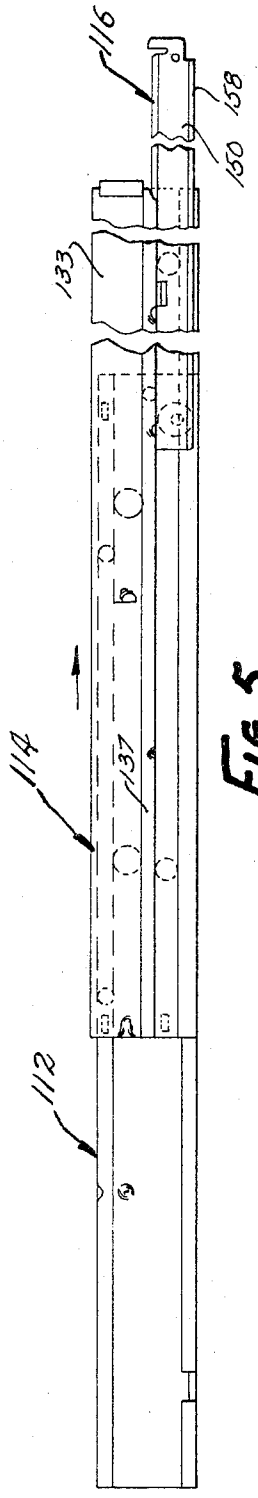



FIG. 5.

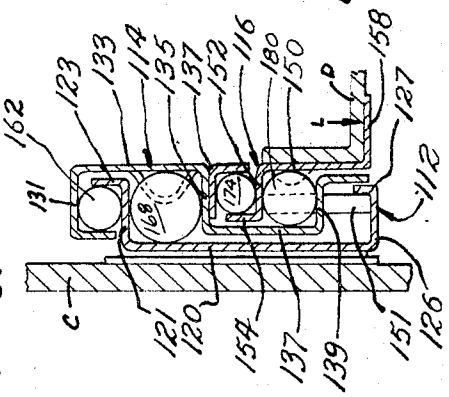



FIG. 6.

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3,431,042

# CANTILEVER LOADING EXTENSIBLE DRAWER RAIL

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Int. Cl. A47b *88/10*

## ABSTRACT OF THE DISCLOSURE

Drawer supporting and straddling rail assemblies achieving excellent retained alignment between the rails in the individual assemblies due to both vertical and lateral compressive loading on each of the individual balls between the rails, such compressive loading resulting from the torsional force applied with unique cantilever loading of the assembly, this cantilever loading being accomplished by the drawer rail having specially arranged and oriented cantilever loading portions.

This invention relates to drawer rail assemblies, and more particularly to telescoping drawer rail assemblies having unique cantilever loading action on the rails to achieve and retain optimum alignment between the rails.

Conventionally, each of the two slide rail assemblies employed in mirror image position on opposite sides of a drawer, between the drawer and the cabinet or case, includes telescopically interfitting rails allowing extension therebetween for drawer extension and retraction. Minimum friction is normally obtained by the use of rolling elements such as rollers or balls between the rails. Typically, a rail assembly includes a case rail for mounting to the inside wall of a cabinet, a drawer rail for mounting to the outer wall of a drawer, and an intermediate rail telescopically mounted between the drawer rail and the case rail, and allowing relatively full extension of the drawer rail and the drawer attached thereto. If desired, a progressive propulsion roller may be mounted on the intermediate rail for contact on its periphery directly with both the case rail and the drawer rail. This roller can have a vertical or a horizontal axis.

Generally, the support between the rails is achieved by a first plurality of balls retained between the case rail and the intermediate rail, and a second plurality of balls retained between the intermediate rail and the drawer rail. This basic known structure effectuates a fairly good limited friction suspension assembly. Such a structure has shortcomings however, with a well known one being the difficulty of keeping the slides aligned vertically when the drawer is under load. This causes scraping contact between the rails themselves, thereby increasing the friction, and consequently increasing the operating force required to extend and retract them, as well as increasing the noise level. The conventional structure also allows considerable side sway of the opened drawer and extended rail assemblies, due to clearance between the rails. Care must be taken to mount the rail assemblies exactly on a horizontal plane, or else rail rubbing etc. will normally occur constantly.

These drawbacks basically are due to the off-center loading of the drawer load with respect to the drawer straddling, drawer rail assemblies. Efforts to improve the structural characteristics have included those to control the lateral movement of the balls by controlling the manufacturing tolerances of the rail members to very critical values, or alternatively by slightly concavely curving the upper and lower ball track surfaces on the rails. Control of tolerances has a very real practical limit however, and is only partially effective anyway. The concave



dishing of the upper and lower track surfaces, although an improvement, is also definitely limited by the narrow breadth of the tracks, so that it is only partially effective in actual practice. Both of these techniques also require considerable added manufacturing cost.

It is an object of this invention to provide a unique drawer rail assembly that uniquely employs cantilever loadnig to constantly retain the rails in optimum alignment.

Another object of this invention is to provide a drawer rail assembly achieving excellent rail alignment under load, resulting in an extremely small and inconsequential side sway of the drawer and assembly, even at full extension of the rail assembly. Moreover this is achieved without special close tolerances for rail parts, and without complicated dishing of the rail track surfaces.

Another object of this invention is to provide a novel cantilever loading drawer rail assembly that eliminates the direct scraping tendency between the rail members themselves, even when approaching full extension. The unit is therefore extremely quiet in operation, and has minimum friction.

Another object of this invention is to provide a drawer rail assembly achieving practically friction-free movement by unique loading of the individual balls on a vertical axis through each ball and also on a horizontal axis through the ball, with these axes being normal to each other.

Another object of this invention is to provide a drawer rail assembly having unique cantilever loading of the assembly in a manner to effect both vertical and lateral loading on the individual balls, on directly opposed bearing surfaces so that friction-free travel results, with constant vertical rail alignment, without lateral movement or sway, and without necessitating close tolerances.

Another object of this invention is to provide a drawer rail assembly that achieves smooth quiet action even if not mounted exactly on a horizontal plane, and in fact enabling the drawer to be mounted even on angles of up to about 45°, yet without rail scraping, side sway, and the like.

These and several other objects of this invention will become apparent upon studying the following specification in conjunction with the drawings in which:

FIG. 1 is a side elevational view of the first form of the drawer rail assembly, shown in its retracted condition;

FIG. 2 is a side elevational view of the assembly in FIG. 1, shown extended;

FIG. 3 is an enlarged sectional view of the assembly in FIG. 1, taken on plane III—III;

FIG. 4 is a side elevational view of a second form of the novel drawer rail assembly, shown in a retracted condition;

FIG. 5 is a side elevational view of the assembly in FIG. 4, shown extended; and

FIG. 6 is an enlarged sectional view of the assembly in FIGS. 4 and 5, taken on plane VI—VI of FIG. 4.

The term "inwardly" when used herein, refers to a direction toward the drawer to be mounted, and away from the case panel. The term "outwardly" means the opposite. It will be realized that although one drawer rail assembly is shown in each form of the invention, a mirror image form will normally be employed in mirror image relationship to this drawer rail assembly. Since these are exactly alike except in mirror image, only one is specifically shown and described.

Referring now specifically to the drawings, the first drawer rail assembly **10** illustrated in FIGS. 1–3 includes a case rail **12**, an intermediate rail **14**, and a drawer rail **16**.

Case rail **12** has an elongated, vertically oriented back

panel **20** for mounting to the inside vertical wall of a cabinet or case into which the drawer is to extend. Integral with this panel is a horizontally inwardly extending upper panel leg **22**, from which depends a flange **24** extending downwardly parallel to panel **20** and terminating short of intermediate rail **14**. Case rail **12** also includes a bottom horizontally inwardly extending leg panel **26** parallel to panel **22**, and normal to back panel **20**, with a lower, depending, downwardly extending flange **28** integral therewith at its outer edge.

Telescopically interfitting within case rail **12** is intermediate rail **14**. This intermediate rail includes a main elongated vertical panel **30**, having an inwardly extending horizontal upper flange **32**. Welded to this flange is a Z-shaped member that includes a horizontal leg **34** secured to panel **32**, an inner downwardly extending flange **36**, parallel with back panel **20**, and an upwardly extending outer flange **38** adjacent panel **20** and parallel to, opposite to flange **24** of case rail **12**. Near to but spaced from the bottom flange **26** of case rail **12**, intermediate rail **14** has a horizontally inwardly, extending panel **40**, a downwardly depending retaining panel **42** extending therefrom and parallel to back panel **20**, and preferably a horizontally extending panel **44** integral with portion **42**.

Drawer rail **16** interfits telescopically in intermediate rail **14**. It includes a retaining panel **50** extending vertically, i.e. parallel to panel **20**, an outwardly extending horizontal panel **52** extending therefrom, and a vertically extending panel **54** extending up from panel **52** inside case rail **14** and parallel to its back panel **30**. This drawer rail also includes an important horizontally extending cantilever loading leg **56** extending inwardly from panel **50**, and in fact from the entire drawer rail assembly to form a loading platform.

Briefly therefore, case rail **12** is basically C-shaped in cross section, but having a pair of downwardly extending inner flanges, both extending in the same direction, from the two legs of the C. Basically, the drawer rail **16** is double L-shaped, with one L being attached to and depending from the first L. Intermediate rail **14** has a C-shaped central portion, with an L-shaped depending portion attached to its lower leg, and a Z-shaped member mounted to the top of its upper leg.

These three rails in the first form of the invention basically define four raceways to receive floating spherical balls. Each raceway preferably includes two spherical balls. Upper raceway **60** has opposite horizontal upper and lower bearing surfaces **22** and **34** of the case rail and intermediate rail, and has opposite vertical side bearing surfaces **38** and **24**, all arranged in a square configuration to abut the retained balls on both a vertical axis and a horizontal axis. The next lower raceway **66** also has opposite upper and lower surfaces **32** and **52** of the intermediate rail and drawer rail, and opposite side surfaces **54** and **36** of the drawer rail and intermediate rail. The third raceway **72** has opposite upper and lower surfaces **52** and **40** of the drawer rail and intermediate rail and opposite side surfaces **50** and **30** of the drawer rail and intermediate rail. The fourth and lowermost raceway **78** has opposite upper and lower surfaces **40** and **26** of the intermediate rail and case rail and opposite side surfaces **20** and **42** of the case rail and intermediate rail. Thus, each raceway is square, has four bearing surfaces. One vertical and one horizontal bearing surface are of one rail and the other vertical and horizontal surfaces are of another rail. Raceway **60** between the intermediate rail and the case rail confines balls **62** and **62'**, raceway **66** between the top of the drawer rail and the intermediate rail confines balls **68** and **68'**, raceway **72** between the bottom of the drawer rail portion and the intermediate rail includes balls **74** and **74'**, and raceway **78** between the bottom of the case rail and the bottom of the intermediate rail includes balls **80** and **80'**. The balls are each retained in their intended section of their raceways by suitable stops formed in conventional fashion as by depressing dimples e.g. **61** (FIG. 1) into the rail member astraddle each ball. Since this is conventional, such stops are not described in detail.

When the assemblies are fully assembled, each square-shaped raceway has width and height dimensions equal to the diameter of the spherical floating balls contained therein. Each ball is contracted on a vertical load axis with bearing surfaces which are directly opposed, and on a horizontal load axis on each side thereof against bearing surfaces which are directly opposed. Hence, when the load is applied to the structure in FIG. 3, with insertion of a drawer (not shown in FIG. 3) between rail assembly **10** and its counterpart rail assembly arranged in mirror image to it on the opposite side of the drawer, the individual rails of assembly **10** will shift laterally and vertically under the cantilever load to take up the slack space shown adjacent the balls in FIG. 3. The two axes of load, vertical and laterally horizontal, are normal to each other.

The rail assembly illustrated in FIGS. 1 through 3 may be readily assembled by inserting the intermediate rail into the case rail, with the floating ball members positioned therebetween, and by inserting the drawer rail into the intermediate rail, with the balls positioned therebetween. The intermediate rail may be securely positioned with respect to the case rail to prevent them from normally being accidentally disassembled as by a small flange retainer member **86** secured to a horizontal flange **44** of intermediate rail, and extending beneath and behind the downwardly depending flange **28** of the case rail. Normally, when load is applied to the special member **56** in cantilever fashion to the drawer rail, the rails will not become disassembled but will be retained in operative relationship. The back of panel **20** is secured to the cabinet, and the drawer is mounted on cantilever flange **56**.

The square raceway configuration, and the opposed loading characteristics on a horizontal axis and a vertical axis of each of the spherical members in the raceways, are uniquely cooperative with the cantilever loading flange **56** to which the drawer load L is applied to achieve the novel result. It will be realized that when load is applied as indicated by the arrow L in FIG. 3, the cooperative drawer rail and intermediate rail will create lateral horizontal and vertical loading on balls **68**, **68'** and **74**, **74'**. The intermediate rail in turn applies lateral loads and vertical loads on balls **62**, **62'** and **80**, **80'**. All of these rails are thereby retained in exact vertical aligned relationship under load yet without requiring especially close tolerances in the manufacture of these parts. There is completely adequate side clearance, yet with no significant lateral sway resulting. The rail members themselves are retained completely out of contact with each other to prevent scraping and friction.

The same cantilever loading principle can be employed with slightly differently configurated rail members. More specifically, the modified rail assembly **110** illustrated in FIG. 4 includes a case rail **112**, an intermediate rail **114**, and a drawer rail **116**. These rail members telescopically interfit to form a plurality of four raceways, each having a square cross sectional configuration of two opposite vertical walls of two different rail members contacting the spherical balls with bearing surfaces on opposite sides, to form a horizontal load axis, and two opposite horizontal walls contacting the spherical elements on top and bottom, to form vertical load axes. The overall configuration of the drawer rail member **116** is substantially like that illustrated in the first form of the invention, but it is assembled in different relationship with the intermediate rail. That is, its horizontal flange extends between the lowermost raceway and the next raceway thereabove, rather than between the two central raceways as in the first form of the invention. The intermediate rail is shaped differently than in the first form of the invention, having a generally C-shaped lower portion, and a back-

wards C-shaped upper portion integral therewith. The case rail basically is still C-shaped in cross sectional configuration, but having two upwardly extending flanges on the two legs of the C, rather than downwardly extending flanges.

The drawer rail **116** has two vertical panels which form two walls of two respective adjacent raceways, one horizontal panel which forms the bottom of one raceway and the top of a second raceway, and a horizontal inwardly extending cantilever loading flange **158** for mounting of a drawer. The case rail includes a main vertical back panel **120**, an inwardly extending upper panel **121**, the upper surface of which forms the bottom of a raceway, and an upwardly extending outer flange **123** forming the inside of the same raceway. It also includes a lower inwardly extending horizontal leg panel **126** and an upwardly extending flange **127**.

Drawer rail **116** includes a vertical panel **150**, the cantilever support panel **158**, an outwardly extending horizontal panel **152** and a vertically extending panel **154**, these latter two forming a bottom and side of a raceway. Intermediate rail **114** includes an upper backwardly positioned C-shaped portion with an upper horizontal leg **131**, the bottom of which forms the top of a raceway, a vertical leg **133** forming one side wall of a raceway, and the lower leg **135** forming the bottom of another raceway. This lower leg has attached thereto an L-shaped member **137** which forms the top of a third raceway, as well as the inside wall thereof. Extending integrally downwardly from this leg **135** is a vertical leg **137** forming the wall of the lowermost raceway, and a horizontal leg **139** forming the bottom of the lowermost raceway. If desirable, a progressive actuating roller member **151** may be mounted on its horizontal axis to the intermediate rail, with the upper surface contacting the drawer rail, and the lowermost portion of the case rail for progressive actuation of the rails during extension and contraction. Two balls are mounted in each of the raceways as illustrated in FIGS. 4 and 5, similar to the first form of the invention.

Balls **162** and **162'** are in raceway **160**, balls **168** and **168'** in raceway **166**, balls **174** and **174'** in raceway **172**, and balls **180** and **180'** in raceway **178**.

In operation, one bottom edge of the drawer D is mounted on the cantilever support flange **158**. The case rail is mounted to the cabinet C as indicated, so that, with the case rail supported against torsional deflection under the torsional forces applied with cantilever loading, the cantilever loading on the drawer rail causes lateral horizontal thrust on horizontal axes across the spherical rollers and vertical load thrust across the vertical axes of the rollers for maintained alignment and absence of side sway.

In operation, both of these novel drawer rail assemblies illustrated have been found to work effectively. Either of the assemblies enable drawers to be mounted off horizontal, even on an angle of up to about 45° or so, without side sway, without binding, without scraping between the rail members, and with smoothness and quietness of operation. The lateral loads applied with drawer tilting are not detrimental as they normally are, since lateral loads are already applied on the novel assembly, and merely help stabilize the apparatus.

The assembly is believed to be a substantial advance over the rail assemblies known heretofore. It is conceivable that certain additional modifications of individual rail construction may be achieved within the concept presented. It will be realized that the concept employs the cantilever loading plus the horizontal and vertical axis loading of individual balls as the core of the unique operation. Hence, the invention is intended to be limited only by the scope of the appended claims and the reasonably equivalent structures to those defined therein.

I claim:

**1.** A drawer rail assembly comprising: telescopically interfitting rails including at least a drawer mounting rail and a case rail; each of said rails having adjoining flat horizontal and vertical portions providing load-bearing surfaces; each pair of said adjoining portions disposed opposite another pair of adjoining horizontal and vertical portions of another of said rails to form a plurality of vertically spaced raceways of generally square cross section; roller means in each of said raceways, each having oppositely disposed upper and lower bearing surfaces and oppositely disposed side bearing surfaces; said drawer mounting rail having a horizontal one of said portions engaging the top of a first one of said roller means and also having a pair of said vertical portions, one engaging at least one side bearing surface of said first roller means and the other engaging an oppositely positioned side bearing surface of a second roller means located in a raceway which is vertically spaced from that of said first roller means, such that said drawer rail when loaded by the weight of a drawer acts as a moment arm to push on said first and second roller means in opposite horizontal directions; said first and second roller means when so pushed acting on the other of said vertical rail portions forming the raceways for such roller means to transfer the horizontally-directed pushing force to the respective rail of which such other portions are a part; each of said roller means in said assembly positioned in contact with both the horizontal and the vertical rail portions forming the raceway for such roller means when said drawer rail is under load; each of said rails in said assembly arranged such that when said drawer rail is under load at least one of said vertical portions in each of said raceways pushes on the roller means in that raceway horizontally toward the other vertical rail portion of that raceway.

**2.** The drawer rail assembly of claim **1**, wherein said vertical portions of said drawer mounting rail in said pair thereof extend in opposite directions from said horizontal portion of such rail, said second roller means and said raceway therefore being located above said first roller means and its said raceway.

**3.** The drawer rail assembly of claim **1**, including at least one intermediate rail in addition to said drawer rail and case rail, said intermediate rail interfitting telescopically generally between said drawer and case rails, said intermediate rail having flat horizontal and vertical portions defining load-bearing surfaces disposed opposite from like portions of both said drawer and case rails to form certain of said vertically spaced square raceways, said certain raceways having roller means therein which when said drawer rail is under load receive both horizontal and vertical loading and transfer such loading from said drawer rail to said case rail.

**4.** The drawer rail assembly of claim **3**, wherein said vertical portions of said drawer mounting rail in said pair thereof extend in opposite directions from said horizontal portion of such rail, said second roller means and said raceway therefore being located above said first roller means and its said raceway.

**5.** The drawer rail assembly of claim **4**, wherein said intermediate rail has a cross-sectional shape including a first vertical portion near the bottom, a first horizontal portion extending laterally of said first vertical portion above said bottom, a second vertical portion extending upwardly from said first horizontal portion, a second horizontal portion extending laterally of said second vertical portion, and a third vertical portion extending downwardly from said second horizontal portion generally parallel to and spaced from said second vertical portion.

**6.** The drawer rail assembly of claim **5**, wherein said case rail has a cross-sectional shape including a first horizontal portion near the bottom thereof, a first vertical portion extending upwardly from said first horizontal portion, a second horizontal portion extending laterally from said first vertical portion and disposed generally parallel to said first horizontal portion, and a second vertical portion extending downwardly from said second horizontal

portion spaced from and generally parallel to said first vertical portion.


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U.S. Cl. X.R.

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