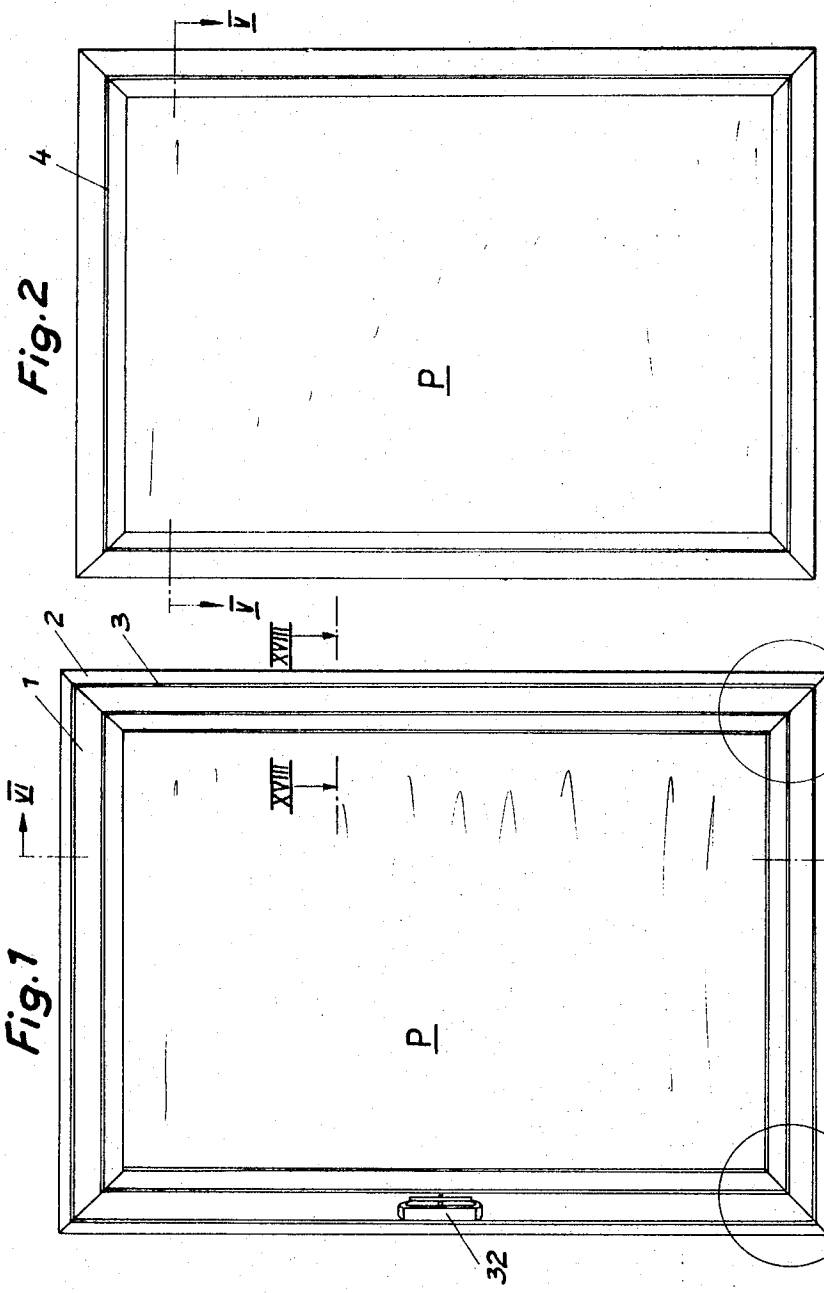
Feb. 13, 1968 E. VON WEDEL ET AL 3,368,306

DOOR OR WINDOW CONSTRUCTION

Filed Jan. 6, 1966 12 Sheets-Sheet 1



Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

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DOOR OR WINDOW CONSTRUCTION

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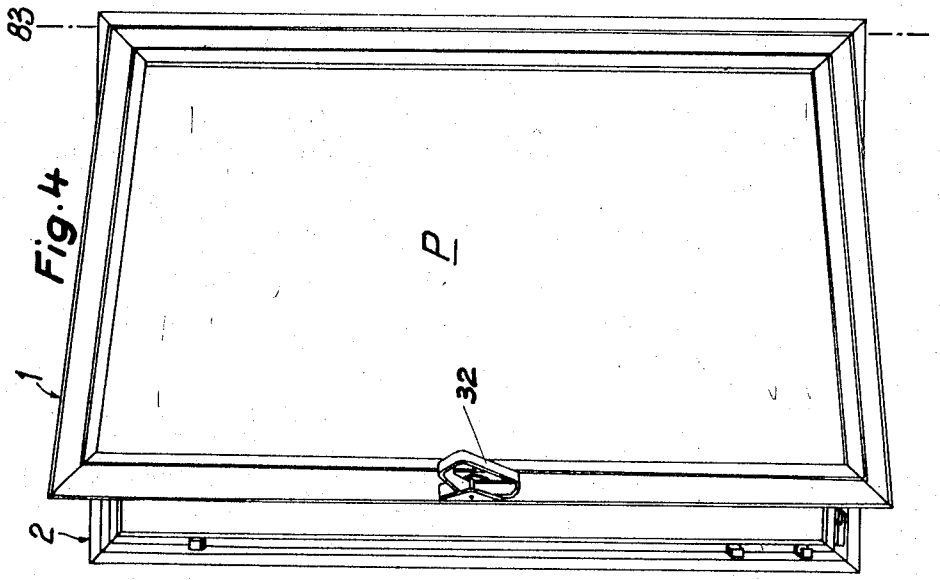


Fig. 4

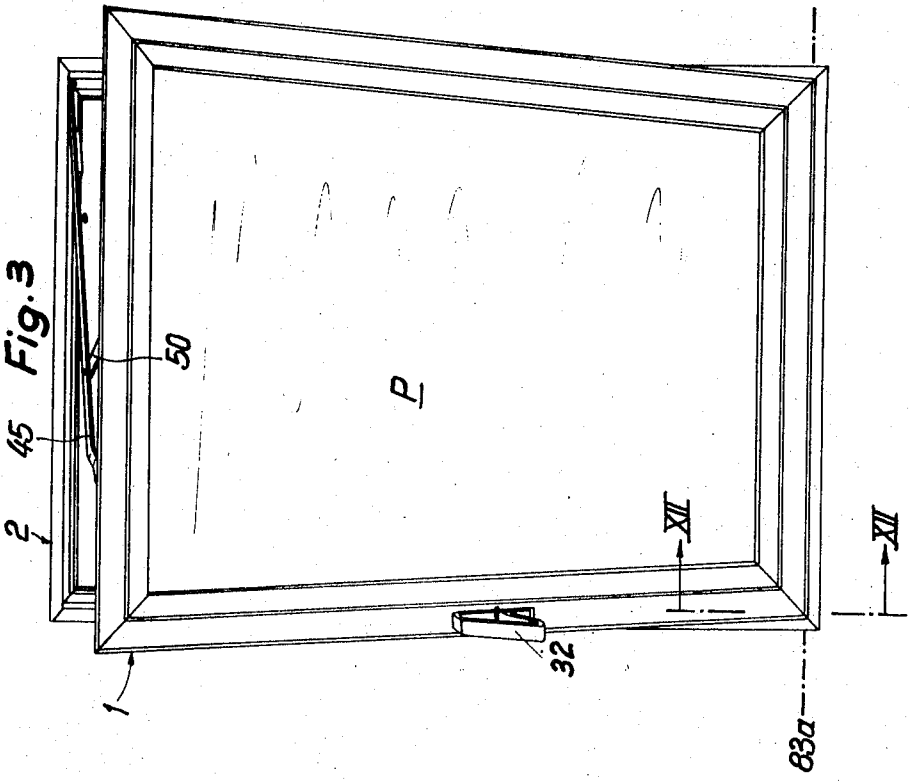


Fig. 3

Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

Feb. 13, 1968 E. VON WEDEL ETAL 3,368,306

DOOR OR WINDOW CONSTRUCTION

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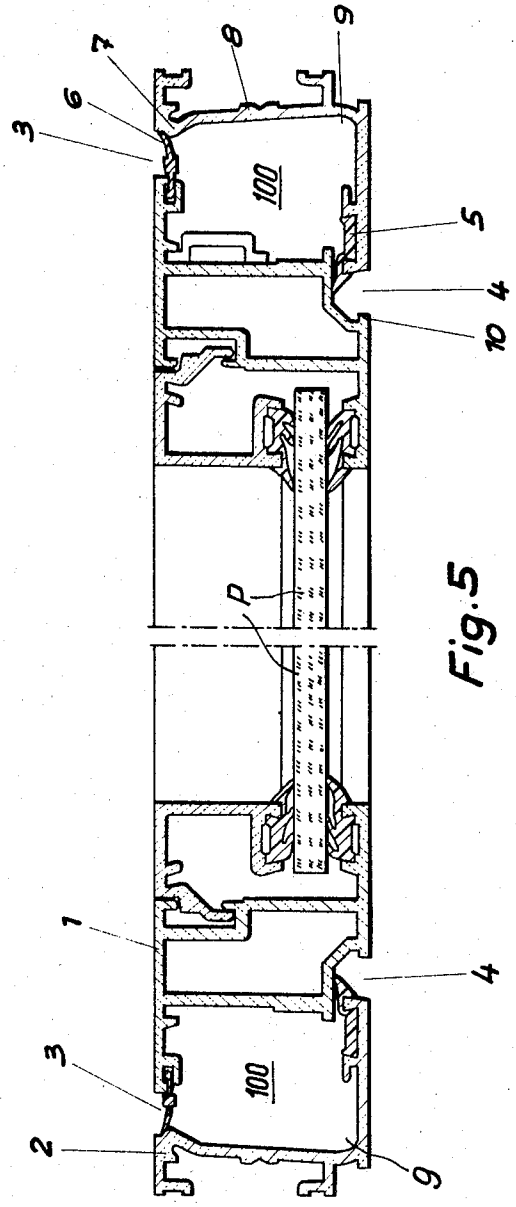


Fig. 5

Inventors
Ernst von Wedel
Manfred Mühle

by
their Attorney

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DOOR OR WINDOW CONSTRUCTION

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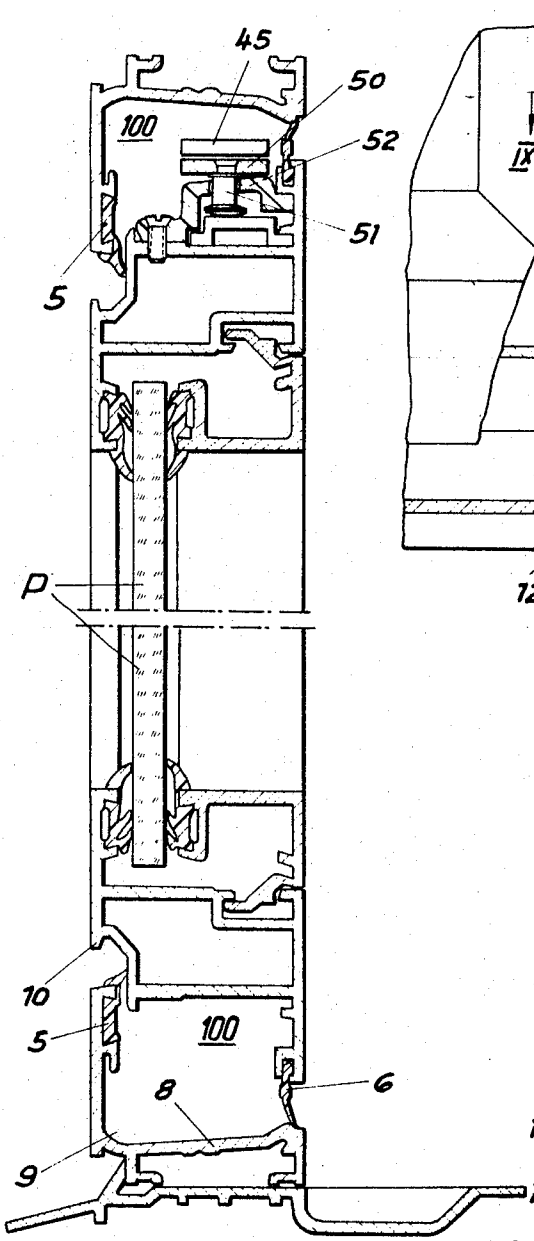


Fig.6

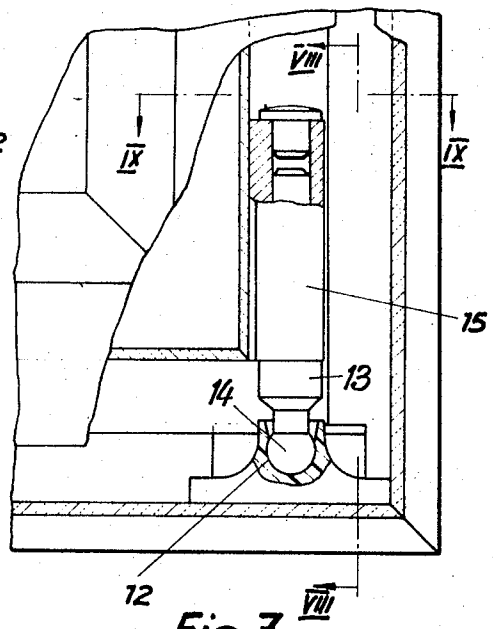


Fig.7

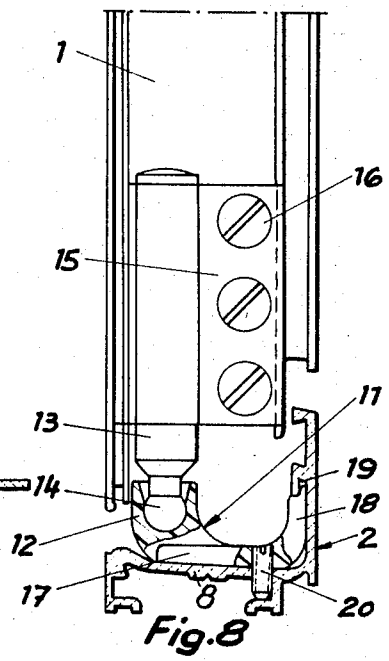


Fig.8

Inventors:
Ernst von Wedel
Manfred Mühle

by their Attorney

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DOOR OR WINDOW CONSTRUCTION

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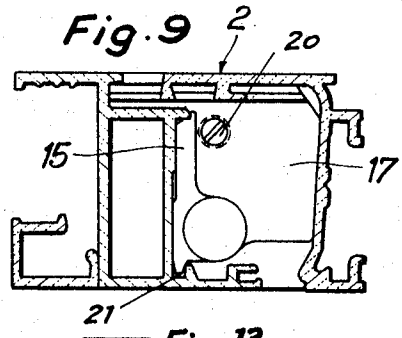


Fig. 9

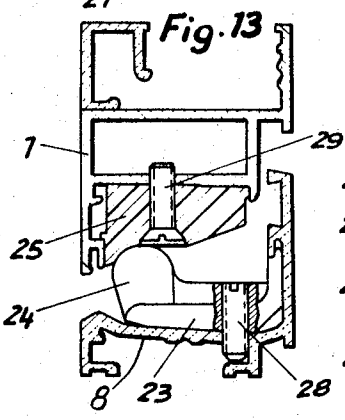


Fig. 13

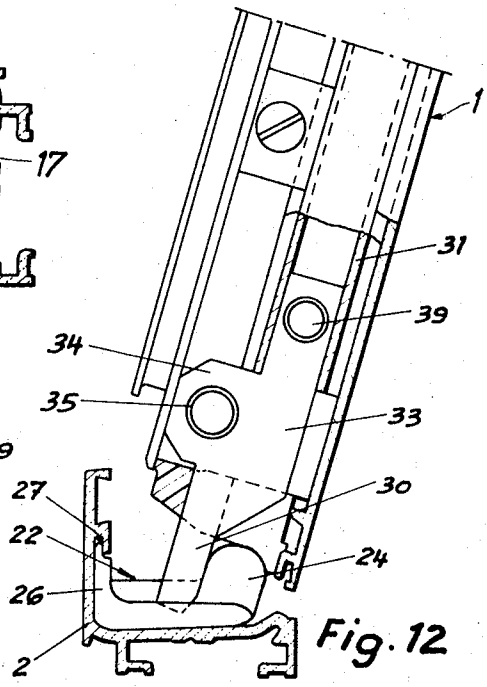


Fig. 12

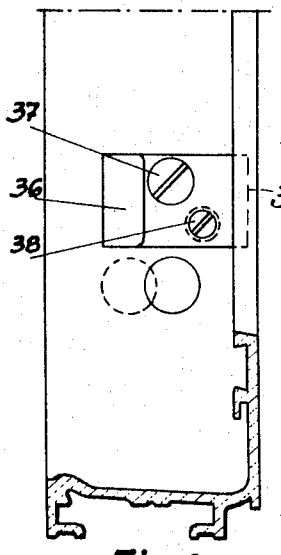


Fig. 11

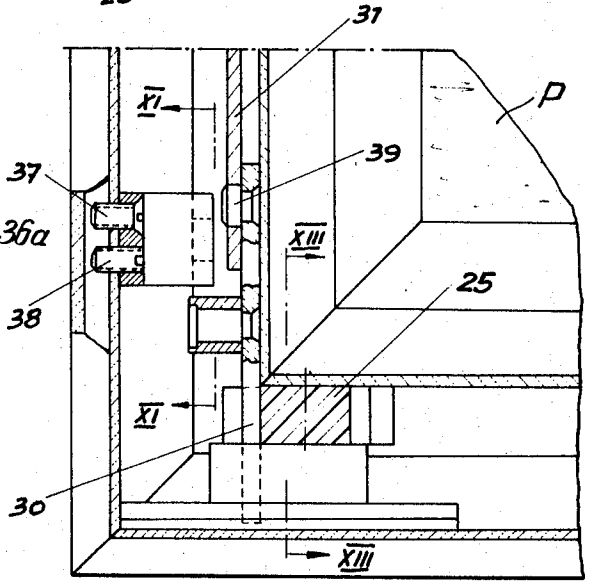


Fig. 10

Inventors:
Ernst von Wedel
Manfred Mühle

by their Attorney

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DOOR OR WINDOW CONSTRUCTION

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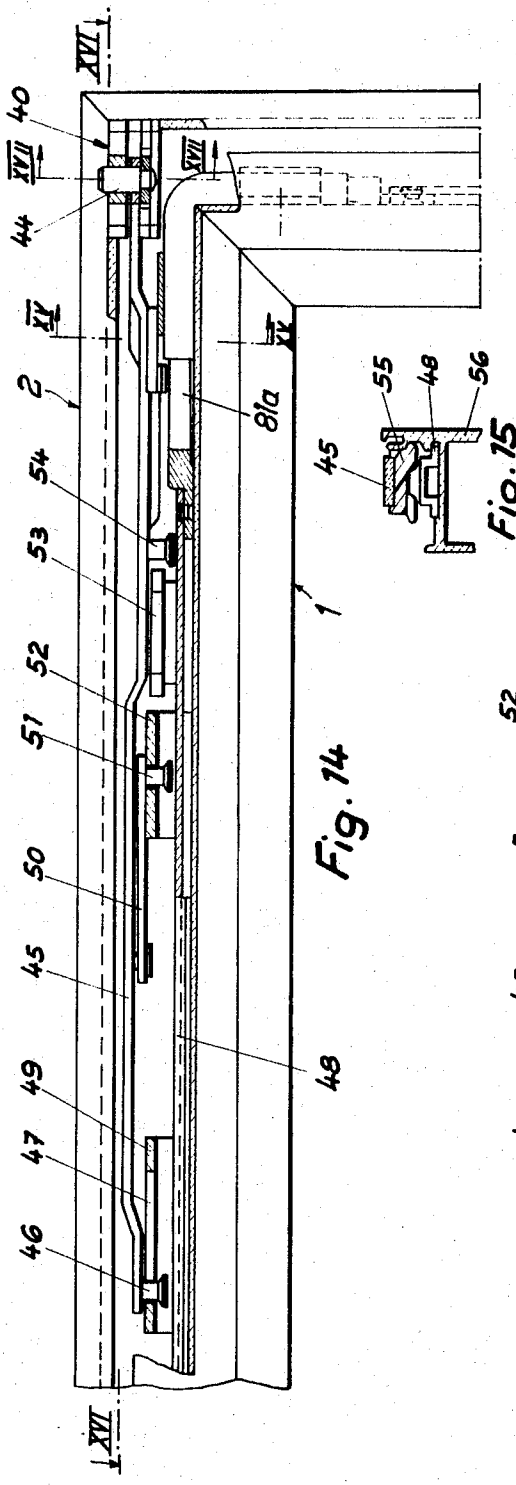


Fig. 14

Fig. 15

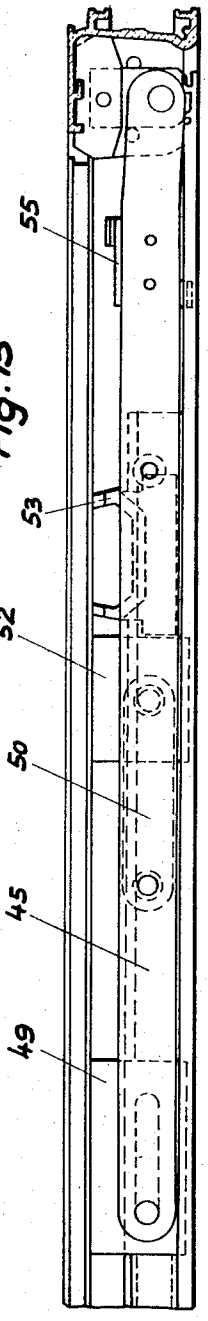


Fig. 16

Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

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DOOR OR WINDOW CONSTRUCTION

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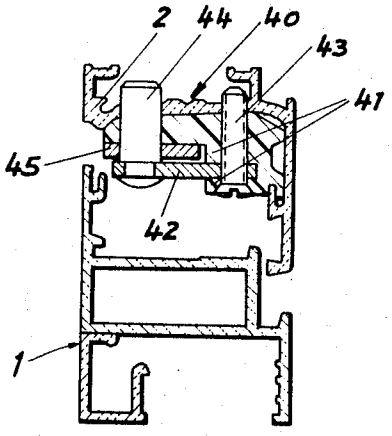


Fig. 17

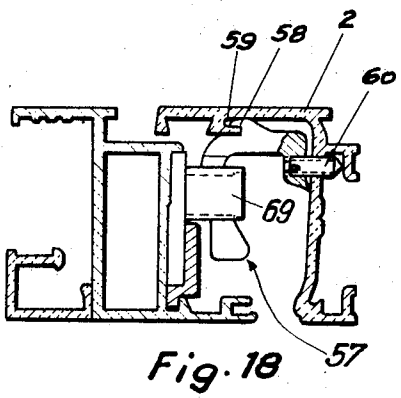


Fig. 18

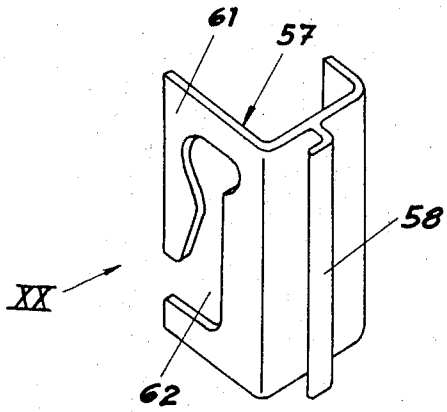


Fig. 19

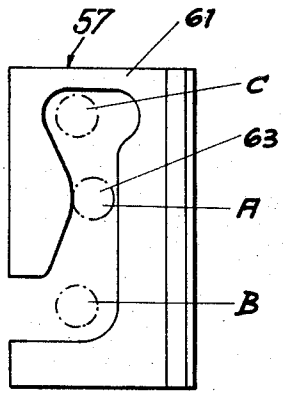


Fig. 20

Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

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DOOR OR WINDOW CONSTRUCTION

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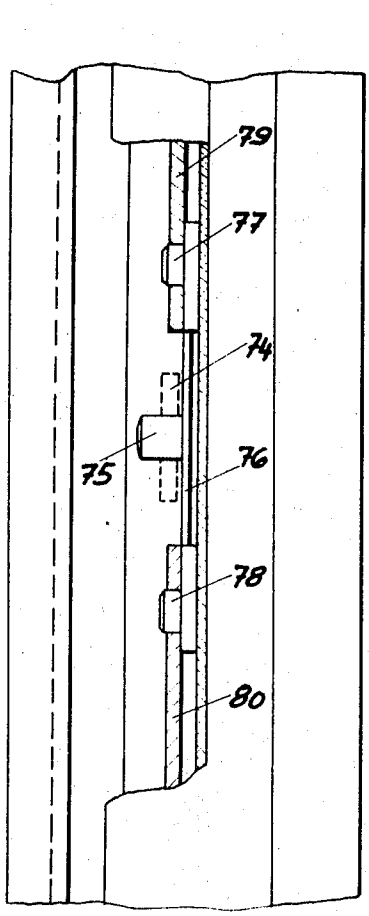


Fig. 22

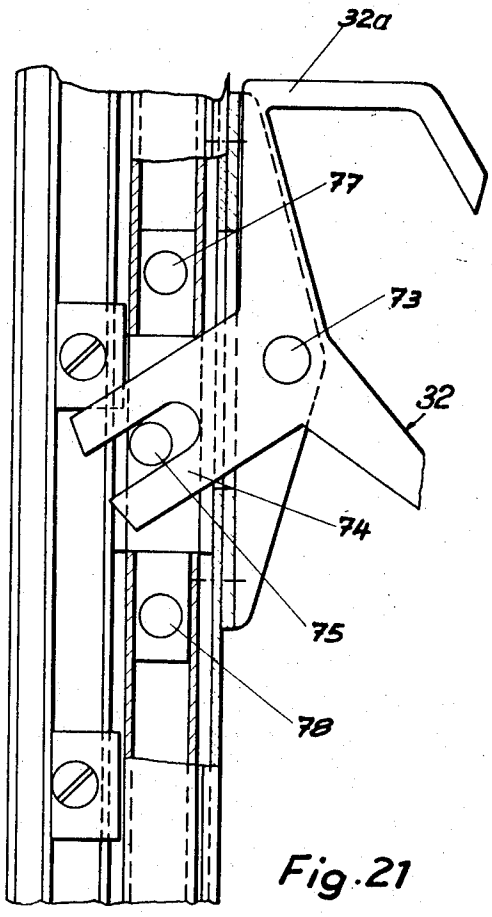


Fig. 21

Inventors:
Ernst von Wedel
Manfred Mühle

by

their Attorney

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DOOR OR WINDOW CONSTRUCTION

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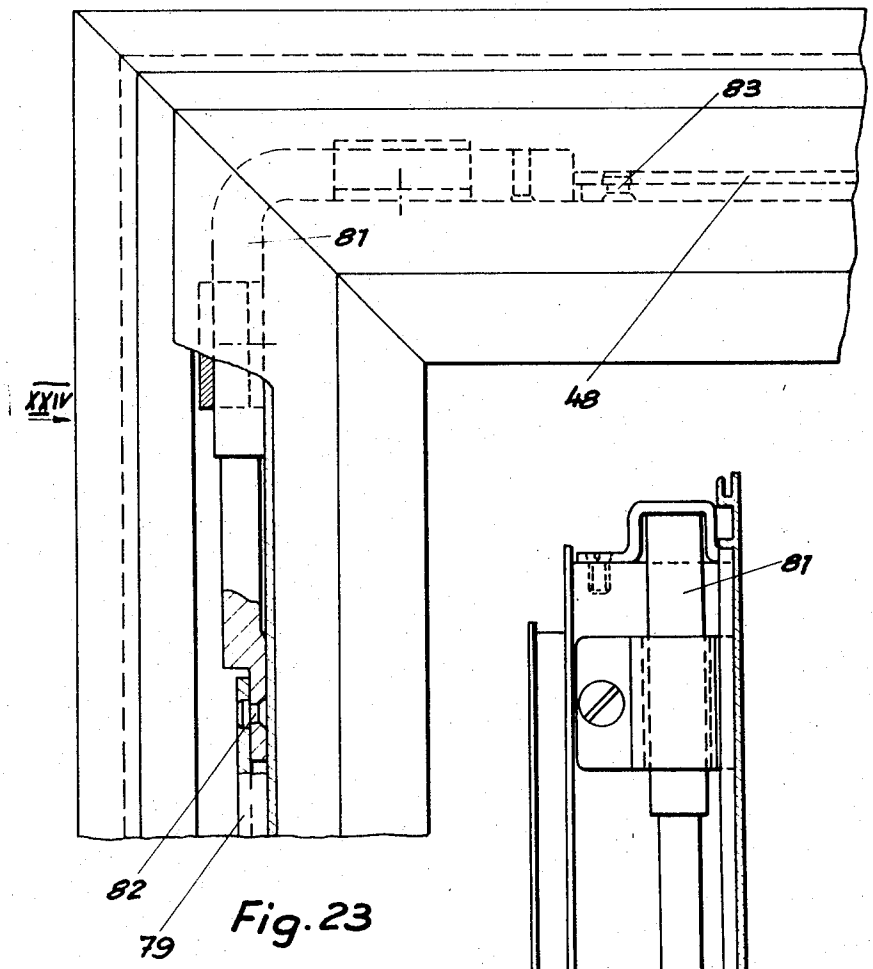


Fig. 23

Fig. 24

Inventors:
Ernst von Wedel
Manfred Mühle

by

their Attorney

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DOOR OR WINDOW CONSTRUCTION

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Fig. 26

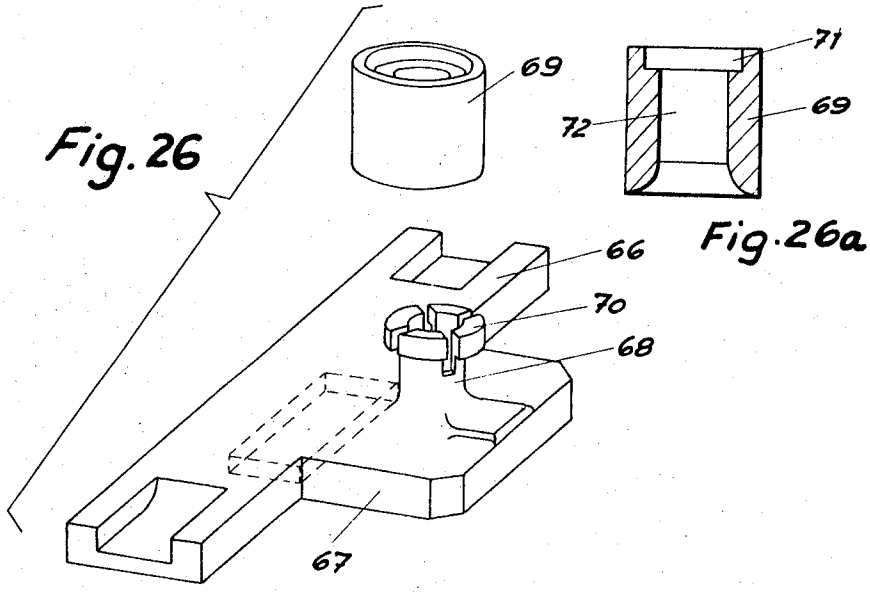


Fig. 26a

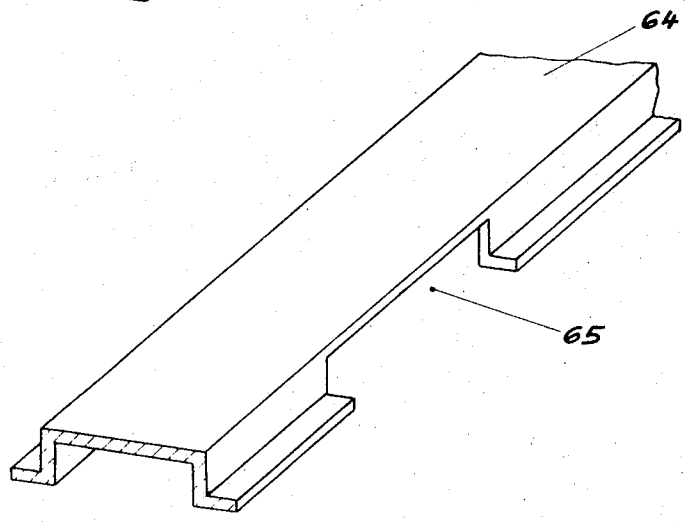


Fig. 25

Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

Feb. 13, 1968 E. VON WEDEL ETAL 3,368,306

DOOR OR WINDOW CONSTRUCTION

Filed Jan. 6, 1966 12 Sheets-Sheet 11

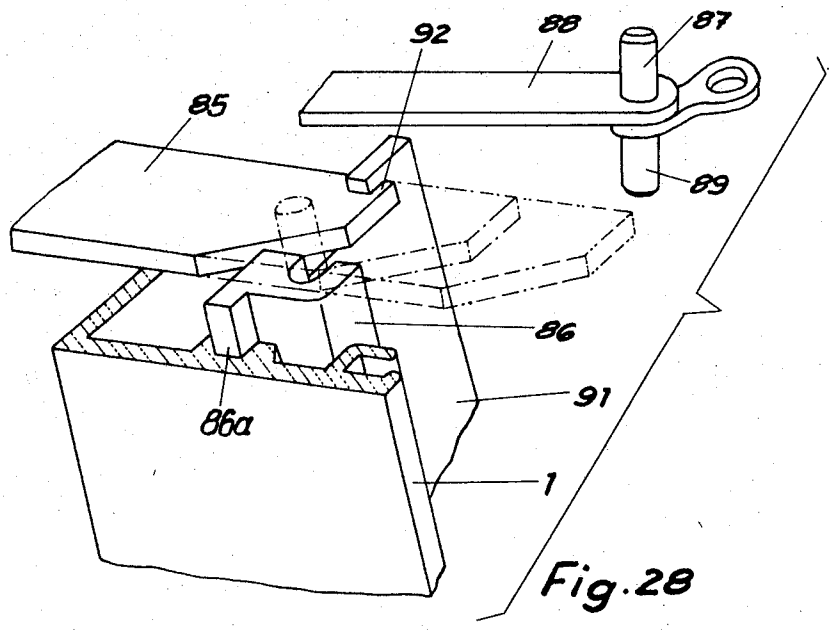


Fig. 28

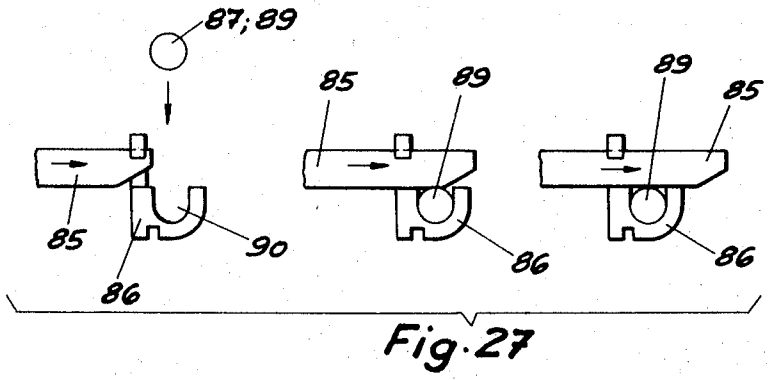


Fig. 27

Inventors:
Ernst von Wedel
Manfred Mühle

by their Attorney.

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DOOR OR WINDOW CONSTRUCTION

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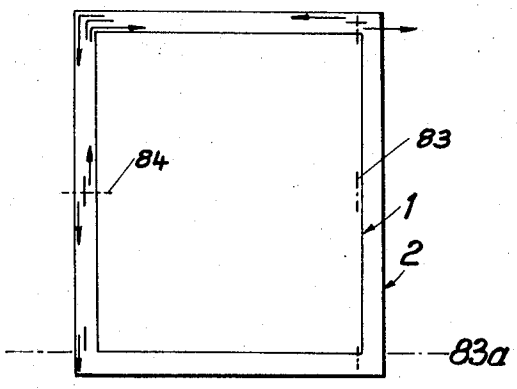


Fig. 29

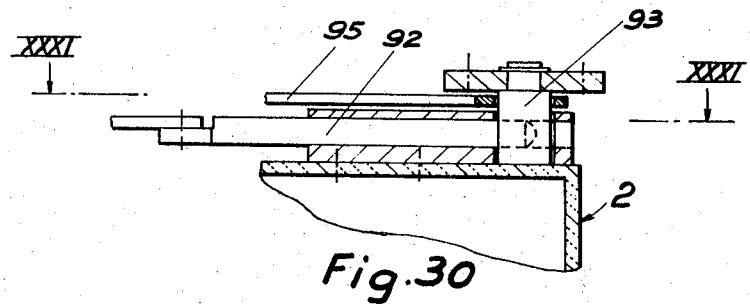


Fig. 30

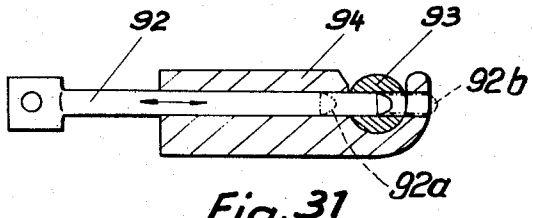


Fig. 31

Inventors:
Ernst von Wedel
Manfred Mühle

by
their Attorney

United States Patent Office 3,368,306
Patented Feb. 13, 1968

3,368,306

DOOR OR WINDOW CONSTRUCTION

Ernst von Wedel, Senne, and Manfred Muehle, Loehne, Germany, assignors to Heinz Schuermann & Co., Bielefeld, Germany

Filed Jan. 6, 1966, Ser. No. 519,406
Claims priority, application Germany, Jan. 7, 1965, Sch 37,415; Aug. 4, 1965, Sch 37,493
36 Claims. (Cl. 49—192)

ABSTRACT OF THE DISCLOSURE

Improved window or door constructions of the type wherein an outer frame accommodates an inner frame or sash and wherein the sash may be pivoted about a vertical axis and about a horizontal axis and including various couplings, sealing elements, actuating and motion transmitting parts and other hardware necessary to insure that the sash can be moved about horizontal and vertical axes, that the sash can be properly locked in closed position, and that the periphery of the sash may be properly sealed against rain, dust and wind when the sash is closed.

In heretofore known window or door constructions of which we are aware at this time and wherein the sash is pivotable about vertical and horizontal axes, certain component parts of the hardware invariably extend beyond the front and/or rear sides of the frames. Such outwardly projecting parts collect dirt and are likely to rust. Also, they affect the appearance of the window or door construction and might cause injury.

Furthermore, heretofore known window or door constructions of the type to which our present invention pertains are normally constructed in such a way that the sash must be lifted with reference to the outer frame if it is to be pivoted about one of the two axes. Such mounting of the sash necessitates the provision of complicated sealing devices and contributes to rapid wear on the joints or couplings which define the pivot axes.

Accordingly, it is an important object of the present invention to provide an improved window or door construction (hereinafter referred to as window construction for short) wherein the sash is mounted in such a way that its front and rear sides need not extend beyond the corresponding sides of the outer frame.

Another object of the invention is to provide a novel system of joints or couplings and actuating and motion transmitting parts which can be utilized in the improved window construction and which are mounted in such a way that they need not be seen at all (with the exception of the actuating member) when the sash is moved to its closed or sealing position.

A further object of the invention is to provide a window construction wherein a single actuating member suffices to place the various joints or couplings into operative or inoperative position, and wherein such single actuating member may also serve as a means for actually pivoting the sash about a horizontal or vertical axis.

An additional object of the invention is to provide a window construction wherein the sash need not be lifted or otherwise shifted with reference to the outer frame when the operator decides to pivot the sash about a horizontal or vertical axis.

A concomitant object of the invention is to provide a window construction which may be provided with one or more locking devices to insure safe retention of the sash in its closing position.

A further object of the invention is to provide a window construction which may be produced and assembled at low cost, which is of lightweight design and may be assembled at least in part of plastic components, and which can be manipulated in a very simple way.

Briefly stated, one feature of our invention resides in the provision of a door or window construction which comprises an outer frame, an inner frame which is surrounded by the outer frame and is pivotable to and from a closed position about horizontal and vertical pivot axes, a chamber defined by the adjoining portions of the two frames, joints provided in the chamber and defining the two pivot axes, releasable locking means provided in the chamber for locking the inner frame to the outer frame at the will of the operator, and a single actuating member provided at the inner side of the inner frame and operatively connected with the locking means and with a least one of the joints, namely, with that joint which must be disengaged or disconnected when the inner frame should pivot about one of the two pivot axes and which must be operative when the inner frame is to pivot about the other pivot axis.

The two frames are preferably of rectangular shape and each comprises two horizontal and two vertical marginal portions. The two pivot axes are respectively parallel with the lower horizontal marginal portions and with one vertical marginal portion and one of the joints is located at the intersection of the two pivot axes. This one joint is preferably a universal joint which need not be disengaged because it can cooperate with a first additional joint to define therewith the vertical pivot axis or with a second additional joint to define therewith the horizontal pivot axis.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved window or door construction itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a front elevational view of a window construction which embodies one form of our invention;

FIG. 2 is a rear elevational view of the window construction;

FIG. 3 is a front elevational view and illustrates the sash in a position it assumes when tilted about a horizontal axis;

FIG. 4 is a similar view and illustrates the sash in a different position subsequent to pivoting about a vertical axis;

FIG. 5 is an enlarged horizontal section as seen in the direction of arrows from the line V—V of FIG. 2 and illustrates the manner in which the chamber surrounding the sash is sealed by elastic sealing strips;

FIG. 6 is an enlarged vertical section as seen in the direction of arrows from the line VI—VI of FIG. 1 and illustrates the linkage which connects the upper portion of the outer frame with the upper portion of the sash;

FIG. 7 is an enlarged fragmentary front elevational view of a detail which is encircled in the lower right-hand portion of FIG. 1, with certain parts broken away to reveal the details of a universal joint or coupling which connects the sash to the outer frame;

FIG. 8 is a fragmentary vertical section as seen in the direction of arrows from the line VIII—VIII of FIG. 7;

FIG. 9 is a fragmentary horizontal section as seen in the direction of arrows from the line IX—IX of FIG. 7;

FIG. 10 is an enlarged fragmentary front elevational view of a detail which is encircled in the lower left-hand portion of FIG. 1, with certain parts broken away to reveal the details of a second joint or coupling which can cooperate with the joint of FIGS. 7 to 9 to define a horizontal pivot axis for the sash;

FIG. 11 is a fragmentary vertical section as seen in the direction of arrows from the line XI—XI of FIG. 10;

FIG. 12 is an enlarged fragmentary vertical section as seen in the direction of arrows from the line XII—XII of FIG. 3 and shows the sash in forwardly tilted position;

FIG. 13 is a fragmentary vertical section as seen in the direction of arrows from the line XIII—XIII of FIG. 10;

FIG. 14 is an enlarged fragmentary front elevational view of the upper right-hand portion of FIG. 1, with certain parts broken away to reveal the details of a third joint or coupling which can cooperate with the joint of FIGS. 7 to 9 to define a vertical pivot axis for the sash;

FIG. 15 is a fragmentary vertical section through the sash, substantially as seen in the direction of arrows from the line XV—XV of FIG. 14;

FIG. 16 is a fragmentary top plan view of the sash substantially as seen in the direction of arrows from the line XVI—XVI of FIG. 14;

FIG. 17 is a fragmentary vertical section as seen in the direction of arrows from the line XVII—XVII of FIG. 14;

FIG. 18 is a horizontal section through an auxiliary locking device which can lock the sash to the outer frame, the section being taken in the direction of arrows as seen from the line XVIII—XVIII of FIG. 1;

FIG. 19 is a perspective view of a locking member which forms part of the structure shown in FIG. 18;

FIG. 20 is a side elevational view of the locking member as seen in the direction of the arrow XX in FIG. 19;

FIG. 21 illustrates the actuating member in a position it assumes when the sash is ready to be tilted about the horizontal axis;

FIG. 22 is an enlarged front elevational view of that portion of the sash which supports the actuating member, with certain parts shown in section or broken away;

FIG. 23 illustrates an articulated shifter which can transmit motion from the actuating member to the auxiliary locking device;

FIG. 24 is a side elevational view of the shifter as seen in the direction of the arrow XXIV in FIG. 23;

FIG. 25 is an enlarged perspective view of a rail which forms part of the auxiliary locking device;

FIG. 26 is an exploded perspective view of a bearing member which also forms part of the auxiliary locking device;

FIG. 26*a* is an axial cross section through part of the bearing member shown in FIG. 26;

FIG. 27 illustrates three positions of a modified joint or coupling which can replace the joint of FIGS. 14 to 17;

FIG. 28 is an enlarged perspective view of the modified joint which is shown in a position corresponding to that illustrated in the left-hand part of FIG. 27;

FIG. 29 is a diagrammatic front elevational view of a window construction which utilizes the joint of FIGS. 27 and 28;

FIG. 30 is af ragmentary section view of a different joint which can replace the joint of FIGS. 14–17 or the joint of FIGS. 27–28; and

FIG. 31 is a horizontal section substantially as seen in the direction of arrows from the line XXXI—XXXI of FIG. 30.

Referring to the drawings in detail, and first to FIGS. 1 to 4, there is shown a window construction which comprises an outer frame **2** and an inner frame or sash **1**. The sash holds a window pane P and is movable with reference to the frame **2** about a vertical axis **83** (see FIGS. 4 and 29) or about a horizontal axis **83***a* (see FIGS. 3 and 29). FIGS. 1, 3 and 4 show the front side or inner side of the window construction, namely, that side which is provided with an actuating member or handle **32**. The outer side of the window construction is shown in FIG. 2. At the inner side, the frame **2** and the sash **1** define between themselves an endless rectangular gap or clearance **3**. A similar clearance or gap **4** is defined by the parts **1** and **2** at the outer side of the window construction. As shown in FIG. 5, the gaps 3 and 4 are sealable by elastically deformable sealing strips **6**, **5** which are respectively anchored in the sash **1** and frame **2**. It will be seen that the sealing portion of the strip **5** is spaced from the outer side of the window construction so that it constitutes the bottom wall of a circumferential groove when the sash **1** assumes the closed position of FIG. 1, 2 or 5. Such offsetting of the sealing strip **5** is of advantage because the strip is not exposed to trickling or dripping water. Save for the provision of the aforementioned circumferential groove, the outer sides of the frame **2** and sash **1** are located in a common plane, see the lower part of FIG. 5, whenever the sash **1** is moved to closed position.

The sealing portion of the strip **6** which normally closes the gap **3** abuts against a bead **7** provided at the inner side of the frame **2**. The arrangement is such that the sealing strip **6** need not slide with reference to the bead **7** when the sash **1** is pivoted about the horizontal axis **83***a* or about the vertical axis **83** so that the wear on this strip is reduced to a minimum. As shown in the upper part of FIG. 5, the inner sides of the sash **1** and frame **2** are coplanar when the sash is moved to closed position. The web **8** of the frame **2** defines with the sash **1** an annular space or chamber **100** which accommodates the hardware so that all component parts of the hardware, with the exception of the actuating member **32**, are fully concealed when the sash **1** is moved to closed position. The web **8** is composed of two horizontally and two vertically extending sections and each of these sections is inclined in such a way that condensate which accumulates in the chamber **100** may flow in the corners **9** and toward the lower horizontally extending section of the web **8** to be evacuated through one or more bores or similar outlets provided in the frame **2**. In other words, the vertical sections of the web **8** may be outwardly inclined with reference to the general plane of the frame **2** and the horizontally extending sections of the web **8** are preferably inclined, at least slightly, with reference to a truly horizontal plane. The outer side of the sash **1** is provided with a projecting guide rib **10** which is adjacent to the outer end of the gap **4** and serves to guide water so that such water does not tend to penetrate into the gap **4**.

The vertical pivot axis **83** is parallel with the right-hand vertical portion of the outer frame **2**, and the horizontal pivot axis **83***a* is adjacent to the lower horizontal portion of the frame **2**, as the parts appear in FIGS. 1, 3 and 4. In order to make sure that the marginal portions of the sash **1** may be swung into the interior of the chamber **100** between the sash **1** and frame **2**, the chamber must be dimensioned in such a way that it can readily accommodate the various bearings, joints and other components of the hardware without interfering with pivotal movements of the sash.

FIGS. 7 to 9 illustrate a universal joint or coupling **11** which connects the lower right-hand corner portion of the sash **1** with the frame **2** in such a way that the sash can be pivoted about the axis **83** or **83***a*. The two axes intersect each other in the joint **11**. This joint comprises a female coupling member in the form of a tubular socket **12** defining a spherical recess for the spherical head **14** of a male coupling member or bolt **13**. The socket **12** extends substantially all the way between the inner and outer sides of the window construction and the bolt **13** is turnable in the tubular portion of a hinge leaf **15** which is attached to the sash **1** by screws **16** or similar fasteners. The component parts of the joint **11** may be made of synthetic plastic material or of cast metal, and the socket **12** is preferably configurated in such a way that it follows the outline of the adjoining portion of the frame **2**. As shown, the socket **12** comprises a horizontal leg **17** which is adjacent to the web **8**

of the frame 2 and an upwardly extending anchoring portion or claw 18 which extends into an internal groove 19 of the frame 2, see particularly FIG. 8. The leg 17 is secured to the web 8 by a screw 20 or by a similar fastener. The connection is preferably such that the leg 17 is tightly clamped to the web 8, for example, by drilling the tapped holes for the screw 20 out of accurate axial alignment with each other. The misalignment may equal the depth of threads on the screw 20 so that, when the latter is driven home, the leg 17 and its claw 18 are wedged against the frame 2 and hold the socket 12 against turning.

The leaf 15 for the bolt 13 is secured to the sash 1 by means of aforementioned screws 16 and is preferably provided with one or more ribs which extend into complementary grooves 21 of the sash, see FIG. 9. In this way, the leaf 15 is safely held against any movement with reference to the sash.

In order to permit for pivotal movements of the sash 1 with reference to the frame 2 in a manner as shown in FIGS. 3 and 4, the window construction further comprises a second joint or coupling 22 which is installed in the lower left-hand corner of the chamber 100 between the sash 1 and frame 22 and is illustrated in FIGS. 10 to 13. This second joint 22 is located at a level below the actuating member 32 and its male component is detachable from the female component so that it allows for pivotal movement of the sash 1 about the vertical axis 83. The female portion or socket 23 of the joint 22 is of angular shape and is attached to the frame 2. This socket includes an upwardly extending projection or cam 24 which is adjacent to the inner side of the window construction. It will be seen that the socket 23 extends substantially all the way between the inner and outer sides of the frame 2. A second cam 25 which is provided on the sash 1 normally abuts against and can roll on the cam 24 as best shown in FIG. 13. The manner in which the socket 23 is attached tothe frame 2 is the same as described in connection with the socket 12 of FIGS. 7 to 9. Thus, the socket 23 comprises an upwardly extending claw 26 which extends into a horizontal groove 27 of the frame 2, and a screw 28 is driven into a pair of slightly misaligned tapped bores which are provided in the socket 23 and web 8 of the frame 2. The cam 25 is attached to the sash 1 by one or more screws 29 or similar fasteners.

When the sash 1 is to be pivoted about the horizontal axis 83*a*, the cam 24 of the socket 23 cooperates with a male coupling member 30 which is reciprocable up and down by means of a C-shaped motion transmitting rail 31. This rail is mounted on the sash 1 and may be reciprocated by the actuating member 32.

The coupling member 30 forms part of a block 33 which preferably consists of synthetic plastic material and further comprises an arm 34 provided with a roller follower 35. The follower 35 can engage a substantially U-shaped retaining member 36 which is mounted on the frame 2. The retaining member 36 is preferably mounted in immediate or close proximity to the joint 22 so that, when the sash 1 is locked in closed position, a positive locking action takes place close to the joint 22. The connection between the retaining member 36 and frame 2 comprises screws 37, 38 or similar fasteners whereby the screw 38 may act not unlike the screw 20 or 28 to insure proper retention of the member 36. As shown in FIG. 11, the retaining member 36 is also provided with a rib 36*a* which extends into a complementary groove of the frame 2.

The motion transmitting rail 31 is coupled with the block 33 and with the coupling member 30 by means of a pin 39. In FIG. 10, the follower 35 is shown in idle position in which it is located at a level below the retaining member 36. By shifting the rail 31 upwardly, the operator can cause the follower 35 to enter between the flanges of the retaining member 36 and to thereby lock the sash 1 in its closed position in close proximity to the joint 22. When the coupling member 30 is in the position of FIG. 12, it cooperates with the head 14 of bolt 13 to define the horizontal pivot axis 83*a*. When lifted by the rail 31, the coupling member 30 is moved above the cam 24 and the sash 1 may be pivoted about the vertical axis 83.

Referring now to FIGS. 14 to 17, there is shown a third joint or coupling 40 which is installed in the upper right-hand corner of the window construction, as viewed in FIGS. 1, 3 and 4. This joint 40 can cooperate with the joint 11 to support the sash 1 for rotation about the vertical axis 83 and also permits pivotal movement of the sash about the horizontal axis 83*a*. It comprises a forked female coupling member 41 which accommodates a coupling element 42. The parts 41, 42 are traversed by a screw-shaped fastener 43 which is driven into the frame 2. The coupling element 42 carries a pivot pin 44 which extends into the frame 2 and is connected with one end of a link 45 forming part of a scissor-shaped linkage or link train connecting the upper part of the sash 1 with the upper part of the frame 2 in such a way that the sash can pivot about the horizontal axis 83*a* and also about the vertical axis 83. The other end of the link 45 carries a follower pin 46 which is slidable in a horizontal slot 47 provided in a guide member or bridge 49 affixed to the sash 1. The member 49 further guides a motion transmitting rail 48 which is reciprocably supported by the sash 1. A link 50 which forms part of the aforementioned linkage carries at its free end a follower pin 51 which is articulately coupled to a second guide member or bridge 52 of the sash 1. The other end of the link 50 is articulately connected to the link 45. As best shown in FIG. 6, the upper sides of the guide members 49, 52 are inclined outwardly and downwardly so that such outer sides of the members 49, 52 are parallel with the planes of the links 45, 50 at the time the sash 1 is moved substantially midway to its forwardly tilted position shown in FIG. 3. This insures that the sash 1 may be tilted about the horizontal axis 83*a* without jamming, even if it is tilted through a substantial angle. Such jamming could take place between the guide members 49, 52 and the links 45, 50.

The rail 48 carries a cam 53 which can retain a locking pin or stud 54 provided on the link 45. The link 45 further carries a stop 55 which is adjacent to the joint 40. In response to lengthwise displacement of the rail 48 by means of the actuating member 32, the stud 54 may be engaged by the cam 53 and the stop 55 then abuts against a vertical web 56 of the sash 1. FIG. 15 shows that the stop 55 may enter a groove in the web 56. The cam 53 and the stop 55 preferably consist of elastomeric material so that they may be deformed in order to compensate for minor inaccuracies in the manufacture of corresponding parts.

A second or auxiliary locking device is preferably provided midway between the joints 11 and 40 to hold the sash 1 against movement with reference to the frame 2 in response to motion transmitted to its movable locking portion by the rail 48. This auxiliary locking device is shown in FIGS. 18 to 20 and comprises a fixed retaining member 57 which is attached to the frame 2. The member 57 resembles a U-shaped body and its flange 61 is provided with a specially configurated cam slot 62. The base or web of the retaining member 57 is formed with a profiled rib 58 which extends into a complementary groove 59 provided in the frame 2. The connection between the retaining member 57 and the frame 2 further comprises one or more screws 60 an analogous fasteners.

The cam slot 62 may accommodate a follower 63 which is guided by C-shaped bearing member or rail 64, see FIG. 25. When the follower 63 assumes a median position indicated at A (see FIG. 20), the sash 1 is locked in closed position. If the follower 63 assumes the position B,

the sash 1 may be tilted about the horizontal axis 83*a*. In the position C, the follower 63 allows for pivotal movements of the sash 1 about the vertical axis 83. The bearing member 64 is affixed to the right-hand vertical edge portion of the sash 1 and is provided with a cutout 65 for the follower 63. This bearing member accommodates a vertically reciprocable slide or carriage 66 which is shown in FIG. 26. The carriage 66 has a projecting portion or platen 67 which carries a stud 68 provided with flexible wings 70. The wings 70 may support a rotatable sleeve 69 having an axial bore 72 and a larger-diameter counterbore 71. In order to pass through the bore 72, the wings 70 must be pressed together and thereupon expand in the counterbore 71 to hold the sleeve 69 in the position shown in FIG. 18. The parts 68, 70 and 69 together constitute the aforementioned follower 63. One end of the carriage 66 is coupled to the rail 48 through the intermediary of an articulatable shifter 81*a* shown in FIG. 14 so that the follower 63 can move up and down in the cam slot 62 of the retaining member 57 in a manner as described in connection with FIG. 20.

The carriage 66 preferably consists of plastic material.

The actuating member 32 resembles a V-shaped body, see FIGS. 21 and 22, and includes an upper end portion 32*a* which may be used as a hardgrip means to tilt the member 32 about a horizontal pivot pin 73 secured to the sash 1. A forked portion 74 of the actuating member 32 straddles a motion transmitting pin 75 which is provided on a vertically reciprocable block 76. The upper and lower ends of the block 76 respectively carry pins 77, 78 which are coupled to motion transmitting rails or bars 79, 80. The upper rail 79 is connected with an articulatable shifter 81, see FIGS. 23 and 24, which can transmit motion to the rail 48 and to the shifter 81*a* for the carriage 66. The lower rail 80 is connected with the rail 31 for the block 33 and coupling member 30.

The ends of the shifter 81 carry pins 82, 83 which are coupled to the rails 79, 48, respectively. The purpose of the shifter 81 (and of the shifter 81*a*) is to transmit motion around the corresponding corner portion of the sash 1 in response to manipulation of the actuating member 32. The actuating member 32 may be formed without the handgrip means 32*a*. The legs of its V-shaped part determine the extent to which the member 32 may be pivoted about the pin 73 and hence the extent of axial displacement of the rails 79, 80.

The heretofore described window construction comprises two shifters 81, 81*a* and a single auxiliary locking device including the parts 57, 63, 64, 66. When the sash 1 is relatively small, the auxiliary locking device and the shifter 81*a* may be dispensed with. The shifter 81 then merely serves to move the pin 54 into engagement with the cam 53 and the lower rail 80 transmits motion to the coupling member 30 and follower 35.

FIG. 29 illustrates schematically a window construction with a single shifter located in the upper left-hand corner above the actuating member 84. The member 84 may be pivoted to a central or locking position, to a lower position in which the joint 22 is operative and enables the sash 1 to pivot about the horizontal axis 83*a*, and an upper position in which the joint 22 is inactive and the sash 1 to pivot about the horizontal axis 83*a*, and arrows facing downwardly and leftwardly, as viewed in FIG. 29, indicate the direction of movement of motion transmitting parts when the sash 1 is to be pivoted about the horizontal axis 83*a*. The remaining arrows indicate the direction in which the motion transmitting parts are displaced by the actuating member 84 when the sash is to be pivoted about the vertical axis 83. The lines without arrowheads indicate the neutral position of motion transmitting parts when the sash 1 is locked in closed position.

Referring now to FIGS. 27 and 28, there is shown a different mode of providing a releasable coupling or joint between the upper right-hand corner of the sash 1 and the adjoining part of the frame 2. The shifter 81 (not shown in FIGS. 27 and 28) is connected with a locking member here shown as a rail or bar 85 which is reciprocable along the upper horizontal portion of the sash in a manner as shown in connection with the rail 48 of FIG. 14. The sash 1 carries a female coupling member or socket 86 which can cooperate with the rail 85 to retain therein a male coupling member or bolt 87 which is fixedly mounted on the frame 2 and serves as a pivot for one end of a link 88 corresponding to the link 45 of FIG. 14. The socket 86 is formed with one or more ribs 86*a* which extend into complementary grooves of the sash 1 to hold the socket 86 in requisite position. The connection between the socket 86 and ash 1 preferably comprises one or more screws which are mounted in the same way as described in connection with the screws 20 and 28.

The lower portion 89 of the coupling bolt 87 may be received in the recess 90 of the socket 86 when the sash 1 is moved to closed position. If the rail 85 is thereupon shifted from the inoperative position shown in the left-hand part of FIG. 27 to the locking position shown in the central portion of FIG. 27, the bolt 87 is retained in the socket 86 and the actuating member 32 simultaneously causes the follower 35 to enter the retaining member 36 of FIG. 11 to thereby lock the sash 1 in closed position. If the actuating member 32 is thereupon pivoted to a position in which the rail 85 assumes the right-hand end position shown in the right-hand part of FIG. 27, the follower 35 is disengaged from the retaining member 36 but the bolt 87 remains locked in the socket 86 so that the sash 1 may be pivoted about the vertical axis 83. The socket 86 further comprises a projection or ledge 91 which carries a nose 92 serving to guide the rail 85. The arrangement is such that the socket 86 can straddle the bolt portion 89 from three sides and that the rail 85 can close the open side of the recess 90 to thereby prevent withdrawal of the bolt.

The front end of the rail 85 is provided with an inclined cam face which serves to force the bolt 87 into the recess 90 if the sash 1 is not moved to its fully closed position while the operator manipulates the actuating member 32 in a sense to move the rail 85 to the position shown in the central or right-hand portion of FIG. 27. In the lefthand portion of FIG. 27, the rail 85 cannot prevent withdrawal of the bolt 87 from the recess 90 so that the sash 1 can be swung about the horizontal axis 83*a* whereby the socket 86 moves forwardly and away from the bolt 87.

FIGS. 30 and 31 illustrate a joint or coupling which may be used as a substitute for the joint of FIGS. 14–17 or 27–28. This modified joint comprises a rod-shaped locking member 92 which replaces the locking rail 85 of FIGS. 27 and 28 and which can enter a diametral aperture or bore provided in a coupling bolt 93 which is rotatably secured to the frame 2. The member 92 is mounted on and can be moved with reference to the sash 1. Its front end portion is guided in a bearing 94 which is attached to the sash and which constitutes a socket for the bolt 93. When the sash is to be pivoted about the horizontal axis 83*a*, the member 92 is retracted to its left-hand end position 92*a* and allows the socket 94 to move forwardly with reference to the bolt 93. When the member 92 is shifted to its solid-line central position and the bolt 93 extends into the socket 94, the sash is locked in closed position because the actuating member then causes the follower 35 to engage the retaining member 36, not shown in FIGS. 30 and 31. If the member 92 is shifted to its right-hand end position 92*b*, the socket 94 remains coupled with the bolt 93 but the follower 35 is disengaged from the retaining member 36 so that the sash 1 can be pivoted about the vertical axis 83. The structure of FIGS. 30 and 31 also requires a single shifter 81 if the auxiliary locking device of FIGS. 18–20, 25, 26 is dispensed with. FIG. 30 further shows a link 95 which

is pivotable on the bolt **93** and performs the same function as the link **45** of FIG. 14.

In accordance with a further modification of our invention which is not shown in the drawings, the window construction may be provided with two couplings or joints which support the sash during pivoting about the vertical axis and with two joints or couplings which support the sash during pivoting about the horizontal axis. Each coupling comprises a male portion and a female portion, and one such portion is movable into and out of operative engagement with the other portion. By utilizing one or more shifters (such as the shifter **81** or **81***a*), the operator can cause the actuating member to disengage the couplings which control pivotal movement about the vertical axis when the sash is to be pivoted about the horizontal axis, and vice versa. Thus, by the simple expedient of disengaging one pair of couplings, the sash may be swung about the axis which is defined by the other pair of couplings or vice versa. All of the couplings are accommodated in the chamber **100**.

A very important advantage of our improved window or door construction is seen to reside in that all movable parts can be operated in response to motion transmitted by a single actuating member **32** or **84**. The appearance of the structure is eye-pleasing because, when the sash is moved to closed position, all components of the hardware, with the sole exception of the actuating member, are accommodated in the chamber **100** and because the two sides of the sash are then flush with the corresponding sides of the outer frame. The joints consists of rugged parts which can withstand repeated pivoting of the sash and which occupy little room by simultaneously permitting substantial angular displacements of the sash about the horizontal or vertical axis.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is:

1. A door or window construction, comprising an outer frame; an inner frame surrounded by said outer frame and pivotable to and from a closed position about horizontal and vertical pivot axes, said frames defining and enclosing at least in said closed position between themselves a chamber extending about said inner frame; joints defining said pivot axes; releasable locking means for locking the inner frame to the outer frame at the will of the operator; a single actuating member provided on said inner frame; and means connecting said single actuating member with said locking means and with at least one of said joints, said joints, said releasable locking means, and said connecting means being located in said chamber and completely covered by said frames at least in said closed position so that only said single actuating members will project beyond said frames.

2. A construction as set forth in claim **1**, wherein said inner frame is of polygonal shape and comprises a lower horizontal and a vertical marginal portion, said pivot axes being adjacent to and parallel with the respective marginal portions and intersecting each other in one of said joints.

3. A construction as set forth in claim **1**, wherein said frames have inner and outer sides and define between themselves rectangular gaps of uniform width respectively extending between said inner and outer sides and wherein said pivot axes are arranged in such a manner that the edges of said inner frame adjacent said pivot axes may move into said chamber during pivoting of said inner frame from said closed to an open position.

4. A construction as set forth in claim **3**, further comprising means secured to one of said frames for covering said gaps.

5. A construction as set forth in claim **4**, wherein said covering means are anchored in grooves provided in said one frame.

6. A construction as set forth in claim **3**, further comprising a sealing strip secured to one of said frames to seal the gap between the outer sides of said frames when said inner frame is closed, said sealing strip being spaced inwardly from said outer sides.

7. A construction as set forth in claim **6**, wherein said inner frame comprises at least one vertically extending guide rib at said outer side thereof, said guide rib being adjacent to said sealing strip.

8. A construction as set forth in claim **3**, further comprising a sealing strip secured to said inner frame and arranged to seal the gap between said inner sides in closed position of said inner frame, said outer frame having a bead against which said sealing strip abuts when the inner frame is moved to closed position.

9. A construction as set forth in claim **1**, wherein said frames are of rectangular shape and said outer frame comprises two horizontal and two vertical webs bounding said chamber and inclined in such a way that any moisture depositing thereon is compelled to flow into the lowermost zone of said chamber.

10. A construction as set forth in claim **2**, wherein said one joint is a universal joint.

11. A construction as set forth in claim **10**, wherein said universal joint comprises a socket secured to said outer frame and defining a recess, and a coupling bolt carried by said inner frame and having a portion arranged to swivel in said recess.

12. A construction as set forth in claim **11**, wherein said socket is located at a level below said lower marginal portion and comprises an anchoring portion extending into an internal groove provided in said outer frame.

13. A construction as set forth in claim **12**, further comprising fastener means securing said socket to said outer frame.

14. A construction as set forth in claim **11**, wherein said universal joint further comprises a hinge member turnably supporting said coupling bolt, and means for securing said hinge member to said inner frame.

15. A construction as set forth in claim **14**, wherein said securing means comprises at least one rib provided on said hinge member and extending into a groove provided on said inner frame and fastener means extending through said hinge member and anchored in said inner frame.

16. A construction as set forth in claim **10**, wherein said joints further include a second joint spaced from said universal joint and defining therewith said horizontal pivot axis, said second joint comprising a socket secured to said outer frame and having a projection, a cam provided on said inner frame and arranged to roll on said projection when the inner frame is pivoted about said horizontal axis, a coupling member reciprocably supported by said inner frame and movable into and from engagement with said projection to thereby respectively prevent or permit pivotal movement of said inner frame about said vertical axis, and an operative connection between said actuating member and said coupling member to reciprocate said coupling member at the will of the operator.

17. A construction as set forth in claim **16**, wherein said socket is located below said lower marginal portion and comprises an upwardly extending claw received in a groove provided in said outer frame, and further comprising fastener means securing said socket to said outer frame.

18. A construction as set forth in claim **10**, wherein said joints further include a second joint adjacent to said vertical marginal portion and spaced from said universal joint, said second joint comprising a forked female cou-

pling member, a coupling element straddled by said female coupling member, fastener means securing said coupling member and said coupling element to said outer frame, a pivot secured to said element, and a linkage having a first portion turnable on said pivot and a second portion articulately connected with said inner frame, said inner frame having an upper horizontal marginal portion adjacent to said linkage.

19. A construction as set forth in claim 18, further comprising a motion transmitting member reciprocable along said upper marginal portion and operatively connected with said actuating member, a locking member provided on said motion transmitting member, and an elastic cam provided on said linkage and arranged to engage said locking member in closed position of said inner frame and in response to manipulation of said actuating member.

20. A construction as set forth in claim 18, further comprising an elastic stop provided on said linkage and arranged to abut against said inner frame when the latter is moved to closed position.

21. A construction as set forth in claim 18, wherein said upper marginal portion comprises a pair of guide members and said second portion of said linkage comprises two relatively movable followers one of which is articulately coupled to one of said guide members and the other of which is reciprocable in a horizontal slot provided in the other guide member.

22. A construction as set forth in claim 21, wherein said guide members are provided with external surfaces of such inclination that said linkage cannot jam in response to pivoting of said inner frame about said horizontal axis.

23. A construction as set forth in claim 10, wherein said locking means comprises a locking device adjacent to said vertical marginal portion above said universal joint, said locking device including a retaining member fixed to said outer frame and having a slot, a follower reciprocably mounted on said inner frame and movable into and from said slot, and an operative connection between said follower and said actuating member.

24. A construction as set forth in claim 23, wherein said retaining member comprises a profiled rib extending into a complementary groove provided in said outer frame, and further comprising fastener means securing said retaining member to said outer frame.

25. A construction as set forth in claim 23, wherein said operative connection comprises a bearing member mounted on said inner frame, a cartridge movable in said bearing member and supporting said follower, and at least one shifter connecting said carriage with said actuating member and arranged to transmit motion around a corner portion of said inner frame.

26. A construction as set forth in claim 25, wherein said follower comprises a stud rigid with said carriage and having flexible wings, and a sleeve receiving said wings and rotatable with reference to said stud.

27. A construction as set forth in claim 10, wherein said joints further include a second joint adjacent to said lower marginal portion and spaced from said universal joint, said universal joint and said second joint defining said horizontal axis and said actuating member being located at a level above said second joint, said locking means comprising a locking device located between said actuating member and said second joint and including a retaining member secured to said outer frame, a follower reciprocably supported by said inner frame and movable into and from locking engagement with said retaining member in closed position of said inner frame, and an operative connection between said actuating member and said follower.

28. A construction as set forth in claim 27, wherein said retaining member is a U-shaped body and comprises a rib extending into a groove provided in said outer frame, and further comprising fastener means securing said retaining member to said outer frame.

29. A construction as set forth in claim 1, wherein each of said joints and said locking means comprises a member adjacent to one of said frames, misaligned bores provided in said member and said one frame, and fastener means driven into said misaligned bores to wedge the member to said one frame.

30. A construction as set forth in claim 29, wherein said bores are tapped and said fastener means comprises external threads.

31. A construction as set forth in claim 1, wherein said actuating member is a V-shaped body and is pivotable with reference to said inner frame, said V-shaped body having outer sides arranged to limit pivotal movements of the actuating member.

32. A construction as set forth in claim 10, wherein said joints further include a second joint located above said universal joint and defining therewith said vertical pivot axis, said second joint comprising a male coupling member secured to said outer frame, a socket secured to said inner frame and receiving said male coupling member in closed position of said inner frame, a locking member movable with reference to said socket to respectively permit or prevent movement of said sockt away from said male coupling member, and a motion transmitting connection between said locking member and said actuating member.

33. A construction as set forth in claim 32, wherein said connection comprises a single shifter arranged to transmit to said locking member motion around a corner portion of said inner frame.

34. A construction as set forth in claim 32, wherein said locking member is movable between three positions including a central locking position, a first end position in which the male coupling member is locked to said socket and the inner frame is pivotable about said vertical axis, and a second end position in which the male coupling member is released and the inner frame is pivotable about said horizontal axis.

35. A construction as set forth in claim 10, wherein said joints further include a second joint located above said universal joint and defining therewith said vertical pivot axis, said second joint comprising a coupling member secured to said outer frame and having a substantially radially extending bore, a locking member reciprocably supported by said inner frame and movable into said bore, and an operative connection between said actuating member and said locking member, said locking member extending into said bore when said inner frame is locked to said outer frame and when said inner frame pivots about said vertical axis.

36. A construction as set forth in claim 1, wherein said joints include a first and a second pair of joints respectively defining said horizontal and vertical pivot axes, each of said joints having a fixed portion and a second portion movable into and from operative engagement with the fixed portion, and further comprising motion transmitting means connecting said actuating member with said second portions, said actuating member being movable between a plurality of positions in one of which the second portions of one pair of said joints are disengaged from the respective fixed portions and in another of which the second portions of the other pair of joints are disengaged from the respective fixed portions.

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KENNETH DOWNEY, *Primary Examiner.*