United States Patent [19]

Armstrong

[11] **3,797,169**

[45] **Mar. 19, 1974**

[54] **WINDOW HINGE**

[75] Inventor: **Henry P. Armstrong,** Etobicoke, Ontario, Canada

[73] Assignee: **Truth Incorporated,** Owatonna, Minn.

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[52] **U.S. Cl.** **49/248,** 49/251

[51] **Int. Cl.** **E05d 15/40**

[58] **Field of Search** 49/246, 248, 250, 251, 49/252

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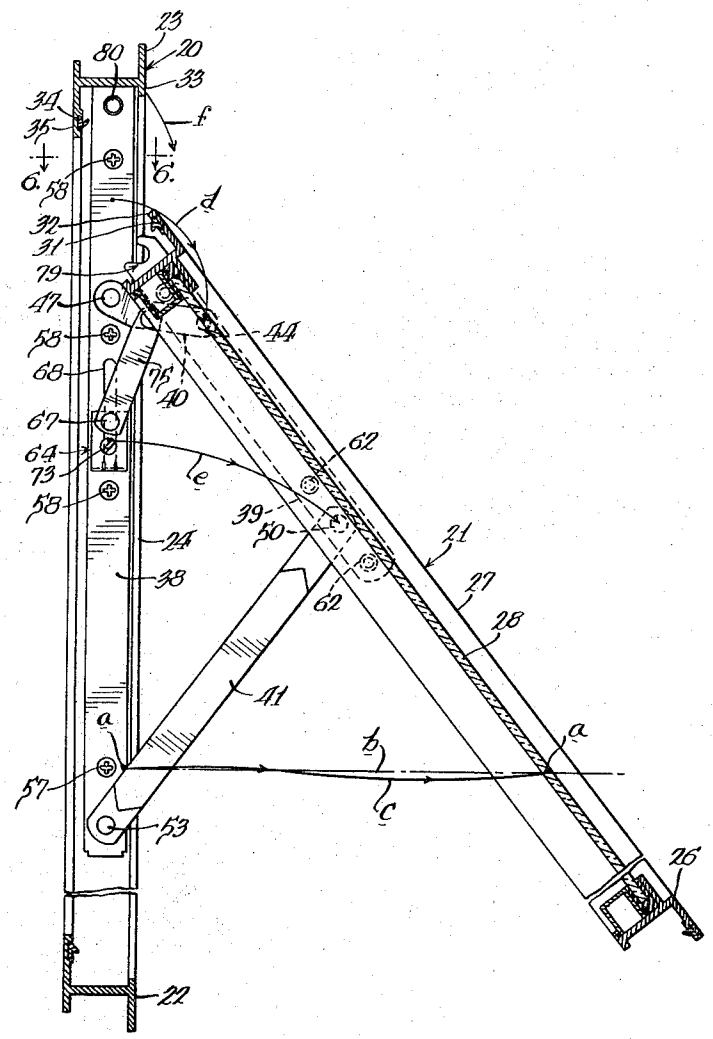
Primary Examiner—Kenneth Downey

Attorney, Agent, or Firm—Hofgren, Wegner, Allen, Stellman & McCord

[57] **ABSTRACT**

A hinge for pivotally supporting a window sash for angular opening and closing movement relative to a window frame, including first and second links pivotally mounted on the window frame and pivotally connected to the window sash, a friction device slidably mounted on the window frame independent of the pivotal mounting of the first and second links on the window frame, a third link pivotally connected to the friction device and pivotally connected to one of the first and second links so that the friction device retards movement of the sash, and coacting cam means including a roller mounted on the window frame and a cam yoke on the window sash operable to hold the sash closed and also arrest inward movement of the sash as it is swung toward open position. A pair of hinges are required along opposite edges of a sash.

1 Claim, 9 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

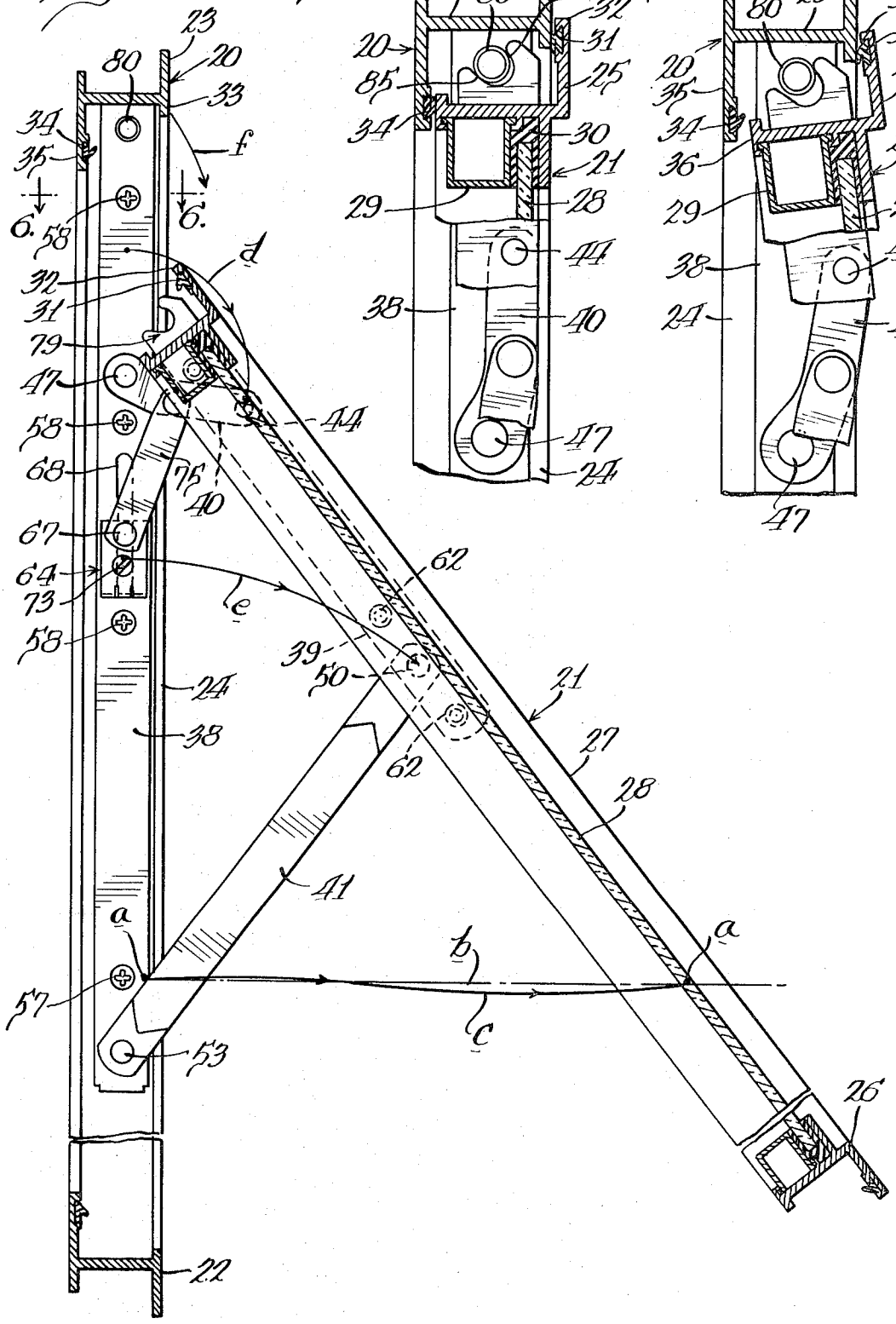


Fig. 2.

Fig. 3.

Fig. 4.

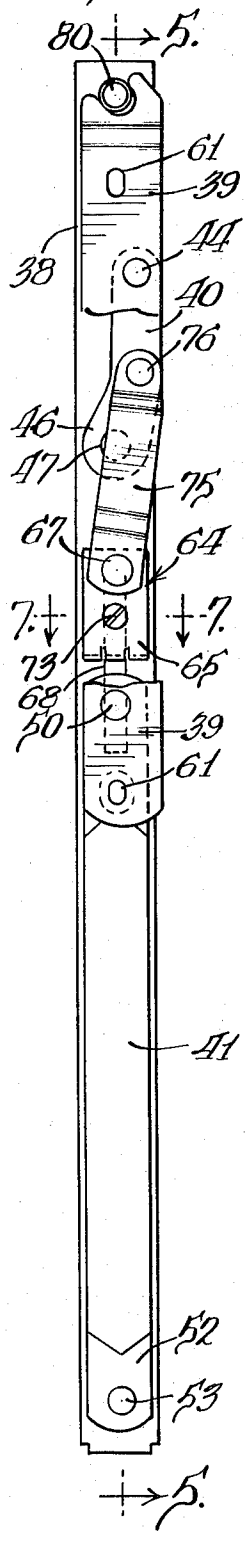


Fig. 5.

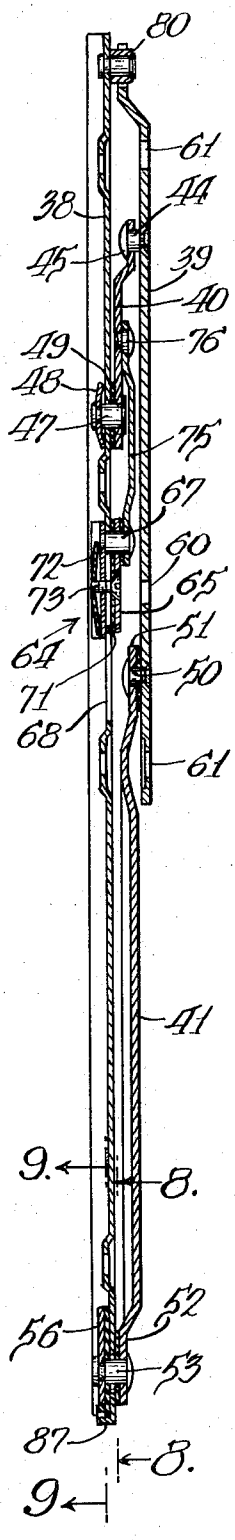


Fig. 6.

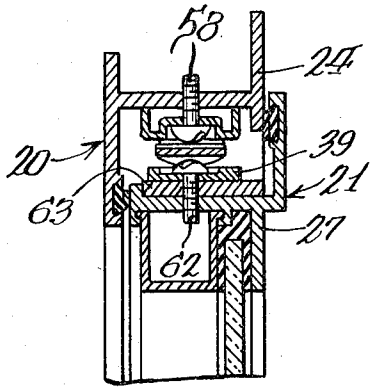


Fig. 7.

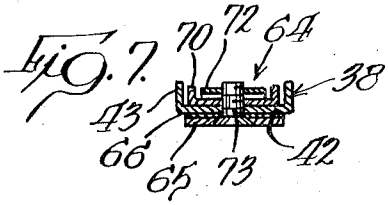


Fig. 8.

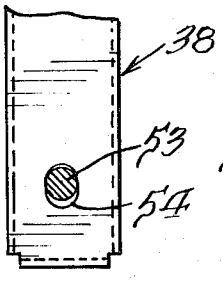
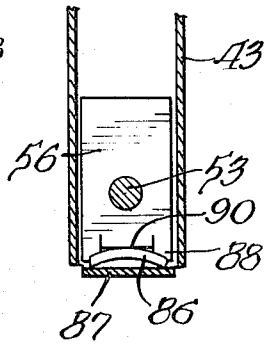


Fig. 9.



WINDOW HINGE

BACKGROUND OF THE INVENTION

This invention relates to a hinge for supporting and controlling angular movement of a casement, awning or hopper type window sash relative to a window frame, so that the sash is movable to an angularly inclined position in which the outside of the sash is accessible from the inside for purposes of cleaning.

In the past, it has been customary to mount sashes by means of a mounting bar secured to the window frame, a mounting bar secured to the window sash, and a pair of links each having opposite ends pivotally connected to the bars, in an arrangement sometimes referred to as a four bar linkage. In order to hold the window in open position, a friction device has been slidably mounted on the window frame bar and connected by linkage with the window sash to retard sash movement. In order to hold the sash in closed position, cooperating cam means on the mounting bars resists lateral force tending to swing one edge of the sash to open position. In general, U. S. Pat. Nos. 2,784,459 and 3,345,777 relate to hinges of the type described. Additionally, U. S. Pat. No. 2,746,101 relates to an awning type sash with a friction device for holding the sash in open position, and U. S. Pat. No. 2,926,399 relates to a casement window with cam means for holding one edge of the sash closed.

It has been found that prior friction devices have some disadvantages in that they have been incorporated in one of the link connections to the window frame bar, as a result of which the friction device has been subjected to excessive loads which accelerate wear. Also, it has been found that prior means for holding the window closed has allowed the edge of the window to move toward the window frame on initial opening movement in a manner which scuffs the weatherstripping and results in premature deterioration.

As a result of experience with prior art devices, it would be desirable to improve the construction in a manner to prolong the life of friction retarding devices and weatherstripping.

SUMMARY OF THE PRESENT INVENTION

It is a general object of the present invention to provide a hinge for pivotally supporting and controlling angular opening and closing movement of a window sash arranged so that pivotal axes of the window sash move away from and toward the window frame, and wherein the hinge is extremely durable and wear resistant.

Another object of the invention is to provide a hinge of the type described including a slidable friction device for retarding sash movement which does not embody a sash pivot or a sash link pivot, and does not directly support sash load.

A further object is to provide a hinge of the character mentioned embodying a window frame member, a window sash member, and a pair of links arranged in spaced relation and pivoted relative to both of the members, together with a friction device slidably supported on one of said members separately from said links and pivotally connected to the other member for frictional sash movement.

The hinge is flexible in accommodating a wide sash weight range, and the components are very compactly arranged, so that the hinge may be proportioned to fit into an uncommonly narrow space between confronting members of a window frame and a sash frame.

Another object of the invention is to provide a four bar articulated link hinge for providing angular swinging movement of a window sash relative to a window frame where flexible weatherstrip is interposed between the sash and the frame, and wherein the hinge embodies cam means acting to guide the hinged edge of the sash into closed relationship with the frame in a manner to limit flexing or compression of the weatherstrip.

The invention is further characterized in that the cam means guides the hinged edge of the sash away from closed relationship with the frame when the sash is opened, in such manner that the sash is not canted back into rubbing contact with the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary vertical sectional view through a typical awning mounted window showing the window sash in open position and supported by hinge means embodying the principles of the present invention;

FIG. **2** is a fragmentary enlarged view similar to FIG. **1**, but with the window sash in closed position;

FIG. **3** is an enlarged fragmentary view similar to FIGS. **1** and **2**, but with the sash and hinge mechanism in partly open position;

FIG. **4** is an elevational view of the hinge mechanism in closed position;

FIG. **5** is a longitudinal sectional view taken at about the line **5—5** of FIG. **4**.

FIG. **6** is an enlarged fragmentary transverse sectional view taken at about the line **6—6** of FIG. **1**, but showing the sash and related hinge parts in closed position;

FIG. **7** is a cross sectional view taken at about the line **7—7** of FIG. **4**;

FIG. **8** is a fragmentary vertical sectional view taken at about the line **8—8** of FIG. **5**; and

FIG. **9** is a vertical sectional view taken at about the line **9—9** of FIG. **5**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

A hinge embodying the principles of this invention may be adapted to support and control movement of a casement, awning or hopper type window sash relative to a window frame, and it is to be understood that application of same to a metal frame awning sash window herein is exemplary. Such type of window is illustrated in FIGS. **1** to **3** and **6**, and comprises a window frame generally indicated by the numeral **20** and a horizontally pivoted outwardly swinging sash generally designated by the numeral **21**.

The window frame **20** may comprise a sill **22**, a head **23** and side jambs as at **24** joined at the ends thereof to form a unitary structure. The sash **20** may comprise a frame in the form of a top rail **25**, a bottom rail **26** and side stiles as at **27** joined at the ends thereof to form a unitary structure. The said sash frame supports a glass pane **28** retained by typical glazing stops **29** and sealing compound **30**. The sash **20** may be weather-sealed by a weatherstrip **31** supported in sash marginal flange **32** and contacting window frame confronting surface **33**, and a weatherstrip **34** supported in window frame mar-

ginal flange 35 and contacting sash frame confronting surface 36.

In an awning type window, the bottom rail 26 of the sash swings outwardly, as is shown in FIG. 1. Right and left-hand hinges are used at opposite sides to support the sash and are located respectively in the cavity between each frame jamb 24 and confronting sash stile 27. A right-hand hinge is shown herein, and the left-hand hinge is similar in design principle and general detail, except for opposite hand characteristics.

Referring now to the hinge structure in detail, it comprises four main parts including a member 38 attachable to a window frame, a member 39 attachable to a window sash, a primary link 40 and a secondary link 41. The window frame member is generally bar-shaped and of channel formation in cross section (see FIG. 7), and comprises a web 42 and two flanges 43. The sash member 39 is generally bar-shaped, and overlies the member 38 in confronting relation (see FIGS. 4 and 5), when the window sash 20 is closed. The primary link 40 is articulated to the sash member 39 by pivot pin 44 extending through a hole in link end 45 and affixed to the said sash member. The opposite end 46 of the said primary link is articulated in relation to the frame member 38 by a pivot pin 47 extending through a hole in the web 42 of the member 38, and affixed to a leaf spring 48 located between flanges 43 of the member 38. A friction washer 49 surrounds the pivot pin 47 and lies between the end 46 of the primary link 40 and the web 42 of the frame member 38.

The secondary link 41 is articulated to the sash member 39 by a pivot pin 50 extending through a hole in link end 51 and affixed to the said sash member. End 52 of the secondary link 41 is articulated in relation to the frame member 38 by a pivot pin 53 which extends through an elongated hole 54 in the web 42 of the window frame member 38, as is shown in FIG. 8. End 55 of the pivot pin 53 is affixed to a slide plate 56 which is located under the web 42 of the member 38 and between the flanges 43 thereof. The purpose of the slide plate 56 is hereinafter defined.

The web 42 of the window frame member 38 has a round screw hole for a screw 57 (FIG. 1) and three horizontally elongated screw holes for screws 58 which fasten the member 38 to the window frame jamb 24. The sash member 39 has a round hole 60 (FIG. 5) and two vertically elongated holes 61 therein through which fastening screws 62 extend into the sash stile 27. At 63, a blocking spacer is located between parts 27 and 39.

When the window sash 21 is arranged for manual opening and closing and is not equipped with a self-locking operator such as a roto-gear crank handle type manual operator, it is essential that friction means be provided to hold the said sash in a wide range of angular open positions. Such means may include the friction washer 49 which is held in compression by the leaf spring 48, and a sliding friction device generally designated by the numeral 64.

Referring now to FIGS. 4 through 7, the friction device 64 comprises a plate 65, and a plastic friction shim 66 interposed between the said plate and the web 42 of the member 38. A pivot pin 67 extends through the plate 65 and a slot 68 in the web 42 of the member 38, and is affixed at 69 to the channel-shaped spring retainer 70 positioned inside of the member 38 between the flanges 43 thereof. A guide lug 71 extends from the plate 65 through the slot 68, and in conjunction with the pivot pin 67, retains the plate 65 in alignment with the member 38. A leaf spring 72 is located in the channel-shaped spring retainer 70, and a pressure regulating screw 73, the head of which fits into a countersunk hole in the plate 65, extends through the friction shim 66, the slot 68, the spring retainer 70, and is threaded into the leaf spring 72. Pivot pin 67 extends through a hole in the end of a connecting link 75, which in turn is articulated to the primary link 40 by a pivot pin 76 affixed thereto between the link ends 45 and 46 thereof and extending through a hole in the end of the connecting link. Functional operation of the friction device generally designated by the numeral 64 is hereinafter described.

When the sash 21 is in closed and locked position with its top rail 25 nested under the frame head 23, as is shown in FIG. 2, the top end of the said sash is retained in such position by cam interlocking means, which in conjunction with the frame member 38, the sash member 39, and the interconnecting links 40 and 41, also controls the closing and opening action of the hinge, and in turn angular movement of the sash 21. It is desirable that the sash of an awning or hopper sash window be balanced in such manner that the sash may be open or closed by hand or through a manually powered mechanical operator, with minimum expenditure of energy. This is of particular importance when the sash is large in size and is glazed with heavy glass. In commercial type windows of this classification, sash weighing one hundred or more pounds are not uncommon. Awning or hopper sash may vary in height from 14 to 48 inches, and the fully opened sash angle may vary proportionate to the sash height, through an angular opening range of from 50° for 14 inch sash to 35° for 48 inch sash. This hinge has been designed in coordination with the foregoing relevant factors.

The upper end of the sash mounting member 39 is profiled in the form of a yoke, hereinafter defined as an internal cam 79, which is generally U-shaped, and in sash closed position straddles a cam roller 80. The latter is rotatably supported on a pin which is affixed to the upper end of the frame member 38. The internal cam has two approximately diametrically opposite cam faces indicated at 84 and 85. Cam face 84 is arcuate and cam face 85 is formed at an angle of approximately 45° in relation to the longitudinal center of the sash member 39. These cam faces contact either one or the other of substantially diametrically opposite surface areas of the cam roller 80, as is shown in FIGS. 2 and 3. The profile of the internal cam 79 has been developed to suit a wide range of hinge sizes for various sash heights and sash opening angles. For example, the hinge illustrated herein is proportioned in part for sash glazed with glass between 24 and 28 inches in height. The approximate center of gravity of sash of the foregoing sizes is indicated by the dots *a* on the horizontal grid line *b*. The curvilinear line *c* related to the said horizontal grid line designates the path of movement of the sash center of gravity, from closed to open sash position, and vice versa.

As the sash 20 is swung from closed and locked position to open position, the primary link pivot pin 44 travels through an arcuate path of movement designated by the curved line *d*, and the secondary link pivot pin 50 travels through an approximately arcuate path of movement designated by the curved line *e*, shown in FIG. 1. To provide for adequate working clearance be-

tween the internal cam surface **85** and the confronting surface area of the cam roller **80** as the sash is swung from its closed position outwardly through an initial seven degrees of angular movement, illustrated in FIG. **3**, the axis of the secondary link pivot pin **50** lowers a few thousands of an inch from a true arcuate path of movement. To accommodate the foregoing, the secondary link **41** moves downwardly. Its lower pivot pin **53** is affixed at **55** to the slide plate **56**, and the said pivot pin has freedom for limited downward movement in the vertically elongated hole **54** in the web **42** of the frame mounting member **38**, shown in FIG. **8**.

To avoid loose or sloppy hinge action and in turn sash flutter under exposure to variable wind pressures, the primary link **40**, the secondary link **41**, and their respective pivot pins are urged into tight working relationship by the arcuate compression spring **86**, the ends of which abut the transverse end flange **87** of the frame member **38**. The ends of the said spring are also supported under the turned down end lugs **88** on the slide plate **56**. The arcuate outer face of the compression spring **86** bears against the flat end **90** of the slide plate **56**, which carries the secondary link pivot pin **53**. A plastic spacer shim **91** is positioned between the slide plate **56** and the inside face of the web **42** of the frame mounting member **38**. The arcuate compression spring **86**, through the slide plate **56** and the attached pivot pin **53** urges related movable components into tight articulation relationship, irrespective of standard manufacturing tolerances.

DESCRIPTION OF HINGE OPERATION

The hinge is generally suitable for application to metal frame awning or hopper sash windows. When applied to an awning sash window, the frame member **38** is fastened to the frame jamb **24** in the position shown, with the upper end **83** of the frame member abutting or near the upper inside corner of the frame **20**. Accordingly, the upper end of the sash member **39** is near and adjacent to said frame inside corner. For hopper type sash, the hinges are located near the bottom of the window in the reverse position to that illustrated and described above.

When the sash **21** is in closed position in relationship to the frame **20**, the hinge is in the closed position illustrated in FIGS. **4** and **5**, and the top rail **25** of the sash **21** is related to the head **23** of the frame **20**, as is shown in FIG. **2**. In FIG. **1**, the sash **21** is shown in open position, and the hinge is likewise shown in open position. To open or close the sash **21**, force may be applied against the bottom rail **26** thereof, by hand or through a mechanical sash operator.

As the sash **21** is opened, the bottom rail **26** thereof swings outwardly, and its top rail **25** moves outwardly and downwardly, through the various positions illustrated in FIGS. **2**, **3** and **1**. The lower end **46** of the primary link **40** pivots around the pivot pin **47**, and the pivot pin **44** affixed to the sash mounting member **39** travels through an arcuate path of movement depicted by the curved line *d* shown in FIG. **1**. The lower end **52** of the secondary link **41** pivots around the pivot pin **53**, and the pivot pin **50** affixed the the sash mounting member **39** travels through an approximately arcuate path of movement depicted by the curved line *e*. Accordingly, the sash member **39** and the sash **21** affixed thereto is swung outwardly, the full open position thereof being as shown in FIG. **1**. As the hinge opens, the leaf spring **48** exerts force on the pivot pin **47**, urging the end **74** of the primary link **40** against the friction washer **49**. Friction thus developed is supplemented by the sliding friction device **64**, the leaf spring **72** of which, through the regulating screw **73**, urges the plate **65** against the underlying plastic friction shim **66**. which in turn is biased against the web **42** of the frame member **38**.

Oscillatory motion of the primary link **40** is transmitted through the connecting link **75** and effects reciprocal movement of the slidable friction device **64** along the frame member **38**. The lower end of the guide slot **68** in the web **42** of the latter serves as a stop for the sliding friction device **64**, and in turn sash outward swinging movement control. The spring **48** may be designed to urge the end **46** of the primary link **40** against the friction washer **49** and so develop between 30 and 40 percent of the frictional resistance required to hold the sash **21** at any open angle. The supplemental frictional resistance provided by the sliding friction device may be determined by the spring pressure regulating screw **73**, which may be adjusted at the time of hinge application to a window to suit sash of different sizes and weights. The design and proportion of the linkage components of this hinge, and the pivotal relation of same to the frame member **38** and the sash member **39**, is preferably such that the center of gravity of the sash **21** moves along a path of movement which is generally perpendicular to the vertical plane of the sash when in closed position, whereby vertical lifting and lowering of the sash is minimal and the sash is virtually balanced. Accordingly, frictional resistance developed by the mechanism above described may be of low order thereby minimizing wear depreciation.

Referring now to FIGS. **2** and **3**, in sash closed position, the angular cam surface **85** bears against the cam roller **80** and the weatherstrips **31** and **34** are held in weather-sealing relationship between the frame **20** and the sash **21**, as shown in FIG. **2**. As opening force is applied against the bottom rail **26** of the sash, it fulcrums on the pivot pin **50**, the top rail **25**, the sash is canted inwardly, and the arcuate cam surface **84** abuts the cam roller **80** and remains in contact throughout approximately the initial seven degrees of sash opening angular movement, the limit of which is illustrated by FIG. **2**. During such sash opening movement, the angular cam surface **85** lowers away from the cam roller **80** and clears same as the sash is opened further. The top edge of the marginal flange **32** of the sash top rail **25** remains clear of and in spaced relation to the frame head **23**, and the related weatherstrip **31** slides downwardly a very short distance while in contact with the surface **33** of the said framehead. Simultaneously, the sash top rail surface **36** moves outwardly from weatherstrip **34** in the frame head **23**. Such movement of the top rail **25** of the sash prevents roll-back, scuffing or damage of the said related weatherstrips.

Continued outward swinging movement of the sash **21** carries the weatherstrip **31** in the top rail **25** thereof outwardly and downwardly, and in sash full open position depicted in FIG. **1**, the top edge of the marginal flange **32** of the sash top rail **25** is spaced outwardly from the confronting face of the window frame **20**. As the sash is opened as above described, the contact flange of the weatherstrip **31** in the sash top rail **25** moves through a path of movement designated by the curved line *f* in FIG. **1**.

Inward retraction force applied to the bottom rail **26** of the sash **21** will cause it is to fulcrum on the pivot pin **50,** and as the said sash in swung to closed position, the top rail **25** thereof is canted outwardly. When the sash **21** is closed to the position illustrated in FIG. **2,** the angular cam surface **85** has passed under the cam roller **80,** and the arcuate cam surface **84** is close to or in contact with the said cam roller. The said arcuate cam surface, in abutting relationship with the cam roller **80,** guides or controls continued closing movement of the top rail **25** of the sash, and prevents excessive deformation or compression of the related weatherstips **31** and **34.** The cam surface **85,** in contact with roller **80,** prevents opening of the window by application of outward force to the upper sash rail **25.**

When applied to a hopper sash window, the sash of which is hinged at the bottom and swings inwardly instead of outwardly, as in the case of the awning type sash herein illustrated and described, the action of the hinge components and swinging movement of the sash is generally similar to that as described, except as may be relevant to an inverted sash and hinge assembly, and reversal of the direction of sash movement.

While the invention is illustrated in an arrangement with the hinge linkage interconnecting the members **38** and **39** attachable to the window frame and window sash respectively, it should be understood that the linakage may be mounted directly on the window frame and the window sash.

I claim:

1. A hinge for pivotally supporting and controlling angular swinging movement of a window sash relative to a window frame and wherein flexible weatherstrip is located between confronting marginal surfaces of the window sash and the window frame, the said hinge comprising,

a. a frame member adapted to be affixed to a window frame with one end of the member near a corner of the frame,

b. a sash member adapted to be affixed to a window sash with one end near said corner of the window frame and generally disposed in confronting relation with the said frame member when the said window sash is in closed position,

c. a primary link pivoted at one end relative to the said frame member and pivoted at its other end relative to the said sash member,

d. a secondary link arranged adjacent to the said primary link, pivoted at one end relative to said frame member and pivoted at its opposite end relative to the said sash member,

e. coacting cam means located on the respective said ends of the said members operable to control movement of the said one end of the sash member when the sash is swung into closed position and arrest inward swinging movement thereof and so limit flexing of the said weatherstrip adjacent the hinge end or side of the said sash, and also restrain outward swinging movement of the said one end of the sash member and so hold the said weatherstrip in weather-sealing relationship between confronting marginal flanges or surfaces of the sash and the frame, said coacting cam means comprising a cam roller on a pin extending from said one end of the frame member, and a curvilineal cam formed in said one end of the sash member adatped to straddle and alternately contact the said cam roller at two surface points of the said cam,

f. a friction device including spring means slidably mounted on said window frame bar independent of the pivotal connection of the first and second links to the window frame bar, and

g. a third link pivotally connected to the friction device and pivotally connected to one of said first and second links for moving the friction device on movement of the window sash bar.

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