Dec. 26, 1967 W. A. HANIFAN 3,360,322

REFRIGERATOR WITH ADJUSTABLE SHELF

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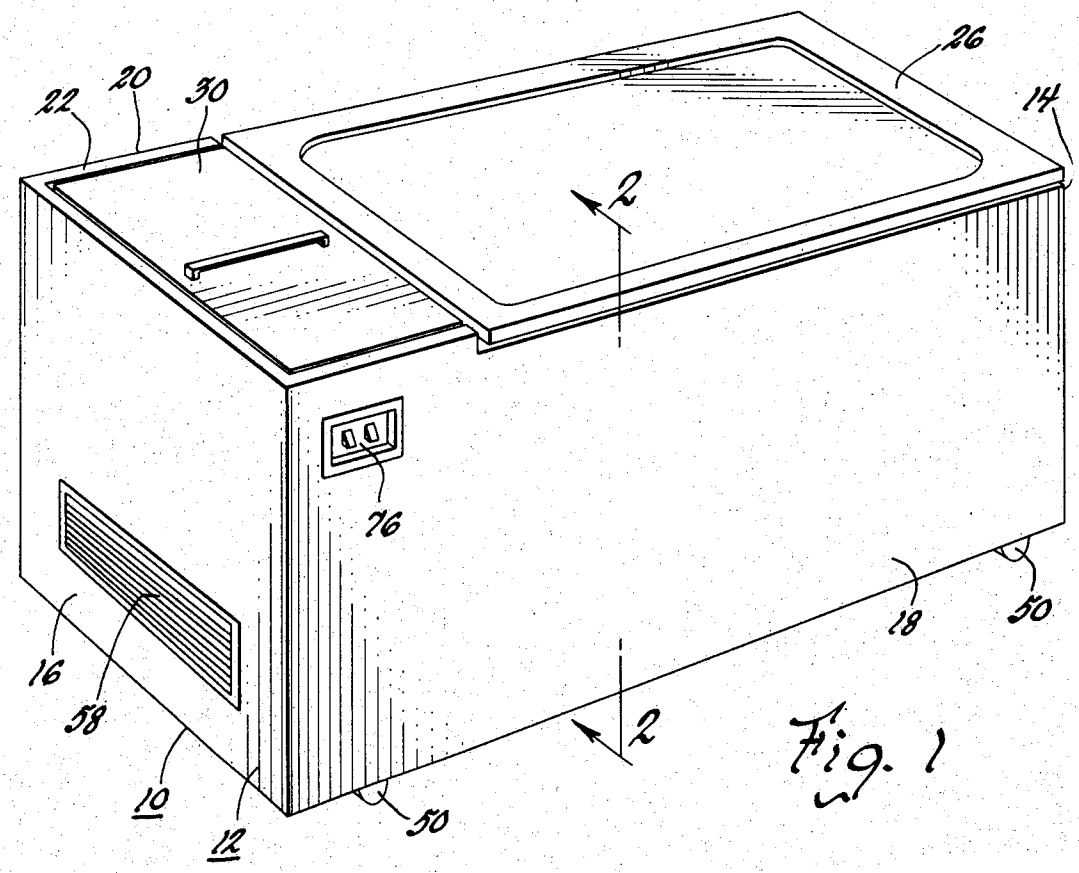


Fig. 1

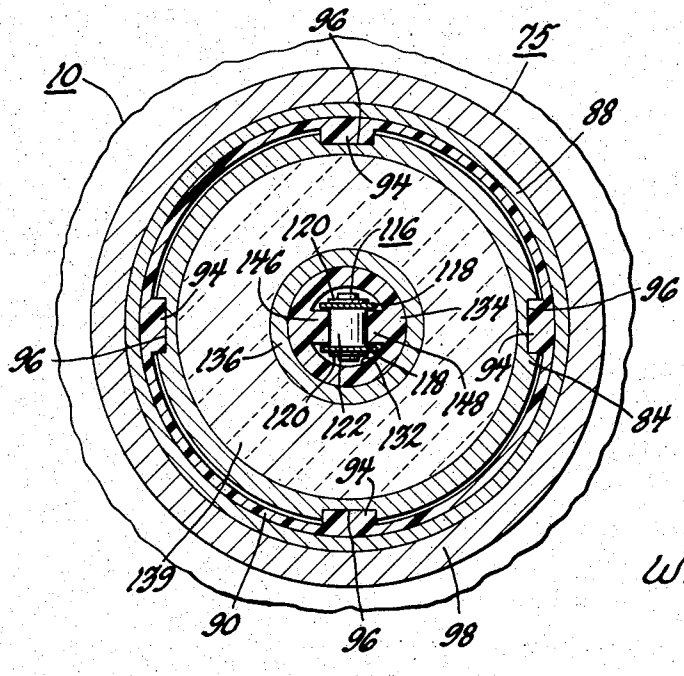


Fig. 7

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REFRIGERATOR WITH ADJUSTABLE SHELF

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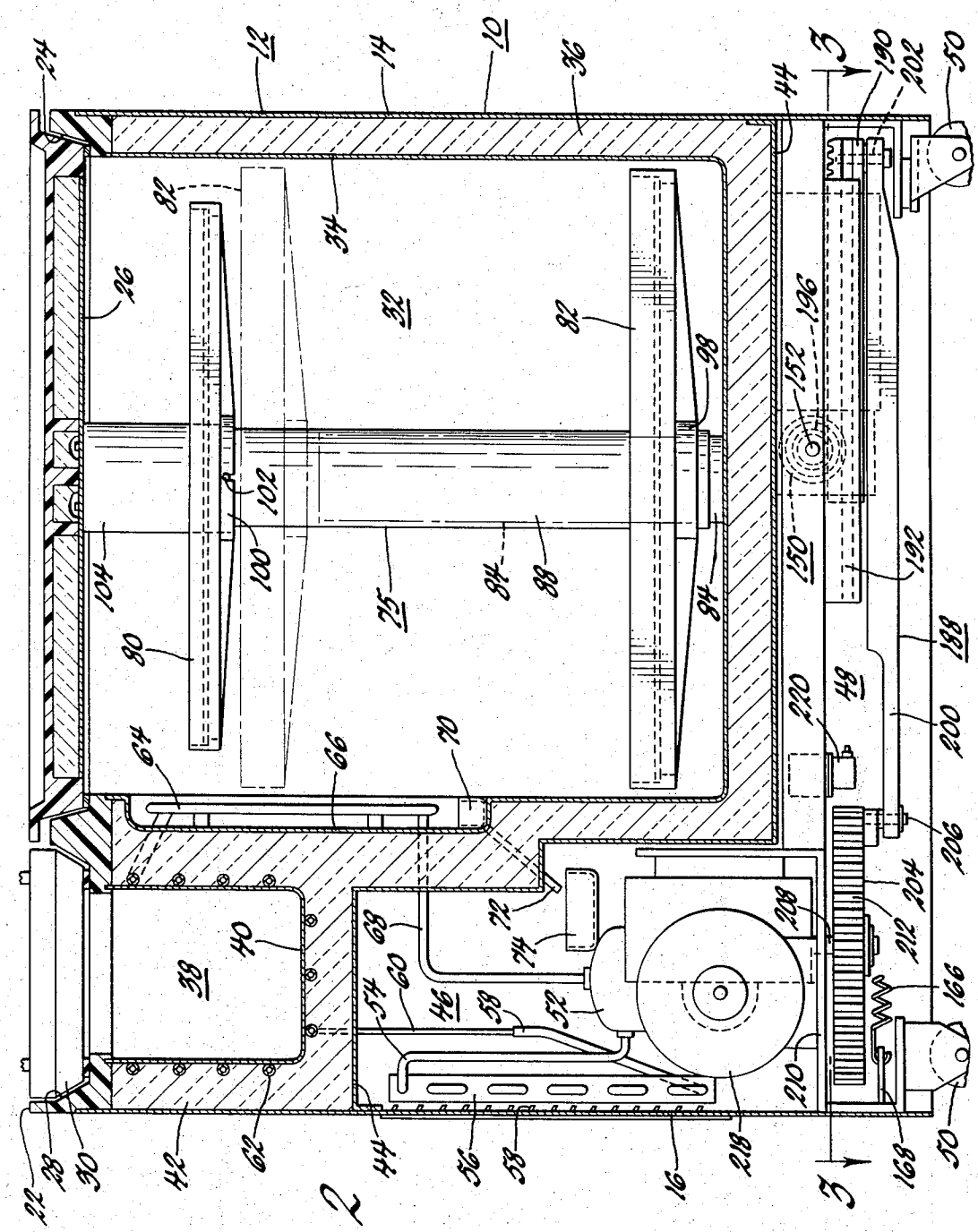


Fig. 2

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REFRIGERATOR WITH ADJUSTABLE SHELF

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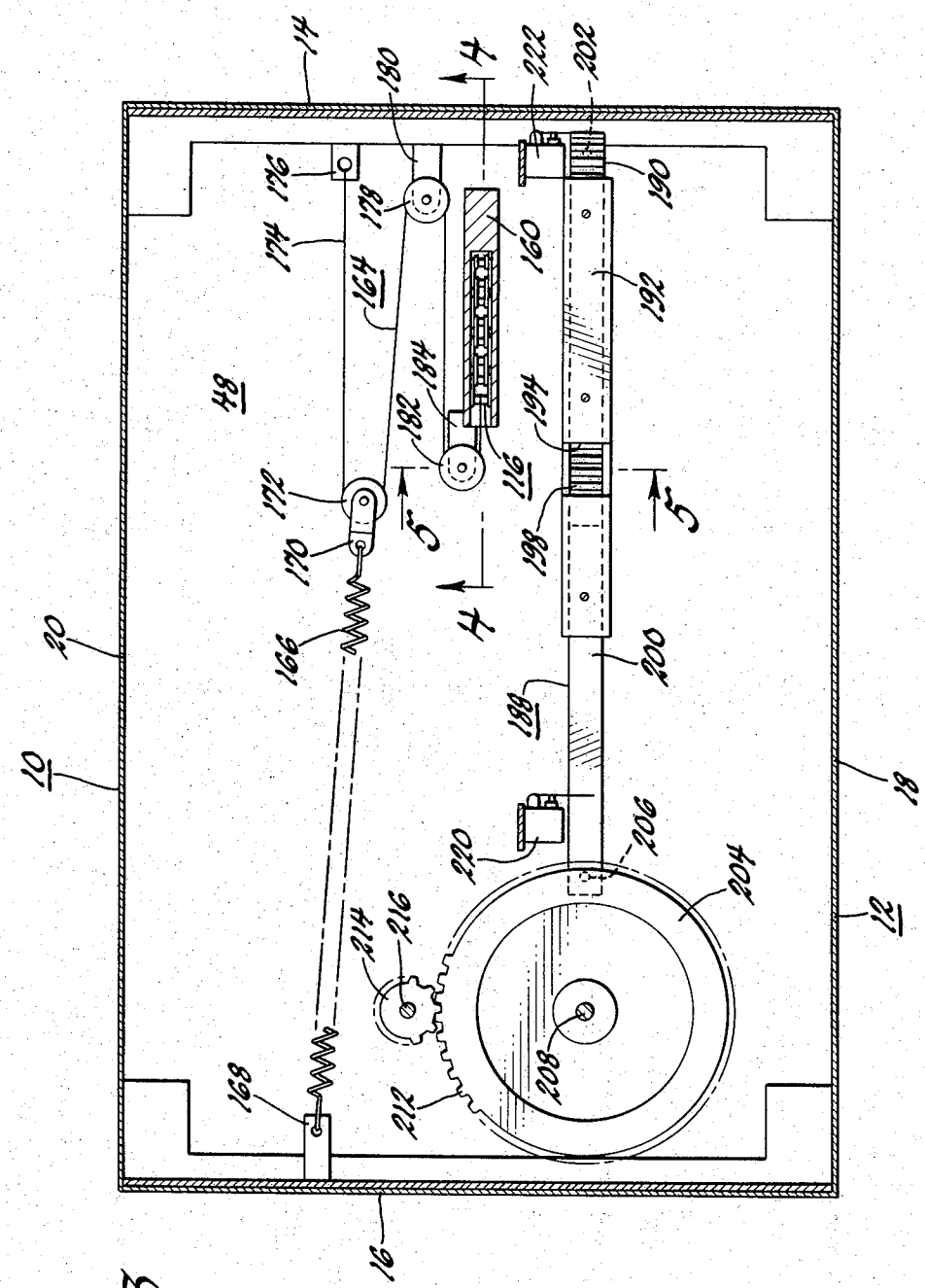


Fig. 3

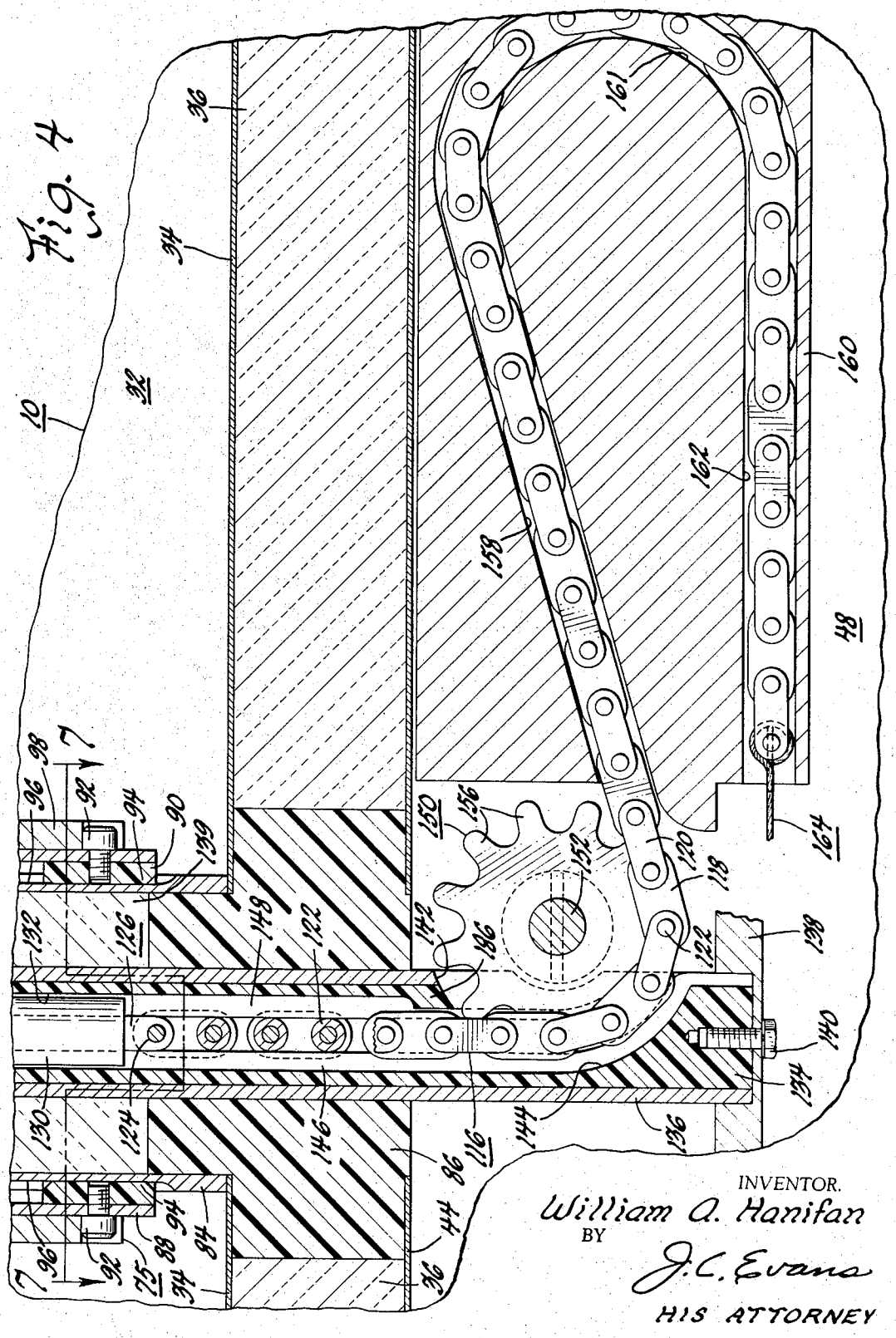
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Fig. 4



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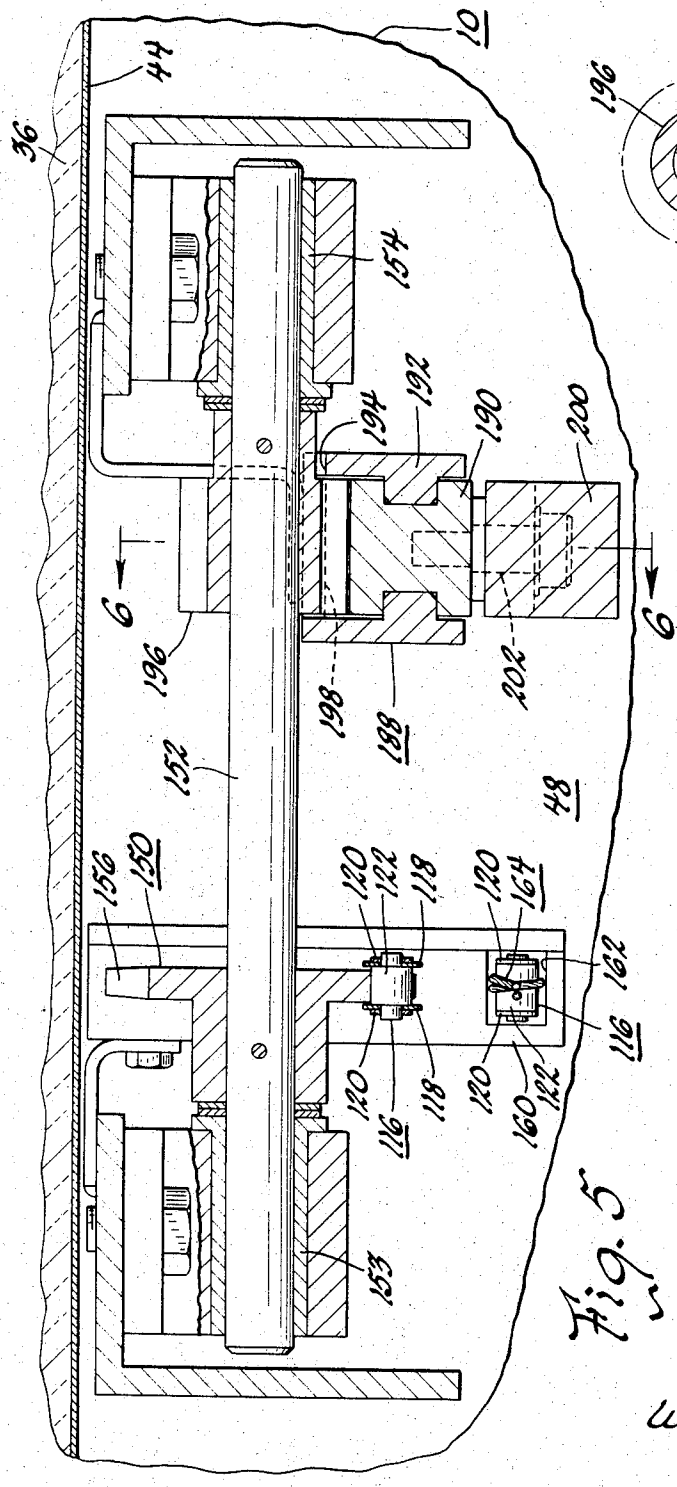


Fig. 5

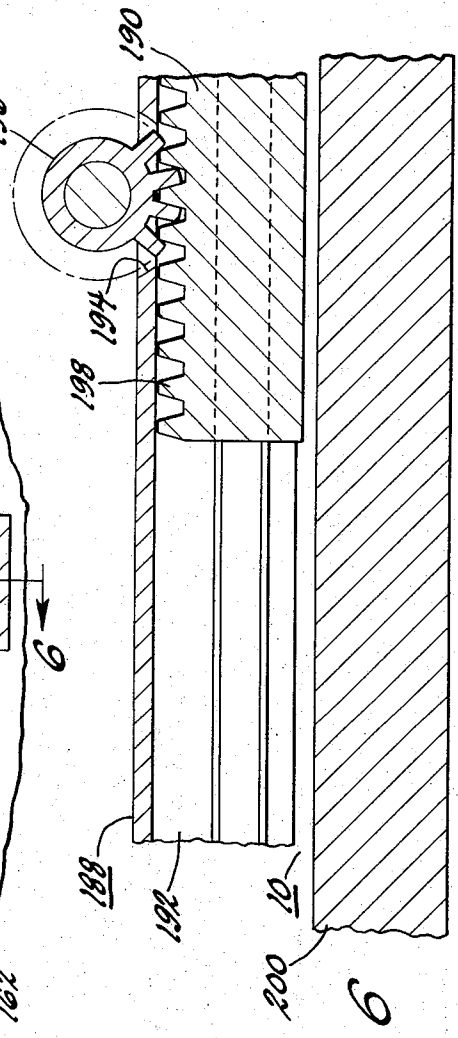


Fig. 6

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REFRIGERATOR WITH ADJUSTABLE SHELF

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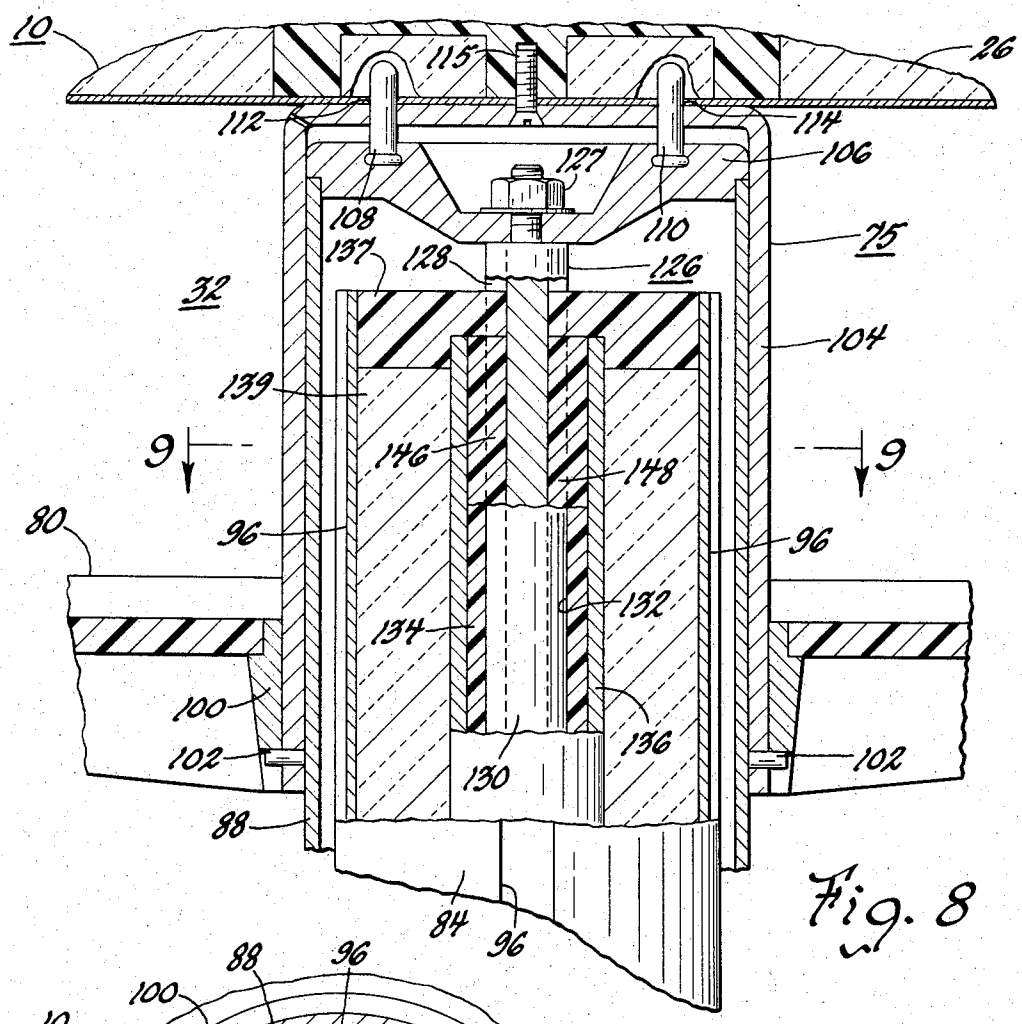


Fig. 8

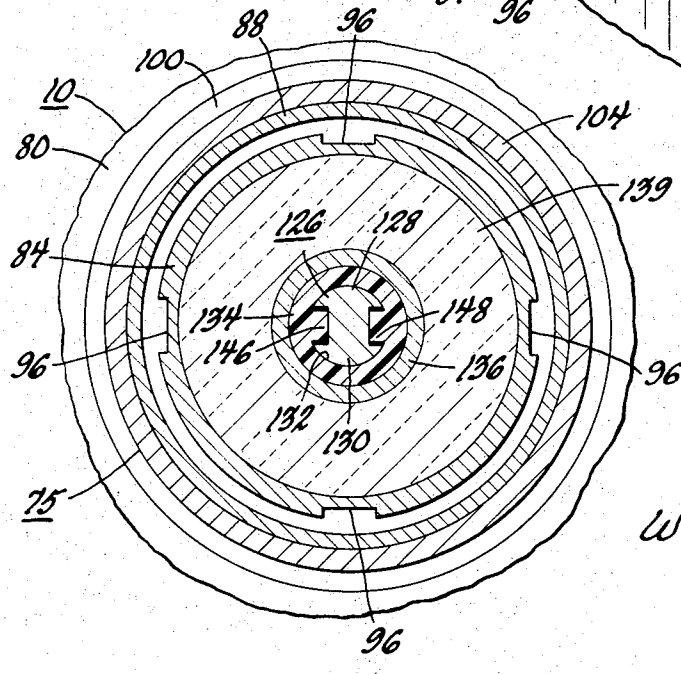


Fig. 9

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United States Patent Office

3,360,322

Patented Dec. 26, 1967

3,360,322

REFRIGERATOR WITH ADJUSTABLE SHELF

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Filed Feb. 1, 1966, Ser. No. 524,012
6 Claims. (Cl. 312—312)

ABSTRACT OF THE DISCLOSURE

In preferred form, a mechanically operated shelf adjusting system for a refrigerator including a refrigerator housing having a top opening to a storage compartment, a shallow machinery compartment below the refrigerator housing, a pair of telescoped shelf adjusting members in the refrigerator compartment, one supporting a shelf, the other fixed to the housing, a flexible chain link drive member guided within the fixed telescoped member and secured to the one member for moving it to adjust the shelf height, the flexible chain link member connected to means including a unidirectional motor actuatable to produce shelf adjustment.

This invention relates to refrigerating apparatus and more particularly to a refrigerator apparatus having adjustable shelf members therein.

In the development of domestic refrigeration units, it is desirable to maintain the dimensional configurations of these units at a minimum while retaining a predetermined desired amount of space for the storage of articles to be cooled.

When accessory packages such as shelf adjusting systems are incorporated in such refrigerators, it is often difficult to retain a maximum storage capacity therein. This problem is noticed especially in small portable refrigeration units of the type used in recreation rooms and the like. In this case, dimensional limitations in the outer housing are such that to obtain adequate storage capacity, it has been necessary to utilize only a minimum space for the machinery compartment devoted to the space required to accommodate a relatively simplified refrigerant compressing system.

An object of the present invention, therefore, is to improve portable refrigerators and like apparatus by the provision therein of a shelf adjusting mechanism including a flexible chain link member and telescoping lift components operable to move shelves within a storage compartment of the unit while occupying a limited amount of space within the unit.

A further object of the present invention is to improve portable refrigerators and like apparatus of the type including an outer housing enclosing a space occupied primarily by storage compartments by the provision therein of a shedf adjusting mechanism including mechanical drive means with a chain link member and telescoping lift components to vertically adjustably locate a shelf within the storage compartment of the unit wherein the mechanical means for obtaining such movements utilizes means associated with the flexible chain link member for maintaining said flexible drive member in compression during a phase of the operation of the shelf adjusting mechanism.

A further object of the present invention is to improve systems of the type set forth in the preceding object wherein the flexible drive member is a chain link member slidably reciprocably movable with respect to a guide insert within a fixed member that has a movable member telescoped thereover and connected to the drive member for movement with respect to the fixed member into retracted and extended positions.

These and other objects are attained in the form shown in the illustrative embodiment of the invention which by summary, includes housing means forming a storage compartment having a top access opening thereto sealed by a movable top closure member and wherein the housing means forms a shallow space beneath the food storage compartment having mechanical means located therein for moving a flexible drive member from the machinery compartment into the food compartment and wherein within the storage compartment is located a pair of telescoped shelf adjusting members one of which receives the flexible drive member in guided relationship with respect thereto and the other of which is operatively connected to the flexible drive member to be driven thereby into retracted and extended positions with respect to the drive member receiving one of the pair of telescoped members and wherein the top closure member is connected to the movable telescoped member so that it will be raised from said top opening by movement of said telescoped members to an extended position to provide access to the storage compartment.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a view in perspective of a portable refrigerator unit including the present invention;

FIGURE 2 is an enlarged view in vertical section taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a view in horizontal section taken along the line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary view in vertical section taken along the line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged fragmentary vertical sectional view taken along the line 5—5 of FIGURE 3;

FIGURE 6 is a fragmentary vertical sectional view taken along the line 6—6 of FIGURE 5;

FIGURE 7 is a view in horizontal section taken along the line 7—7 of FIGURE 4;

FIGURE 8 is an enlarged fragmentary vertical sectional view of a portion of the shelf adjuster of the present invention; and

FIGURE 9 is a view in horizontal section taken along the line 9—9 of FIGURE 8.

Referring now to the drawings, in FIGURE 1 a portable refrigerator unit **10** is illustrated including an outer casing **12** having side walls **14**, **16**, a front **18**, a rear wall **20** and a top **22** with a primary access opening **24** therein closed by a movable top closure member **26** and a secondary access opening **28** therein closed by a removable closure member **30**. The top access opening **24** communicates with a primary storage compartment **32** defined by an inner liner **34** located in spaced relationship with the side wall **14**, front **18** and rear wall **20** and being insulated therefrom by thermal insulating material **36** disposed therebetween. The opening **28** communicates with a freezer compartment **38** defined by an inner liner **40** located in spaced relationship with the side wall **16**, front **18**, rear **20** and liner **34** being insulated therefrom by a layer of thermal insulating material **42**. An internally located wall **44** serves to bound the insulating material **42**, **36** interiorly of the cabinet **12** to define a machinery compartment **46** that extends as a shallow space **48** beneath the food storage compartment **32** at the bottom of the cabinet **12**.

In the illustrated arrangement caster units **50** are located on the cabinet **12** at each of the diagonal corners thereof to support the refrigerator unit **10** for movement with respect to a supporting floor.

Within the machinery compartment **46** is located a refrigerant compressor **52** that has its outlet connected by a conduit **54** to a condenser assembly **56** located adjacent the side wall **16** in alignment with a louvered air flow director **58** which directs cooling air into the machinery compartment **46** to pass over the condenser **56** for cooling refrigerant passing therethrough. From the condenser refrigerant passes through a conduit **58** thence through a refrigerant expansion means representatively shown as being an elongated capillary tube **60** which connects to an evaporator coil **62** located in conductive heat transfer relationship with liner **40**. A second evaporator unit **64** is serially connected to evaporator **62** and located within a recess **66** formed in one of the side walls of the liner **34** in convective heat transfer relationship with the storage space **32**. A conduit **68** connects the evaporator **64** in serial refrigerant flow relationship with the inlet of the compressor **52**. In the illustrated arrangement a drip pan **70** is located at the bottom of the recess **66** to drain condensed moisture from the evaporator coil **64** through a drain tube **72** into a collector pan **74** located within the machinery compartment **46**.

In accordance with certain principles of the present invention, in order to maintain a substantial portion of the space bounded by the outer housing **12** as storage space, and to maintain an easy access to all portions of the storage space bounded by the outer housing **12**, an improved shelf adjusting assembly **75** is located within the outer housing **12**. The assembly **75** is operated by a controller **76** on the front **18** to raise the top closure **26** and upper and lower shelves **80, 82** outwardly of the storage space **32** so that easy access is obtained through the top opening **24** in the outer housing **12** into the space **32** so that articles can be located on and removed from the shelves **80, 82**.

More particularly, the assembly **75** comprises lift components representatively shown as including a cylindrical guide post **84** located centrally of the space **32** and being disposed vertically thereof. The post **84** is fixedly secured to the bottom of the liner **34** on an insert member **86** fixedly located between the liner **34** and the wall **44**, as best illustrated in FIGURE 4. The post **84** has a movable cylinder **88** telescoped thereover and, as best seen in FIGURES 4 and 7, the lower end of the movable cylinder **88** has a guide ring **90** secured thereto by suitable fastening means such as screws **92** to locate radially inwardly directed tabs **94** of the ring **90** in guided relationship with elongated grooves **96** in the guide post **84**, as best seen in FIGURE 7. In the illustrated arrangement, the lower shelf **82** has a central depending hub **98** thereon that seats on the heads of the screws **92** to support the shelf **82** on the movable cylinder **88**. Similarly, the top shelf **80** has a depending central hub **100** thereon which seats on pins **102** secured to an inverted cup-shaped cap member **104** received over the upper end of the movable cylinder **88** and supported thereon for movement therewith. The upper end of the movable cylinder **88** is closed by a member **106** which is secured thereto. Pins **108, 110** are secured to and extend upwardly from the member **106** through the head of the cap member **104** into index openings **112, 114** in the top closure member **26** to interlock the shelf **80** against rotative movement with respect to the cylinder **88**. A screw **115** fastens top closure member **26** to cap **104**. By virtue of this arrangement, the top **26** is carried by the cylinder **88** with respect to the outer housing **12** but, if desired, the top **26** can be moved from the top opening **24** without movement of the cylinder **88**.

One feature of the present invention is the manner in which the cylinder **88** is moved into retracted or extended positions with respect to the fixed guide post **84**. The means for obtaining the extension and retraction of the telescoped members comprises a mechanical actuator utilizing a flexible drive member **116** made up of a plurality of links **118** having a first predetermined width

joined to a second plurality of links **120** with a lesser width by rollers or pins **122** to form a chain link configuration with one end thereof connected by a pin **124** to one end of a chain link guide rod **126**. An upper end of rod **126** is connected by a fastener **127** to the member **106** and thence to the top of the movable cylinder **88**.

The guide rod **126**, as best seen in FIGURE 9, has an H-shaped configuration with side wall portions **128, 130** slidably and guidably received within an opening **132** in an insert member **134** that is received within a guide tube **136** directed coaxially and longitudinally through guide post **84** in spaced relationship therewith. The upper end of tube **136** has an annular cap **137** thereon which fits into the upper end of post **84**. The space between tube **136** and post **84** is packed with insulation material **139**. The lower end of the tube **136** is directed through insert member **86** and is received within a fixed support member **138** which has a screw fastener **140** directed therethrough to hold the guide insert **134** with respect to the tube **136**. The tube **136** has a side opening **142** therein which overlies a curved surface **144** formed in the lower end of the insert member **134**. The surface **144** guides the flexible member **116** into and out of the opening **132** in the insert **134** so that the wide link members **118** of the flexible drive member **116** will overlie radially inwardly directed portions **146, 148** of the insert **134**, as best seen in FIGURE 7, to prevent side movement of the drive member **116** with respect to the insert **134**. The portions **146, 148** also engage the rollers **122** in sliding relationship therewith to further guide the flexible drive member **116** as it is being moved into and out of the insert member **134**.

The drive member **116** is driven by means including a sprocket **150** supported by a shaft **152** for rotation therewith. Fixed bearings **153, 154** support either end of shaft **152** (FIGURE 5) to locate the sprocket **150** for rotation so that teeth **156** on the sprocket **150** engage the chain track in spaces between the rollers **122** to drive the flexible drive member **116** into and out of the insert member **134**. The flexible drive member **116** preferably is passed through a wrap of greater than 90° about the sprocket **150** thence passes through an upwardly directed guide passageway **158** in a loop guide member **160** and is returned downwardly through a curvilinear passageway **161** back on itself through a lower guide passageway **162** where the opposite end of the drive member **116** is connected to a cord **164** that, as best illustrated in FIGURE 3, is maintained under tension by an elongated spring **166** having one end thereof connected to a fixed member **168** and the opposite end thereof connected to a bracket **170** that rotatably supports a movable pulley **172**.

The pulley **172** has a first pass **174** of the cord **164** passed thereover with the pass **174** being connected to a fixed member **176**. From the pulley **172** the cord **164** passes about a second pulley **178** rotatably supported on a fixed member **180** thence about a pulley **182** rotatably supported on a fixed member **184** from whence the cord passes to be connected to the flexible drive member **116**. By virtue of this arrangement, the spring member **166** will tension the flexible chain link against the drive sprocket **150** whereby the drive chain passes from the sprocket **150** and is moved therefrom by a cam surface **186** on the end of the insert member **134**, into the opening **132** through the insert member **134**.

The chain link guide and tensioning arrangement are characterized as seen in FIGURES 2 and 3 as being located in a common plane within the shallow machinery compartment space **48** thereby occupying a limited part of the space bounded by the outer housing **12** of the refrigerator **10**.

The sprocket **150** is driven by a power transmission **188**, that likewise, is characterized by having a low profile with the component parts thereof being located substantially in a common plane within the shallow space **48**. More particularly, the power transmission **188** includes

a reciprocal rack **190** slidably received in a guide member **192** having an opening **194** formed therein into which a drive gear **196** connected to the shaft **152** is directed to drivingly engage teeth members **198** on the rack member **190**. Beneath the rack member **190** is located a connecting link **200** having one end thereof pivoted to the end of the rack **190** at **202** and the opposite end thereof pivotally connected on the outer periphery of a driven gear **204** at **206**. The driven gear **204** is supported rotatably by a shaft **208** on a frame member **210** and has teeth members **212** on the outer periphery thereof located in driving engagement with a spur gear **214** connected to a shaft **216** from a unidirectional drive motor **218** located within the machinery compartment **46**.

Thus, when the controllers **76** are actuated, the motor **218** will rotate the driven gear **204** through the spur **214** so as to cause the link **200** to reciprocate the rack **190** within the guide **192** thereby driving the sprocket **150** through the drive gear **196**. Following a predetermined travel of the rack **190** suitable limit switches **220**, **222** will be engaged to terminate rotation of the sprocket **150**.

The driven gear **204** and link **200** in the mechanical drive system constitute a crank wherein movement of the drive gear **204** from the position as illustrated in FIGURE 3 to point where the pivot **206** is located diametrically opposite the illustrated position constitutes the opening phase of operation of the mechanism which is terminated by switch **220** engaging the rack **190**. As the driven gear **204** is moved to return the pivot point **206** to its original position, the rack **190** is driven to cause the sprocket **150** to be rotated reversely so as to cause the chain link **116** to be withdrawn from the guide insert member **134** to cause the movable cylinder **88** to be moved into its retracted position so that the shelves **80**, **82** will be positioned as illustrated in FIGURE 2. This movement is terminated by rack **190** engaging switch **222**.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for securing one end of said drive member to said movable cylinder, means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members joined by rollers, said guide means including an insert within said cylindrical member having side wall portions thereon slidably engaging said rollers for maintaining said link members colinearly with the axis of said cylindrical member.

2. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for securing one end of said drive member to said movable cylinder, means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members interconnected by roller members to form a chain, rotatable means including a gear for driving said chain, means for holding said chain in tension against said gear including tensioning means located in a plane common to the plane of said gear.

3. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for securing one end of said drive member to said movable cylinder, means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members joined by rollers, said guide means including an insert within said cylindrical member having side walls portions thereon slidably engaging said roller members for maintaining said link members colinearly with the axis of said cylindrical member, certain of said link members having a greater width than other of said link members, said insert member having other side wall portions, said greater width link members being located in overlying juxtaposition with said other side wall portions to prevent a predetermined sidewise movement of said rollers with respect to said insert member.

4. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for securing one end of said drive member to said movable cylinder, drive means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members joined by rollers to form a chain, said guide means including an insert within said cylindrical member having side wall portions thereon slidably engaging said rollers for maintaining said link members colinearly with the axis of said cylindrical member, said drive means including a rotatable member having a portion thereof drivingly engaging said chain, a reciprocal member in driving engagement with said rotatable member, a guide for said reciprocal member, and means including a unidirectional drive motor for producing relative reverse reciprocation of said reciprocal member with respect to said guide and reverse rotation of said rotatable drive member.

5. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for securing one end of said drive mem-

ber to said movable cylinder, means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members joined by rollers to form a chain, said guide means including an insert within said cylindrical member having side wall portions thereon slidably engaging said rollers for maintaining said link members colinearly with the axis of said cylindrical member, said insert being disposed coaxially of and through substantially the full length of said cylindrical member, said means for connecting one end of said flexible member to said movable cylinder including a chain link rod directed into said insert and slidably reciprocably movable with respect thereto, said insert having a recess formed in one side thereof for guiding said chain outwardly of said insert at the opposite end thereof through a predetermined curvilinear path, a drive sprocket disposed within said recess in said insert having teeth thereon disposed in driving engagement with rollers of said chain, said sprocket being rotatable to drive said chain through said curvilinear path and into and out of said insert.

6. In a compact portable refrigerator or like unit, the combination of a shelf adjuster mechanism comprising, a cylindrical member, a movable cylinder telescopingly received on said cylindrical member, an elongated flexible drive member located within said cylindrical member, means for connecting one end of said drive member to said movable cylinder, means secured to the opposite end of said flexible drive member for reciprocating said drive member relative to said cylindrical member to cause said movable cylinder to move into extended and retracted positions with respect to said cylindrical member, means within said cylindrical member to prevent buckling of said flexible member whereby said flexible member is

maintained in compression between said movable cylinder and said drive means during movement of said movable cylinder into an extended position with respect to said cylindrical member, said flexible member including a plurality of link members joined by rollers to form a chain, said guide means including an insert within said cylindrical member having side wall portions thereon slidably engaging said rollers for maintaining said link members colinearly with the axis of said cylindrical member, said insert being disposed coaxially of and through substantially the full length of said cylindrical member, said means for connecting one end of said flexible member to said movable cylinder including a chain link rod directed into said insert and slidably reciprocally movable with respect thereto, said insert having a recess formed in one side thereof for guiding said chain outwardly of said insert at the opposite end thereof through a predetermined curvilinear path, a drive sprocket disposed within said recess in said insert having teeth thereon disposed in driving engagement with rollers of said chain, said sprocket being rotatable to drive said chain through said curvilinear path and into and out of said insert, means for maintaining said chain in tension with said sprocket, said means including spring means connected to an end of said chain disposed exteriorly of said curvilinear portion of said insert at a point to produce greater than a ninety degree wrap of said chain about said sprocket.

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