United States Patent

[11] 3,610,313

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[33] **Germany**
[31] **P 17 08 149.1 and P 18 08 214.9**

[54] **GUIDING BAND FOR FOLDING DOORS, PARTICULARLY OF FURNITURE BODIES**
8 Claims, 15 Drawing Figs.

[52] **U.S. Cl.** **160/206**
[51] **Int. Cl.** **E05d 15/26**
[50] **Field of Search** 160/199, 206, 118, 117

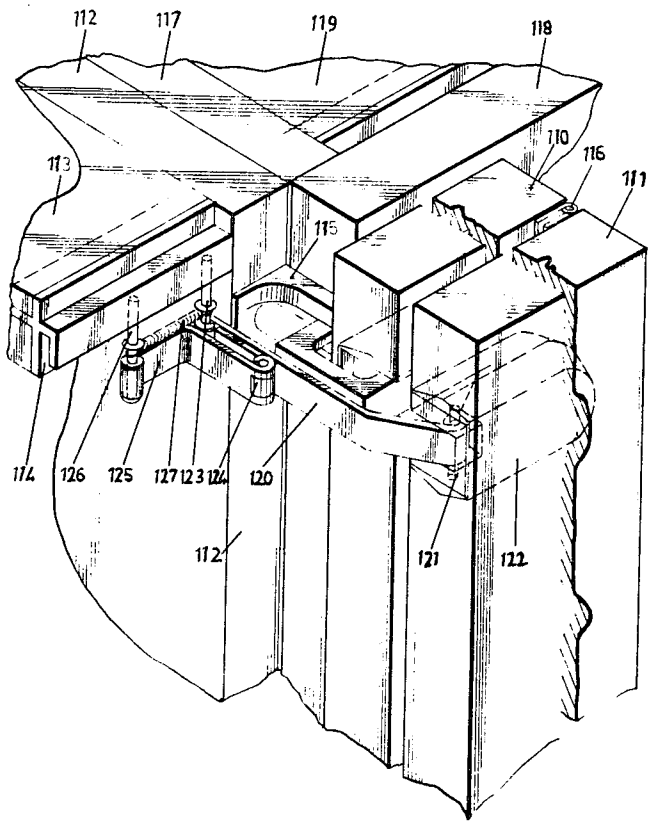
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Primary Examiner—Dennis L. Taylor
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ABSTRACT: A holding device and driving band for folding doors particularly of furniture, closets and other structure. A door wing journaled to swing about a vertical axis has a lever carried pivotally along one side thereof. The lever has more than one arm portion optionally resiliently movable in longitudinal, bellcrank and triangular manner with respect to each other. Up to two pin members are carried by the arm portion arrangement and these pin members cooperate with a fixed guide track. A resilient means is optionally provided between an end stop of the guide track and one of the pin members.



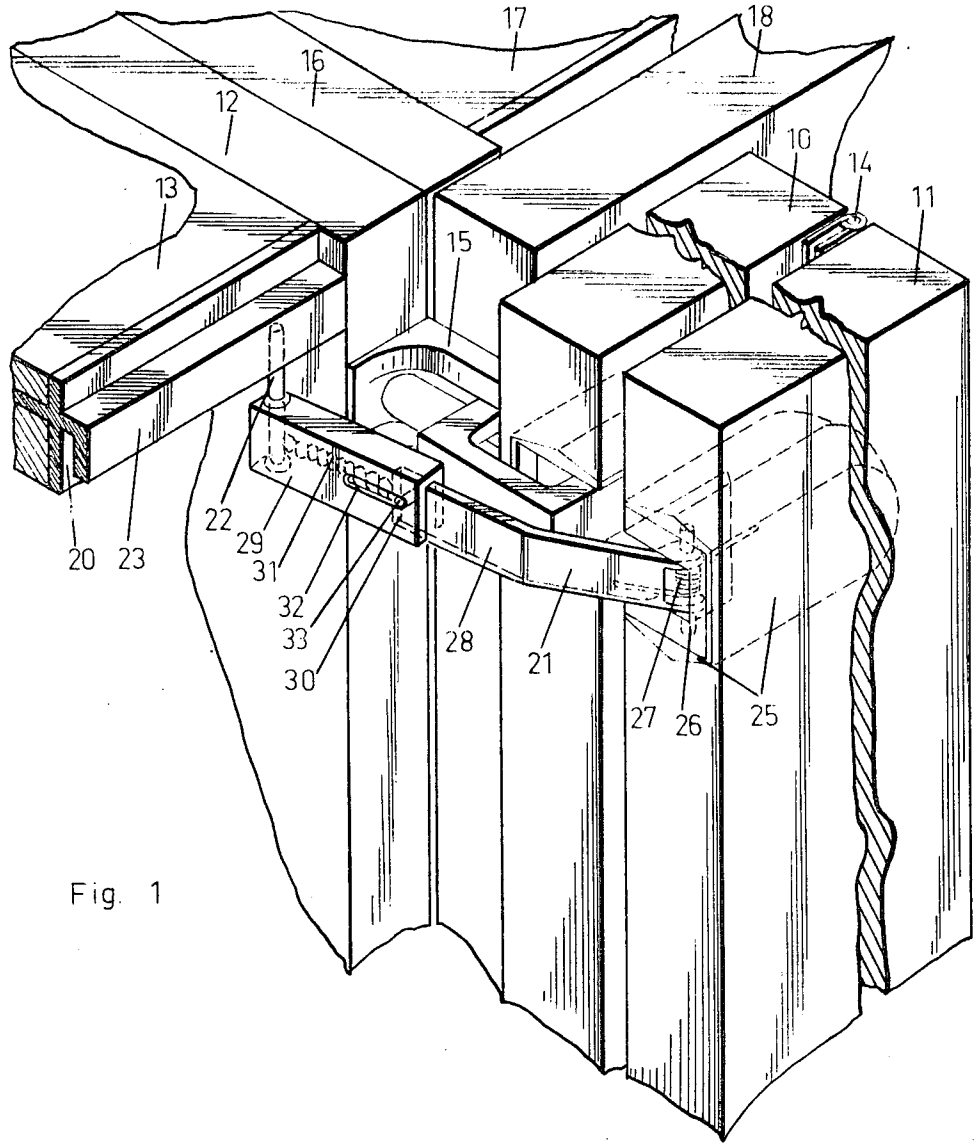


Fig. 1

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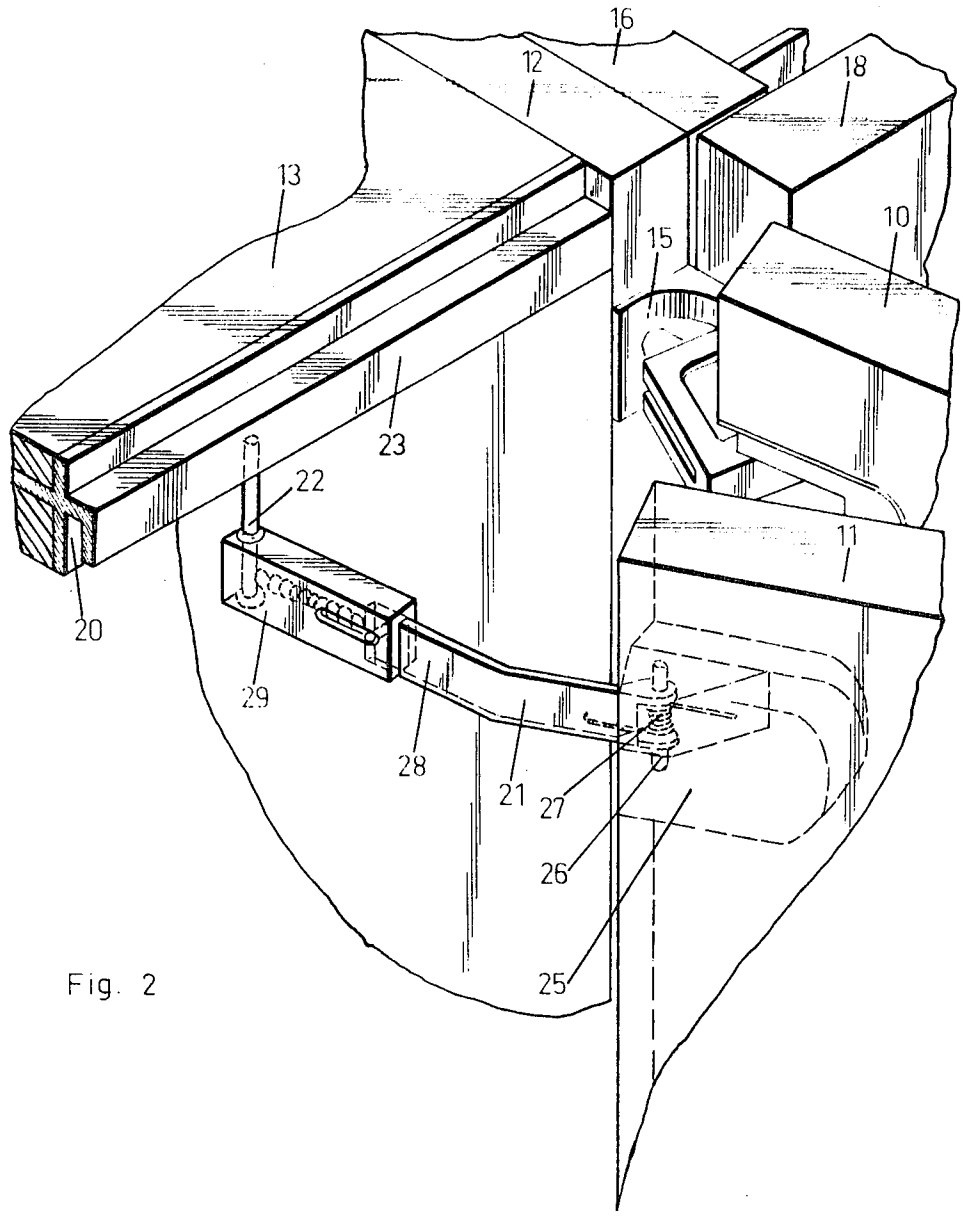


Fig. 2

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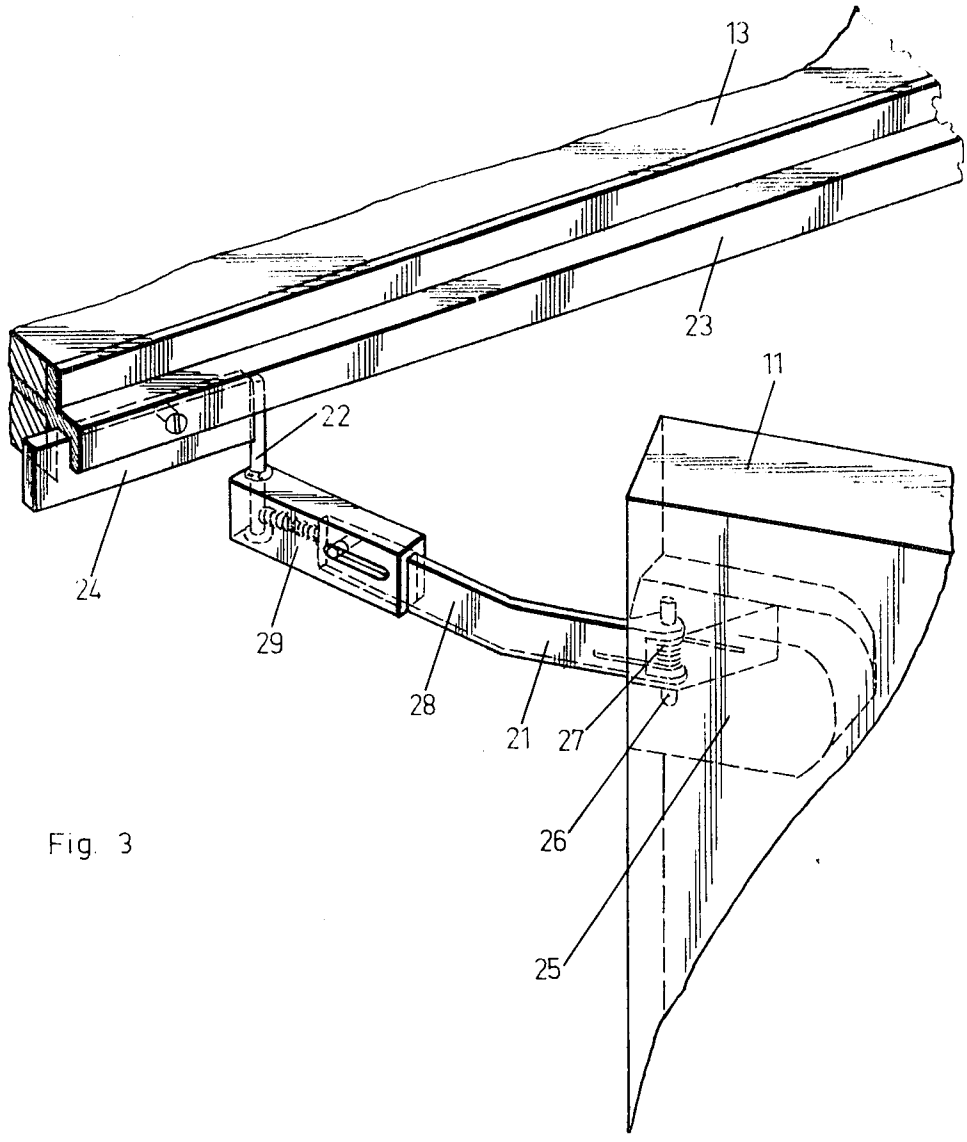


Fig. 3

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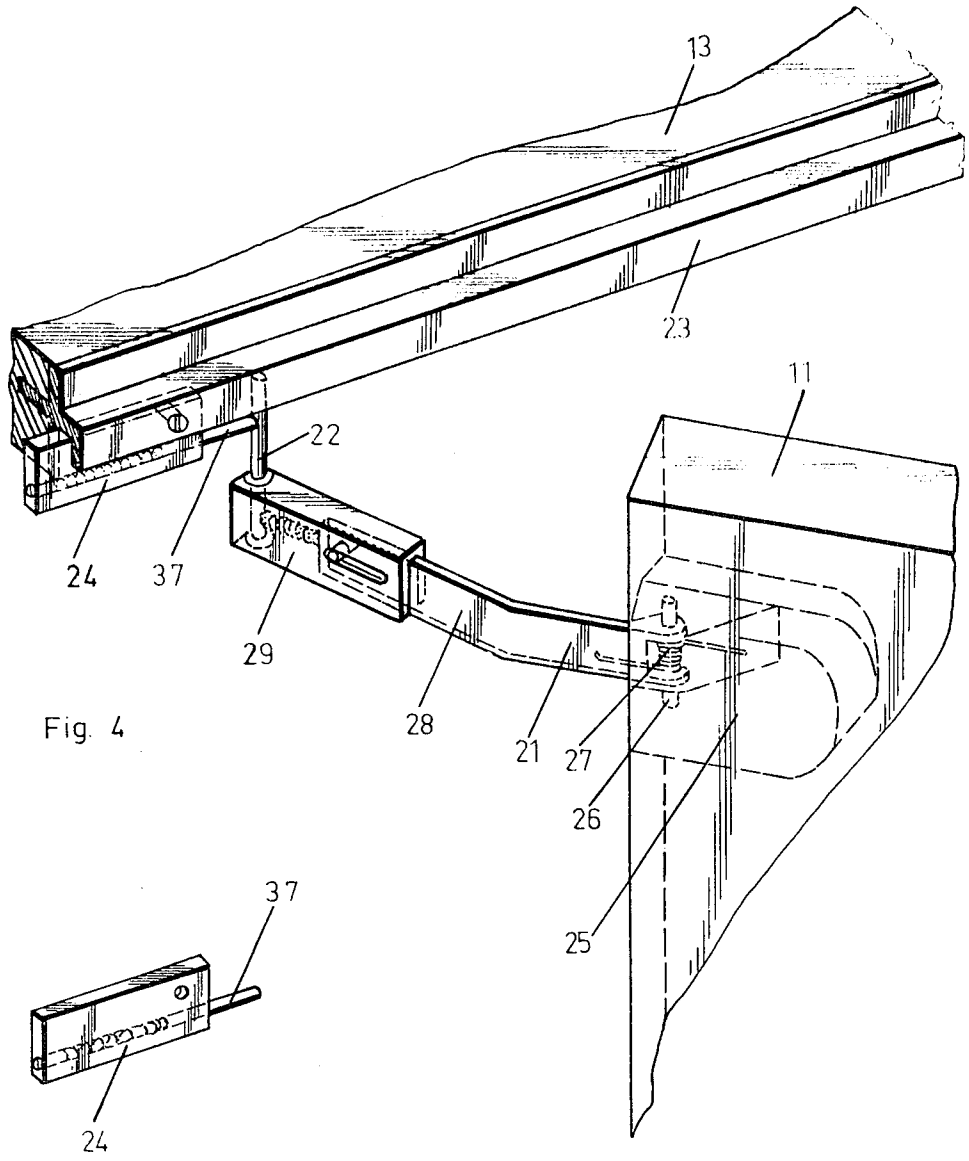


Fig. 4

Fig. 5

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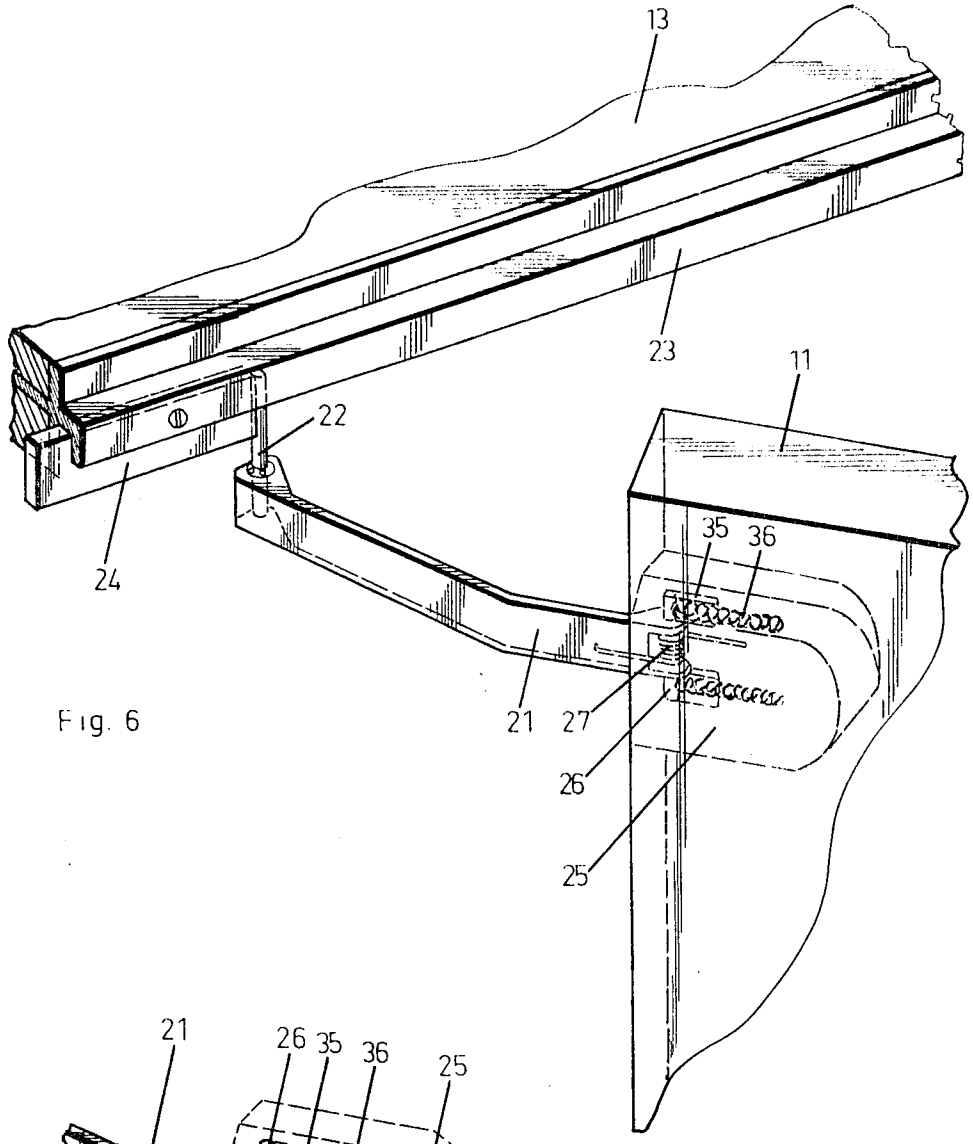


Fig. 6

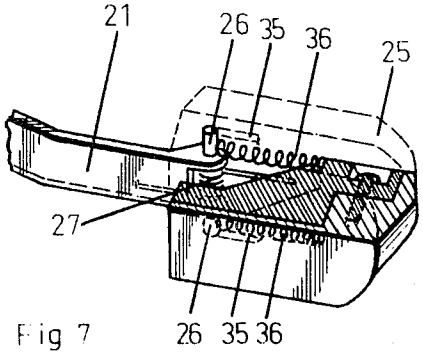


Fig. 7

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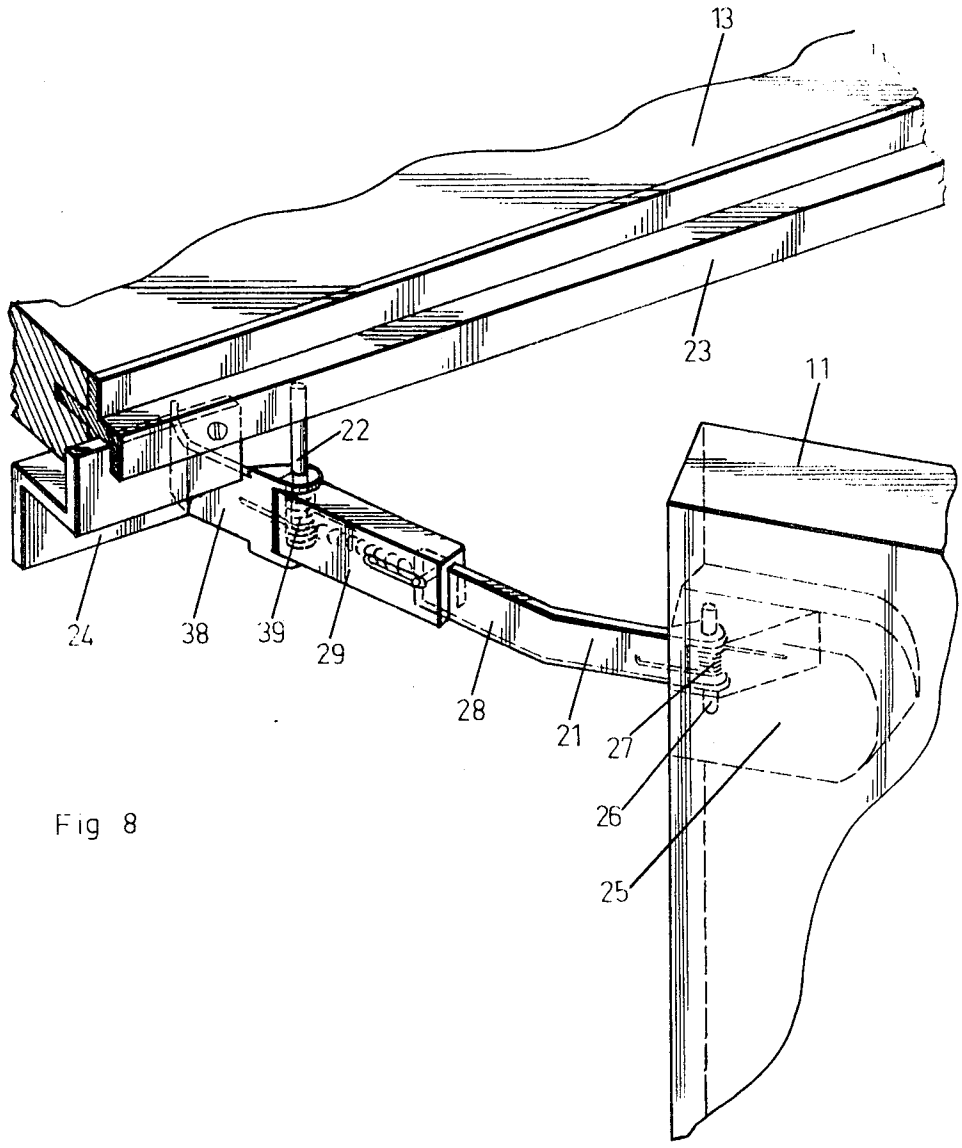


Fig 8

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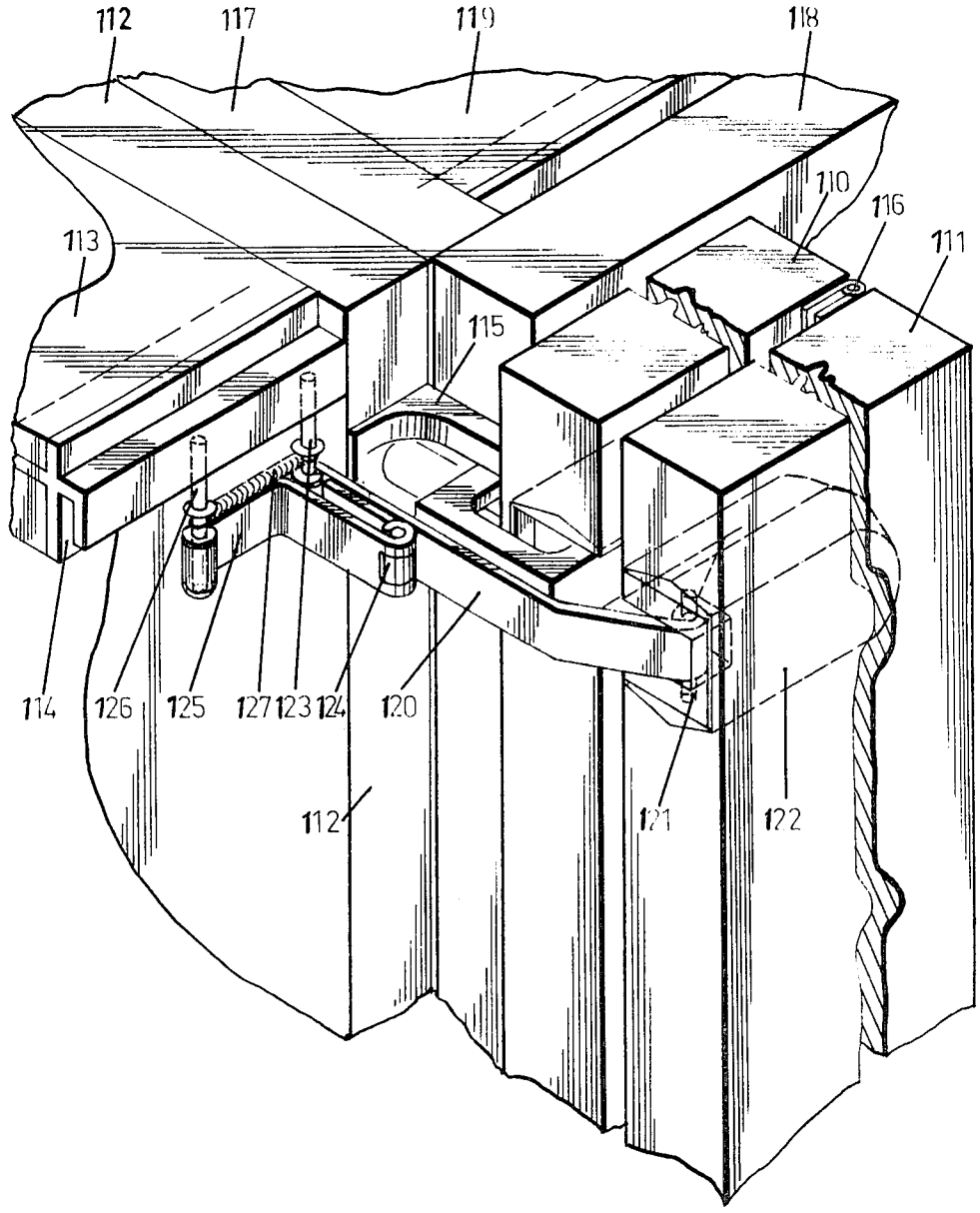


FIG. 9

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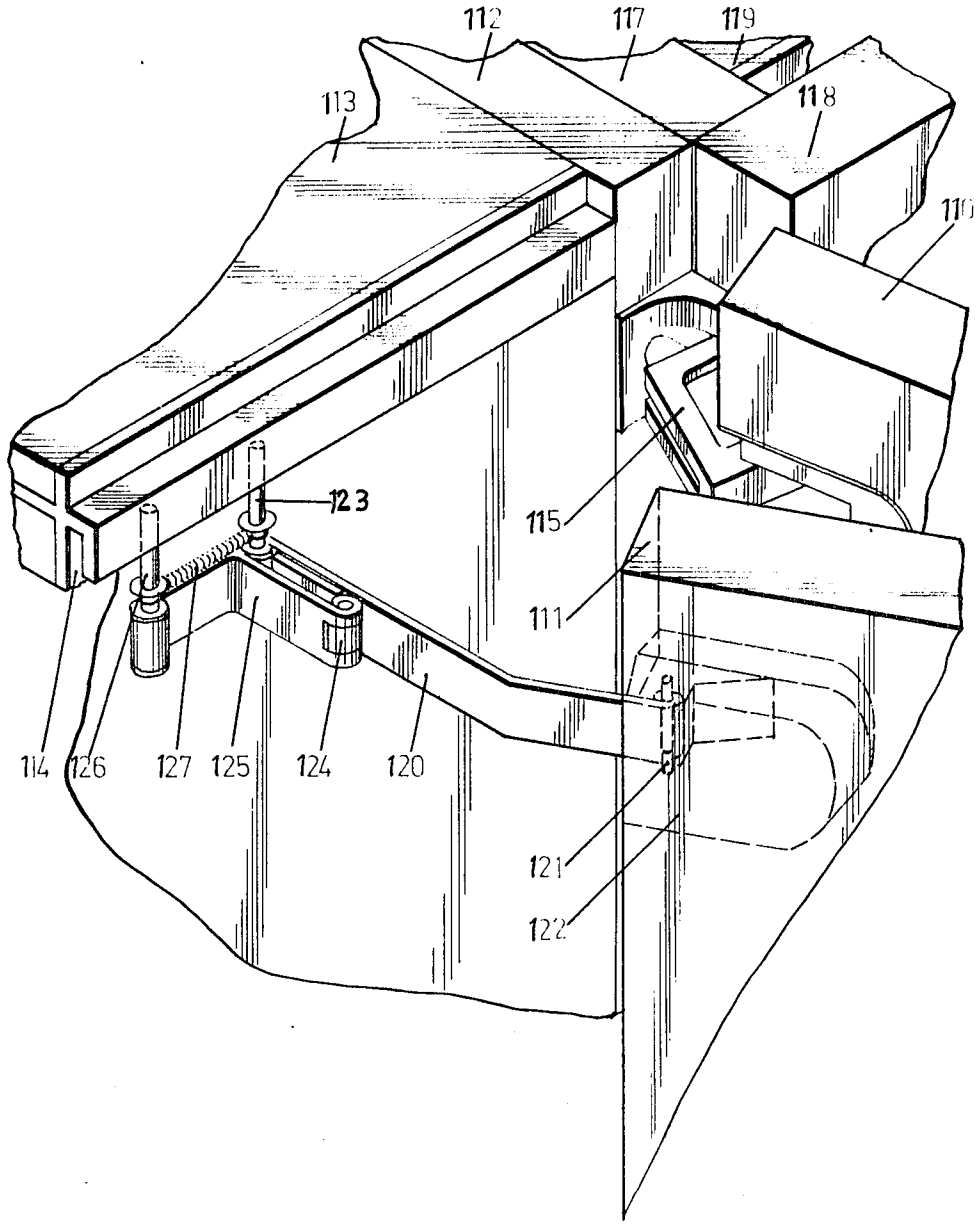


FIG 10

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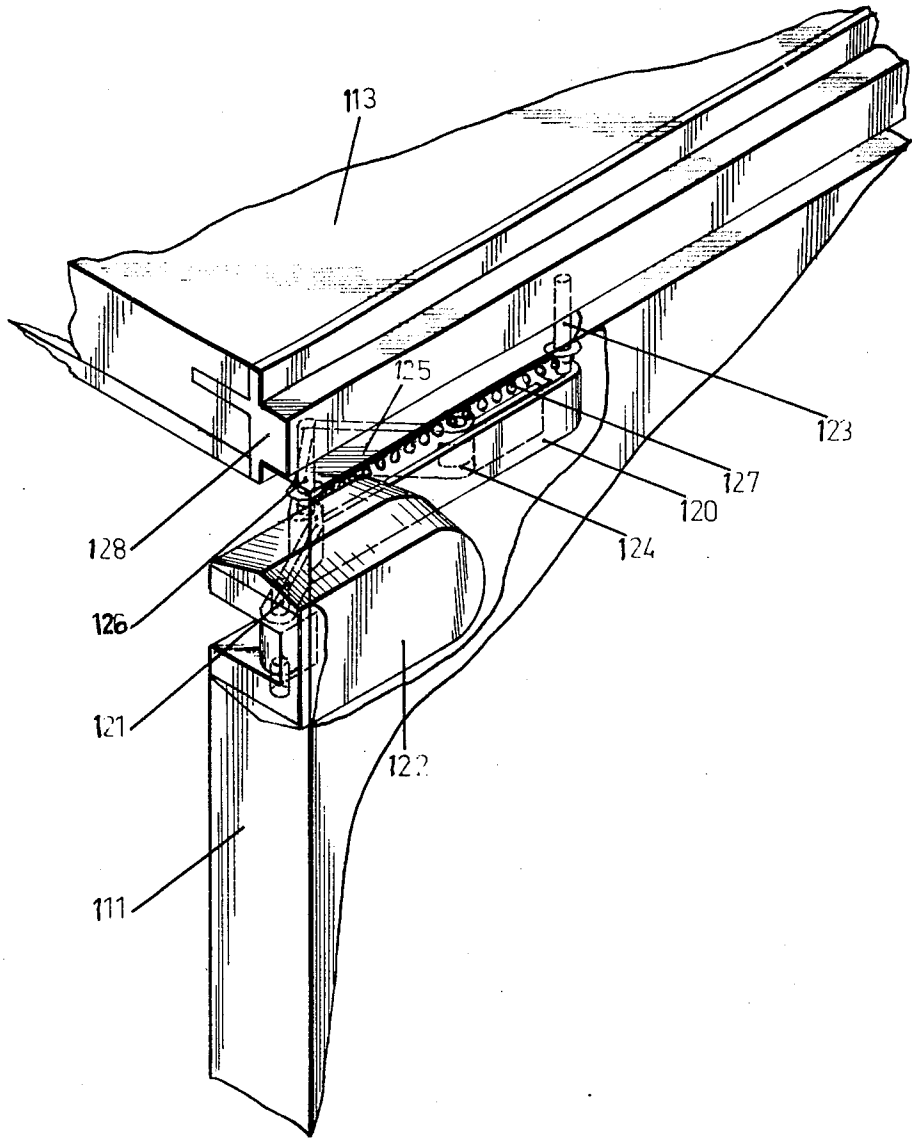


FIG 11

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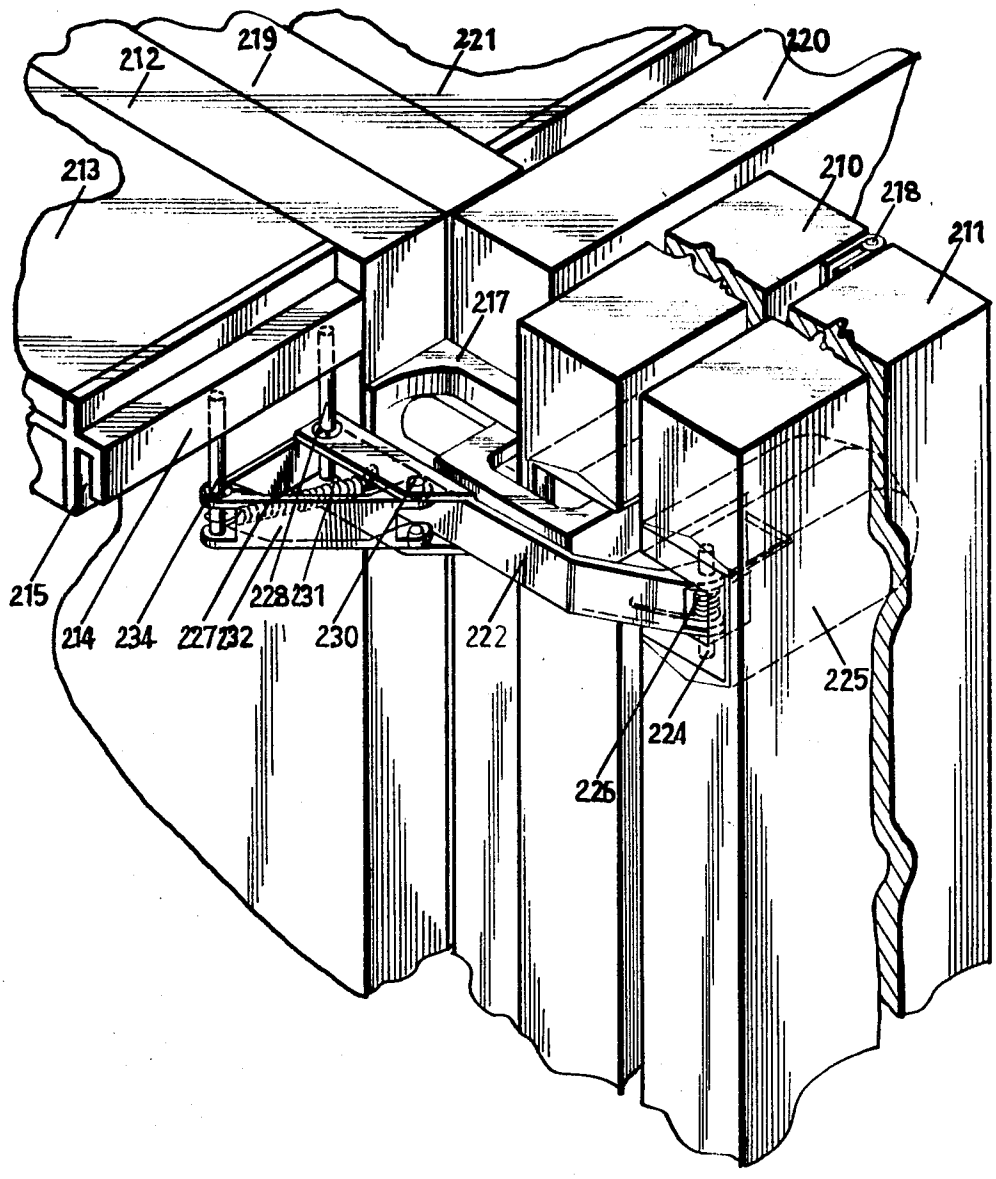


Fig. 12

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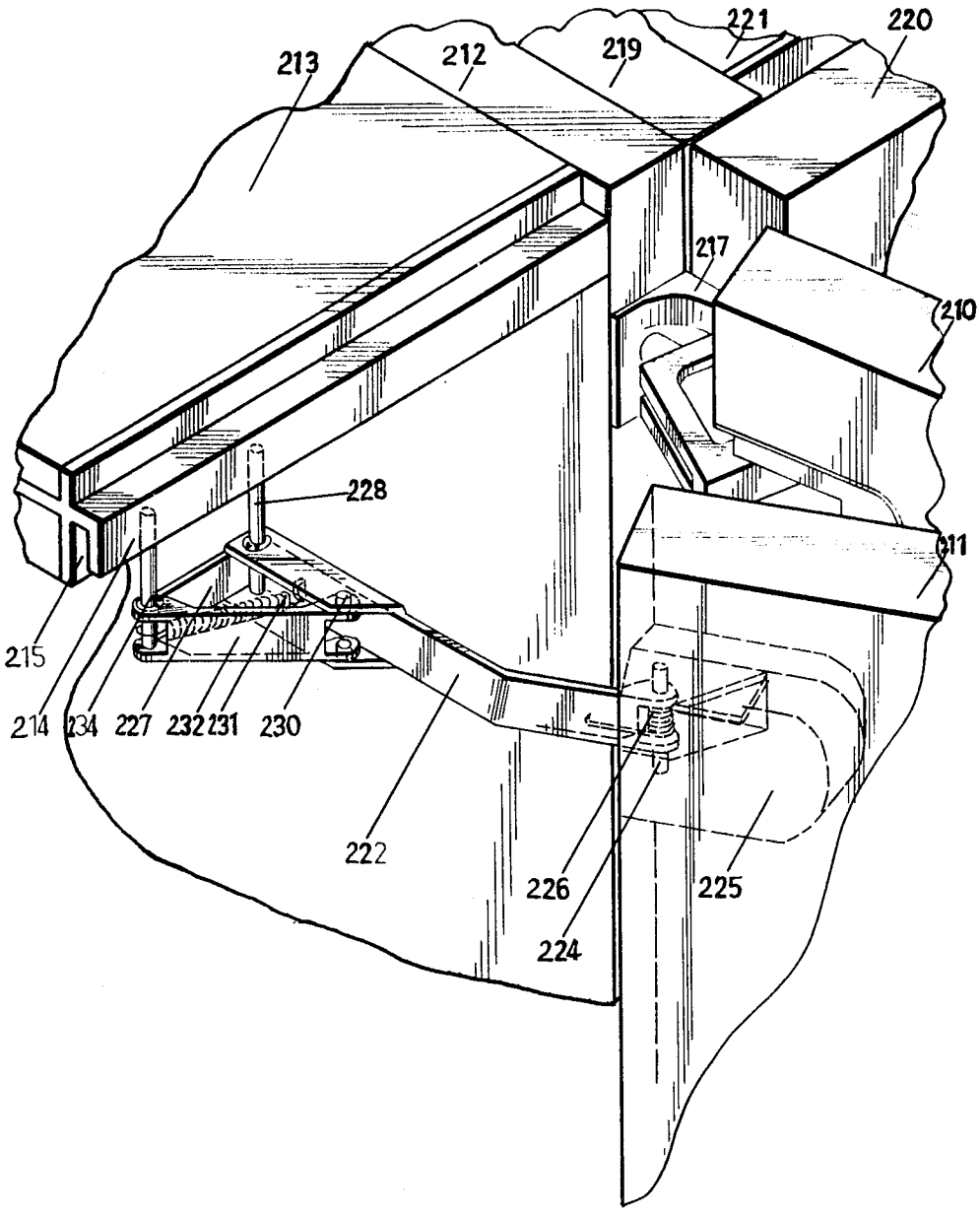


Fig 13

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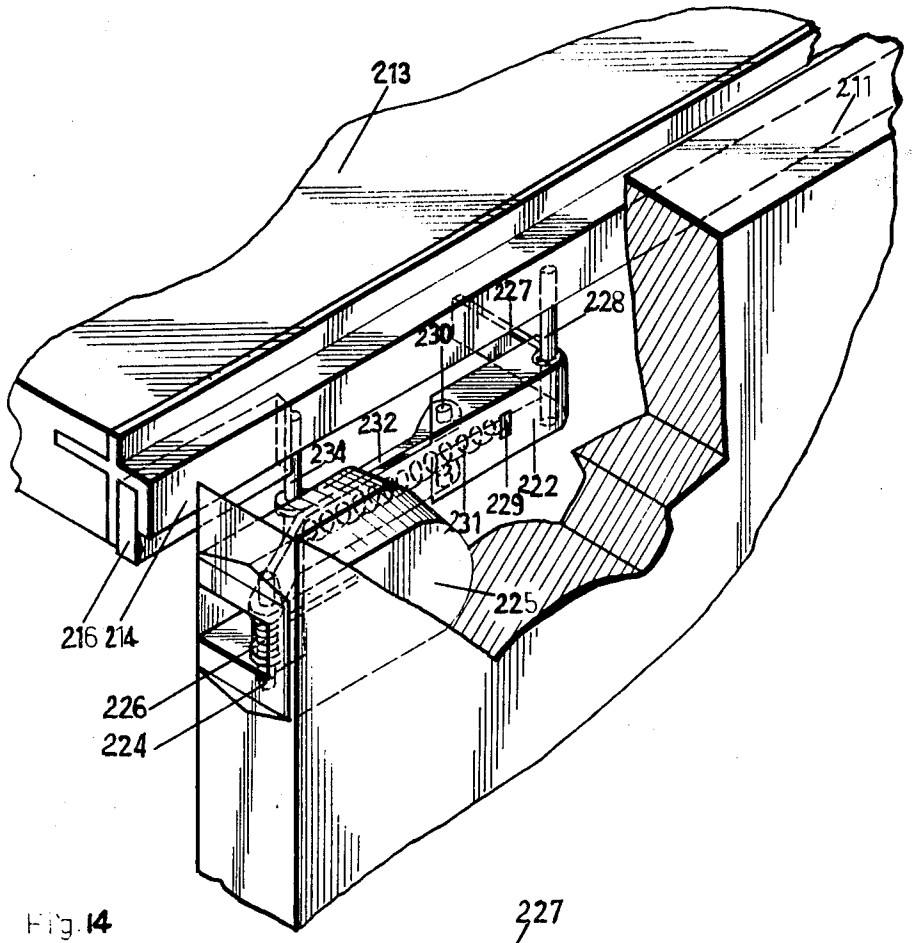


Fig. 14

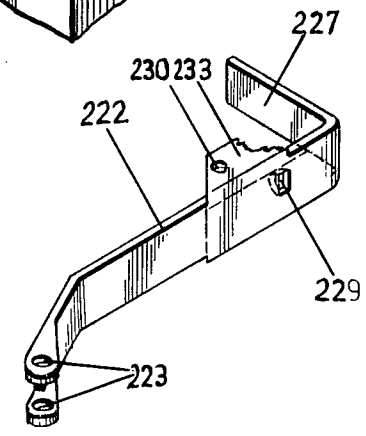


Fig. 15

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GUIDING BAND FOR FOLDING DOORS, PARTICULARLY OF FURNITURE BODIES

The invention relates to a holding device for folding doors including two wings interconnected along a vertical folding axis and adapted especially for furniture, closets and other structure.

Folding doors of the type noted for closing of furniture, closets and other structure possess a vertical folding axis formed by means of a hinge strip for swingable door wings opposite to usual linkage means connected directly to the door frame or to a sidewall of a body with respect to which the wings naturally have a greater degree of freedom of movement. Opening and closing of the door is made more difficult because of the wing secured to the free side of the folding axis and swingable up to 180° and such difficult opening and closing is attributable to the foregoing circumstances. Often this wing must be brought independently and isolated from the neighboring wing by hand into the closing or opening position. This disadvantage, due to the considerable swinging scope of the folding axis of turnable wings exists also when the door collectively is adapted for opening by use of special door linkage instead of from 90° to 180° opening.

An object of the invention is to avoid the noted type of shortcomings with folding doors. The present invention proceeds from the knowledge that such folding doors are easier and more readily opened and closed when the door wing connected to the folding axis and freely swingable is secured to a furniture or structure body and permits only such a degree of freedom that only with and in the condition for progressive opening and closing movement of the door collectively is there swinging movement about the folding axis. Such a fastening in addition makes possible that during opening and closing of the door without swinging one wing at a time both wings necessarily are adjusted together. Corresponding to this realization a holding device for the folding doors is attainable readily and particularly for mass production, which inventively is characterized by means of a horizontal structural body boundary provided at or in the area of the interface of a top and/or bottom location and provided with a guide track having an end stop and also having a pin member, bolt part or similar component engageable in the guide track and subject to effect of a spring upon a one-armed lever. The lever at one end is secured to a surface or longitudinal side of the door wing swingable about the folding axis. A pivot support for securing the lever to the door wing is provided and the lever is provided with means which effect a movement in the direction of the longitudinal axis of the lever during swinging of the lever over the dead center position. Particularly, the formation of the lever in accordance with the present invention achieves that a swinging movement about the turning axis during opening and closing of the door occurs at a time when exceeding the dead center position, so that the lever encounters a longitudinal movement in addition to the dead center position whereby the free length of the lever is shortened. In addition to the notable advantages of the holding device at hand, the further advantage is realized that the door is capable of being closed and opened in a shock-free and jolt-free manner. A preferred embodiment of the invention providing a longitudinally movable single-arm lever in a straight-forward manner provides for formation of the lever arm in two or more parts and the arm portions are telescopically connected with each other. For such telescopic type provision of the levers there is provided in a purposeful manner a spring means effective between the arm portion carrying a pin, bolt or similar member engageable in the guiding track with respect to the arm portion of the lever connected upon a pivot support. Further in accordance with the present invention, the longitudinal movement of a one-armed lever is also achieved by having the lever pivot support formed in a longitudinally shiftable manner. Hereby the pivot support in a purposeful manner comprises a journaling body with a vertically turning axis adapted to be inserted inwardly into a recess directed into the longitudinal side of the inner body of a door wing swingable about the folding axis with a shoe-type interfit and longitudinally shiftable or adjustable across from the guiding slits of the journaling body against force of spring means. A requisite damping of the lever advance against a stop of the guiding track during closing of the door is attainable additionally in accordance with the present invention by having the stop resiliently formed or possessing a spring-biased striker or engageable member. In place of or in addition to this embodiment, the damping of the lever advance can also be brought about by having the lever at its free end being swingable about a pin member engageable in the guide track and under effect of spring means upon an extension which arrives at the stop of the guiding track for engagement.

The foregoing and other objects of the invention will become apparent from the following disclosure in connection with the accompanying drawings, in which:

FIG. 1 illustrates a folding door equipped with a holding device with respect to a furniture body or structure and having open positioning;

FIG. 2 shows the folding door in an intermediate position;

FIG. 3 shows the folding door in a closed position;

FIG. 4 shows the holding device with a stop member having resilient spring means;

FIG. 5 shows the stop member of FIG. 4 in another perspective;

FIG. 6 shows a modification of the holding device;

FIG. 7 shows a detail of the holding device according to FIG. 6;

FIG. 8 is a perspective view of a holding device having a lever provided with an engageable stop member;

FIG. 9 illustrates a folding door structure having a folding band adapted for opening movement at 180° in the opening position;

FIG. 10 shows the folding door of FIG. 9 having the guide band in an intermediate position;

FIG. 11 shows the folding door of FIGS. 9 and 10 with the guide band in the closed position;

FIG. 12 shows a further foldable door having a guide band adapted for opening at 180° in the open position;

FIG. 13 shows the folding door of FIG. 12 having the guide band in an intermediate position;

FIG. 14 shows the folding door of FIGS. 12 and 13 having the guiding band in the closed position; and

FIG. 15 shows in perspective a detail part of the guide band.

A door wing freely secured with respect to the folding axis is usually swingable up to 180°. Difficulty in opening and closing of such folding doors can be attributed to the fact that such a door wing must be manually caused to have swinging movement together with the other wings secured to the door linkage. This considerable scope of swinging movement of the door wing freely connected to the folding axis is also unimpaired when the door collectively is adapted to be opened when using special door linkage to permit movement about 180° rather than 90°.

The present invention is concerned with the solution and avoidance of the known shortcomings of previously disclosed folding doors and proceeds upon the principle that opening and closing of such doors is facilitated. The free door wing connected to the folding axis is secured and has only such a degree of freedom that this door wing is swingable only during and in the condition of progressive opening and closing movements of the door about the folding axis. As a means for securing the freely movable door wing with respect to the folding axis, the present invention provides a guide band characterized in having a one-armed lever which at one end is swingable with respect to the surface side or interface of the door wing freely movable with respect to the folding axis and at the other end engaging a guide track of the furniture body or structure. This one-armed lever carries a further right-angled lever member subjected to effect of spring means and pivotally secured at an intermediate flange point of the lever. A free end of the right-angled lever member also engages the guide track of the furniture body or structure. In accordance with a preferred embodiment of the present invention the free

ends of the two levers are provided with identical extensions or projections for engaging the shared guide track on the furniture body or structure. The invention further relates to a guide band particularly for folding doors having two swingable wings journaled about a folding axis, for example, a hinge band. A lever connected to the door wing carries a further spring-biased right-angled crank or lever member which is engageable at its free end with a track of a furniture body or structure. A further embodiment of the present invention provides a less complex and less expensive fabrication of the guide band having advantageously a better track for the doors. A lever pivotally connected to the door wing has its free end bent into a right-angled shape and carries an arm serving for engagement of the one-armed lever. Identical extensions or projections for engagement of the shared track of the furniture body or structure can also be provided with this embodiment. These projections are provided with the one-armed turnable lever at its free end and with the neighboring lever in the area of the right-angled bend or division of the bending angle of the extension.

As can be seen from FIG. 1, the folding door comprises two wings 10 and 11. The folding door is provided on a furniture body or structure of which a sidewall 12 and the upper boundary forming a base 13 are illustrated. A hinge strip 14 forms the folding axis of the door wings 10, 11 and interconnects the two wings 10, 11 which each have securing connection at the interface of the body or structure sidewall 12 to wing 10 at an upper linkage band 15 and lower linkage band (not illustrated). The formation of the linkage bands 15 permits opening of the door wings 10, 11 out of the closed positions about 180°. The body or structure walls and base 12, 13 are contiguous with the same type body and form of an element of addition or cabinet part of which the sidewall 12 of the body or structure 12, 13 adjoining the side wall 16 and the upper base 17 as illustrated. The element of addition or closet (cabinet part) 16, 17 likewise has a folding door 18 standing in the closed position.

The holding device provided for securing the folding door wings 10, 11 on the furniture body or structure 12, 13 essentially comprises an upper base part 13 of the body or structure 12, 13 having a guiding track 20 and a one-armed lever 21 swingably secured to a wing 11. A free end of the lever carries a vertical pin bolt or similar member 22 engageable in the guiding track 20 and movable in the direction of its longitudinal axis. The guide track 20 is purposely provided in the form of a longitudinal groove with a U-formed cross section carrying a profile ridge 23 which is secured with a downwardly directed open side of the groove along the interface of the base part 13 of the body or structure 12, 13. At one end, which is located across from the folding axis 14 of the attached wing 11 during closing of the door wings 10, 11 is limited at a fixedly provided striker, stop or abutment 24 of the guide track 20 (FIG. 3). In place of the ridge 23 the guiding track 20 can also be provided in the form of a longitudinal slot directly along the underside of the base 13 near the interface thereof.

A shoe-type journaling body 25 serves in a purposeful manner for fastening the lever 21 on the wing 11. This journaling body 25 is insertable in a corresponding recess at the inwardly directed longitudinal side body of the wing 11. The journaling body 25 has a vertical turning or pivot axis 26 to which the lever 21 is connected. The axis 26 additionally serves as a bearing or support for a spring 27 effective upon the slightly bent or angled-off connecting end of the lever 21.

The one-armed lever 21 is formed of several parts and comprises an arm portion 24 connected to the axis 26 and a forward arm portion 29 carrying a pin member 22 engageable with the guide track 20. Both lever parts or portions 28, 29 are telescopically connected to each other so that the arm portion 29 is longitudinally movable with respect to the arm portion 28. For this purpose the arm portion 29 is provided with a cross section complementary to a slot 30 of the cross section of the arm part 28 and provides longitudinal shift or adjustment upon the part 28 against the force of a spring 31. A pin or rod 33 guided in a longitudinal hole or slot 32 serves as a holding means for the arm portion 29 and limits the longitudinal movement thereof on the part 28.

Another embodiment for the holding device with a lever 21 longitudinally movable and adjustable in the direction of its longitudinal axis can be seen in FIGS. 6 and 7. The lever 21 is formed herewith in one part. The turning axis 26 of the lever 21 is provided in two opposite longitudinal slits 35 in a journaling body 25. Springs 36 are effective upon the ends of the pivot axis 26 in two horizontal parallel spaced positions with respect to each other.

In the opening position of the door wings 10, 11 in which the door is located in folded-together condition adjacent to the door 18 of the furniture body or structure 16, 17 at 180° about the linkage bands 15, the lever 21 is in the position illustrated in FIG. 1 with the pin member 22 engaging the guiding track 20 with the previously described embodiments of the holding device. During closing of the door wings 10, 11 by means of straightforward swinging about the linkage bands 15, the lever 21 occupies a preliminary position under influence of the force of spring 27, whereby the pin member 22 glides along the guide track 20 and the wing 11 swings about the folding axis 14 (FIG. 2). When the pin member 22 reaches the end of the guide track 20 and engages the stop 24 for emplacement, then the lever 21 swings during progressive movement of the door wings 10, 11 into the closing position against the force of spring means 27 about the axis 26 and lies in alignment with the inner side of the door during closing of the door wings 10, 11. During this turning movement in a clockwise direction about the axis 26 the lever 21 passes beyond the dead center point position. The necessary shortening of the free lever length for the purpose of shock and jerk-free closure of the door can be effected by means in accordance with the present invention making possible the movement of the lever 21 in the direction of its longitudinal axis. Therefore in the illustrated embodiment in accordance with FIGS. 1 through 4 the telescopic-type formation of the lever 21 occurs with the part 29 thereof longitudinally movable on the part 28 against the force of spring 31 in the direction of the turning axis 26 and after reaching the end position of the lever 21 with closed door wings 10, 11 the starting position is again occupied and with the lever embodiment according to FIG. 6 the movable lever journal 25 of which the turning axis is shifted or adjusted against the effect of spring means 36 in the longitudinal slits 35.

Upon opening of the door wings 10, 11 subsequently, the lever 21 then carries out an opposite turning movement about the axis 26 under effect of the force of spring means 27 and occupies again the starting position illustrated in FIG. 1. Hereby again the lever 21 passes beyond the dead center point position whereby the described means for longitudinal movement of the lever 21 are again effective.

For damping the door during closing procedure, particularly with the pin member 22 engaging the stop 24, the lever can be provided with a resilient stop or abutment 24 or as illustrated in FIGS. 4 and 5 with a spring stop member 37.

In place of or in connection with the spring formation of the stop 24 the closing movement of the door wings 10, 11 can also be damped by means of a swingable extension 38 on a free end of the lever 21, which reaches into engagement with the stop 24 in place of the pin member 22. The projection or extension 38 is journaled to be swingable in a purposeful manner about the pin member 22 in a clockwise direction against the force of a spring means 39 limiting means provided therewith hold the same in an end position in line with the longitudinal axis of the lever 21.

It is understandable that the holding device in accordance with the present invention is not limited to folding doors which are adapted to be opened about 180° around the linkage bands 15. The holding device is also usable for folding doors for which the opening angle 90° and more can be provided. Likewise, the present invention encompasses the embodi-

ments of prerequisite folding doors secured in place by the described upper holding device only with one lower or with one upper and lower holding device with respect to the furniture body or structure.

A guide band is intended for a folding door consisting of two wings **110** and **111**. It provides closure for a furniture body or structure of which a sidewall **112** and a base **113** can be more readily seen in FIGS. **9** and **10**. The base **113** has a guide track in the form of a ridge having a slit **114**.

By advantageous means of linkage bands **115**, however, not belonging to the present invention it is possible to open the door wings **110**, **111** about 180° from the closed position and the wing **110** is secured to the interface of the sidewall **112**. The freely turnable wing **111** is connected to the securely anchored soor wing **110** by means of a hinge band **116** forming a folding axis.

The body or structure **112**, **113** adjoins a comparable body or structure in the form of an element of addition of which the sidewall **117**, the door **118** and a base **119** are indicated.

The guide band comprises essentially a one-armed lever **120** extending predominantly and secured pivotally at one of its ends to an interface of the wing **111**. The turning point **121** is located in a purposeful manner in a recess **122** of the door structural part or wing **111**. The other lever end is provided with an extension **123** engaging the slotted ridge **114**.

The lever **120** carries a right-angled lever member **125** formed and secured to a laterally flanged turning point **124**. This double-shanked lever member has an extension **126** likewise engaging the slotted ridge across from the shank end with respect to the turning point **124** and is subject to effect of a spring means **127**. In the open position of the door wings **110**, **111** in which the latter are swingable about linkage bands **115** in the folded condition at the door **118** of the furniture body or structure **117**, **119** adjacent thereto, the spring means **127** maintains the lever **125** in an end position, in which the lever is positioned at a right angle with respect to lever **120** as shown in FIGS. **9** and **10** and there is connection with respect to the turning point **24** of the adjoining shank. During closure of the door by means of ordinary swinging of the wings **110** or **111**, the lever swings in a clockwise manner about the axis **124** with a free shank end engaging abutment or stop **128** under effect of such engagement recognizable from FIG. **11** and occupying the position shown in FIG. **11**. After this movement against the force of spring means **127**, the extension **126** of the lever **125** is positioned in front of the abutment or stop **128**. The free shank end now lies within alignment with the turning point **124** on lever **120** which during closure of the door extends along the inner side thereof.

If the door is subsequently opened again by swinging one of the door wings **110** or **111**, then the lever **125** under force of spring means **127** has a turning movement again in an opposite direction about the point **124** and occupies the end position in FIG. **9** and **10** as noted. The lever **125** remains in this position in all intermediate positioning as well as in the open positioning of the folding door wings **110**, **111**.

Of course, the guide bands are not restricted to folding doors which are adapted to be opened about the linkage bands **115** by 180°. The structure of the present invention is also usable for folding doors of which the opening angle is 90° and more. In these cases, the turning point **121** of the adjoining part of the lever **120** is formed in an entirely shortened manner.

According to the sample embodiment of FIGS. **12 – 15**, the guiding band is provided for a folding door including both wings **210** and **211**. The folding door provides closure for a furniture body or structure of which FIGS. **13** and **14** illustrate a sidewall **212** and a closure base **213**. At the interface of the base **213** a guide track is provided. This guide track purposefully comprises a strip or ridge **214** having a groove **215** therein. The open end of the groove **215** is closed off by means of an insertable stop or abutment block **216** (FIG. **14**).

The wing **210** is secured to the interface of the sidewall **212** of the furniture body or structure **212**, **213** advantageously by means of linkage bands **217** not belonging to the present invention though permitting opening of the folding door wings **210**, **211** by 180° out of the closure position. The freely turnable wing **211** is connected by means of a hinge band **218** forming the folding axis with respect to which the turnable door wing is joined for 180° movement.

The body or structure **212**, **213** adjoins a body or structure of the same type formed as an added element of which the sidewall **219**, door **220** and closure **221** are shown.

The guide band comprises essentially an angle or bellcrank lever **222** shown more specifically in FIG. **15**. The angle or bellcrank lever **222** at its slightly cropped off end is pivotally secured with a bearing or journal **223** at the interface of the door wing **211**. As a result, the vertical turning axis **224** of the bearing or journal **223** lies purposely in a shoe-type bearing or journaling body **225** which is insertably secured in a recess of the door wing **211**. A spring **226** surrounding the pivot axis **224** additionally has effect upon the lever end.

The opposite lever end engages the guide groove **215** on the furniture body or structure **212**, **213** and engages an arm **227** bent into a right angle. A vertically secured bolt or pin **228** in the vertex of the bending angle serves for engaging the groove **215**. Adjoining the pin or bolt **228** there is spring journaling means **229** and before this a journaling location **230** for a one-armed lever **232** under effect of a spring means **231**. The lever journaling location **230** and the bearing or journal for the bolt, projection or pin **228** purposefully form flanges or flaps **223** that are primarily in U-shaped profile.

At its free end the lever **232** carries a pin, projection or bolt **234** identical to the pin, projection or bolt **228**, likewise engaging the groove **215** of the furniture body or structure **212**, **213**. The arm **227** of the lever **222** in this way serves as the stop or abutment for the lever **232**. The arm **227** is longitudinally dimensioned so that the projections or pins **228** and **234** glide in the groove **215** in a line one after another.

The open position of the door wings **210**, **211** into which they swing about 180° by means of the linkage bands **217** in a folded condition of the door **220** of the furniture body or structure **219**, **221**, the spring **231** holds the lever **232** in an end position as shown in FIGS. **12** and **13** engaging an arm **227** of the lever **222**. Upon closing of the door wings **210**, **211** by ordinary swinging of the wings **210** and **211** both projections or pin members **228** and **234** glide in the guide groove **215** in the direction of the abutment or stop **216**. In this way the lever **222** encounters a turning movement progressively under effect of the spring means **226** in a clockwise manner about the axis **224**. If the projection, pin or bolt **234** of the lever **232** engages the stop or abutment **216** prior to closure positioning of the door wings **210**, **211**, then the lever **222** continues in a turning movement and passes over a dead center point position. Thereafter the lever **222** picks up the stop position with the lever **232** and occupies an end position in which the free lever end extends along the inner side of the door subject to corresponding magnitude or size of amplitude of the spacing between the pin members or projections **228** and **234** in the closed position of the door wings **210**, **211**. Now the largest spacing exists between the pin members or projections **228** and **234** (FIG. **14**).

If the door wings **210**, **211** are again opened subsequently by means of swinging of the door wings **210** and **211**, then the lever **222** follows an opposite turning movement about the point **224** whereby there is return gliding in the groove **215** and the engaging position of the lever **232** against the lever arm **227** is reestablished. This positioning shown in FIGS. **12** and **13** is maintained by the levers **222** and **232** in all intermediate positions as well as in the open position for the door wings **210**, **211**. The guide band according to the present invention is in no way limited to folding doors which are adapted for opening about 180°. The present invention is also applicable for folding doors having an opening angle between 90° and 180°. For these cases the part of the lever **222** carrying the bearing or journal **223** is formed in an entirely shortened manner.

It is, of course, to be understood that the present invention is, by no means, limited to the particular arrangement shown in the drawings, but also comprises any modifications within the scope of the disclosure.

I claim:

1. A driving band for folding doors particularly of structure having at least one freely movable wing journaled along a door folding axis and having a guide track for the structure, comprising: lever means having a first projection engaging the track and journaled at one end to the door wing, a second projection likewise engaging the track and provided in end stop position at a constant spacing from said first projection on said lever means, pivot means carried by said lever means in a location intermediate said first projection and the door wing journaled locations thereof, a further lever arm member journaled at one end to said pivot means and journaled at an opposite end to said second projection, said pivot means together with said first and second projections defining collectively a triangular relationship for end stop position between said lever means and said lever arm member relative to each other, and spring means having one of opposite ends thereof secured to said second projection so that against bias of said spring means there is a dead center pivotal relationship that exists between said lever means and said further lever arm member for reaching end stop position thereof.

2. A driving band for folding doors particularly of structure having at least one freely movable wing journaled along a door folding axis comprising: a guide track for the structure, a lever engaging said track and end journaled with respect to said wing in a location spaced from said door folding axis, a turning point adjacent to said track engaging end thereof and located intermediate opposite ends of said lever, a right angle crank having one end pivotally journaled to said turning point and an opposite end journaled to said track, and spring means resiliently biasing track ends of said lever and crank with respect to each other.

3. A driving band according to claim 2, in which identical pin members engage said guide track and are carried respectively by track ends of both said lever and said crank.

4. A driving band according to claim 2, in which means forming a turning axis of said lever is recessed into said wing.

5. A driving band for folding doors particularly of structure having at least one freely movable wing journaled along a door folding axis and having a guide track for the structure, comprising: a lever engaging the track and journaled at one end to the door wing, a pivot means carried by said lever in a location intermediate opposite ends of said lever, a further single arm lever member journaled to said pivot means, a stop arm linked to track ends of said lever and said lever member, and spring means resiliently biasing said lever member and said stop arm with respect to said lever.

6. A driving band according to claim 5, in which identical projections engage the track shared thereby and are carried respectively by said lever member and said stop arm.

7. A driving band according to claim 5, in which a spring is effective upon a pivot axis for journaling said lever with respect to said swing.

8. A driving band according to claim 7, in which said pivot axis for journaling said lever is formed by a journaling body recessed into said wing.