United States Patent [19]

Frank

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[54] **COVERING AND STAIR ACCESS FOR OPENINGS IN CEILINGS, ROOFS AND SIMILAR WALL STRUCTURES**

[75] Inventor: **Wilhelm Frank,** Leinfelden, Germany

[73] Assignee: **Wilh. Frank GmbH,** Leinfelden, Germany

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[52] **U.S. Cl.** **182/81**
[51] **Int. Cl.** **E06c 9/06**
[58] **Field of Search** 182/81, 77–80

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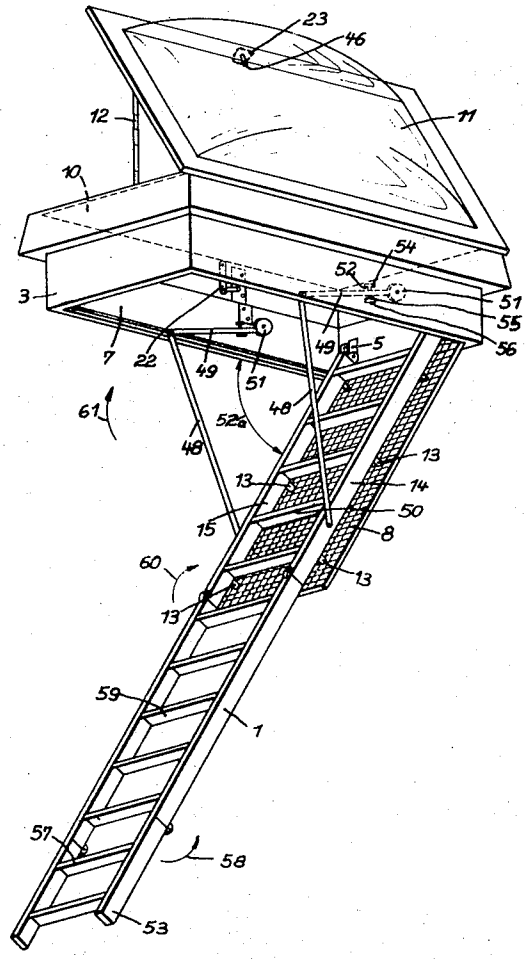
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Primary Examiner—Reinaldo P. Machado
Attorney, Agent, or Firm—McGlew & Tuttle

[57] **ABSTRACT**

A covering for openings in ceilings, roofs and similar structures comprises a frame adapted to be fitted into the opening with its outer periphery sealed within the opening structure. A cover panel such as a skylight cupola is pivotally mounted adjacent the top of the frame member and it is movable between a closed and a fully opened position to provide either ventilation or access through the frame. The frame also carries a foldable staircase which may be pivoted downwardly and extended outwardly to ground level to permit access through the frame from the ground level to the roof structure. In the closed position, the folded stair assembly forms aligned stair threads which define air flow passages therebetween to permit ventilation through the staircase when the skylight cupola is opened partly. In the folded and closed position, the underside of the staircase is closed by a panel which may be solid or which may be formed as an opened grid or louvre which permits the free flow of air therethrough but which provides a concealment for the staircase when viewed in any position except directly underneath.

9 Claims, 23 Drawing Figures



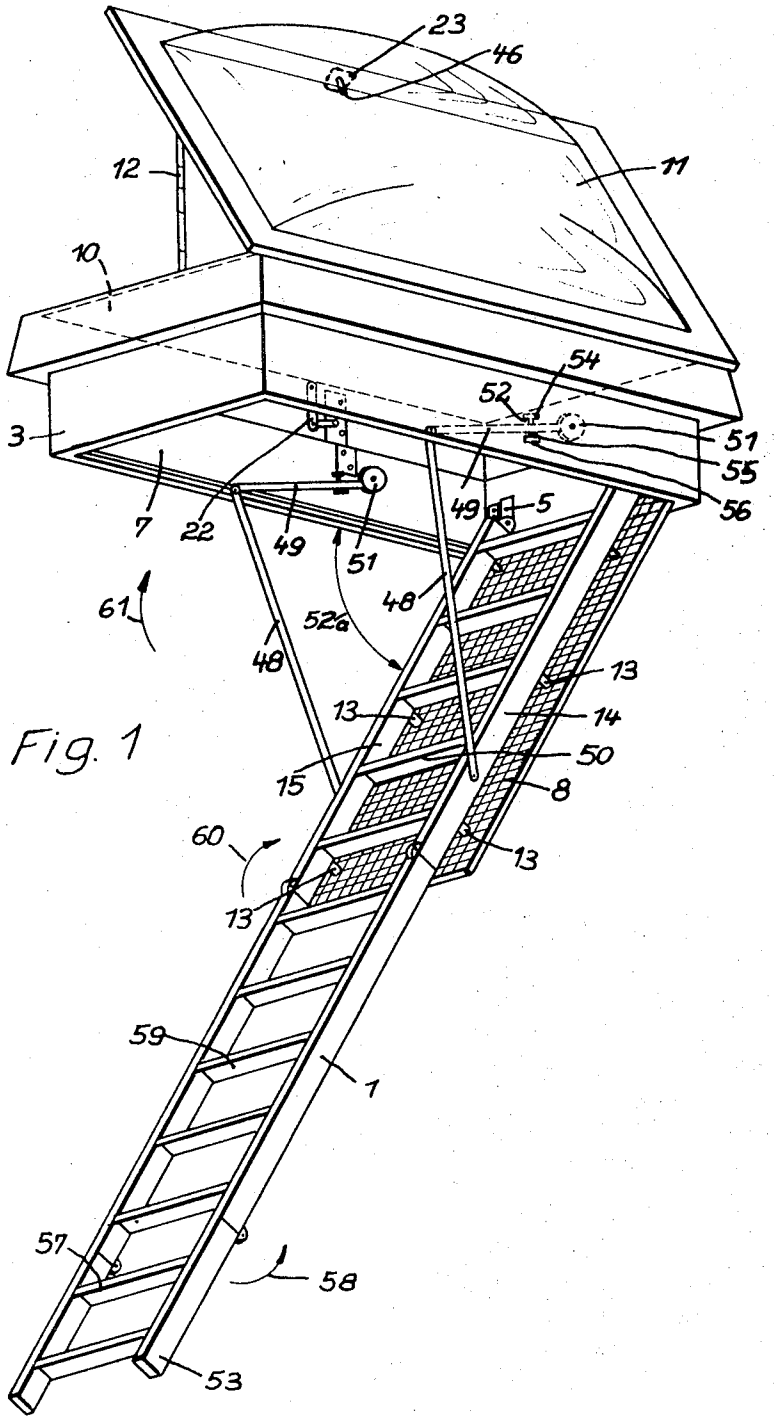

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Fig. 1

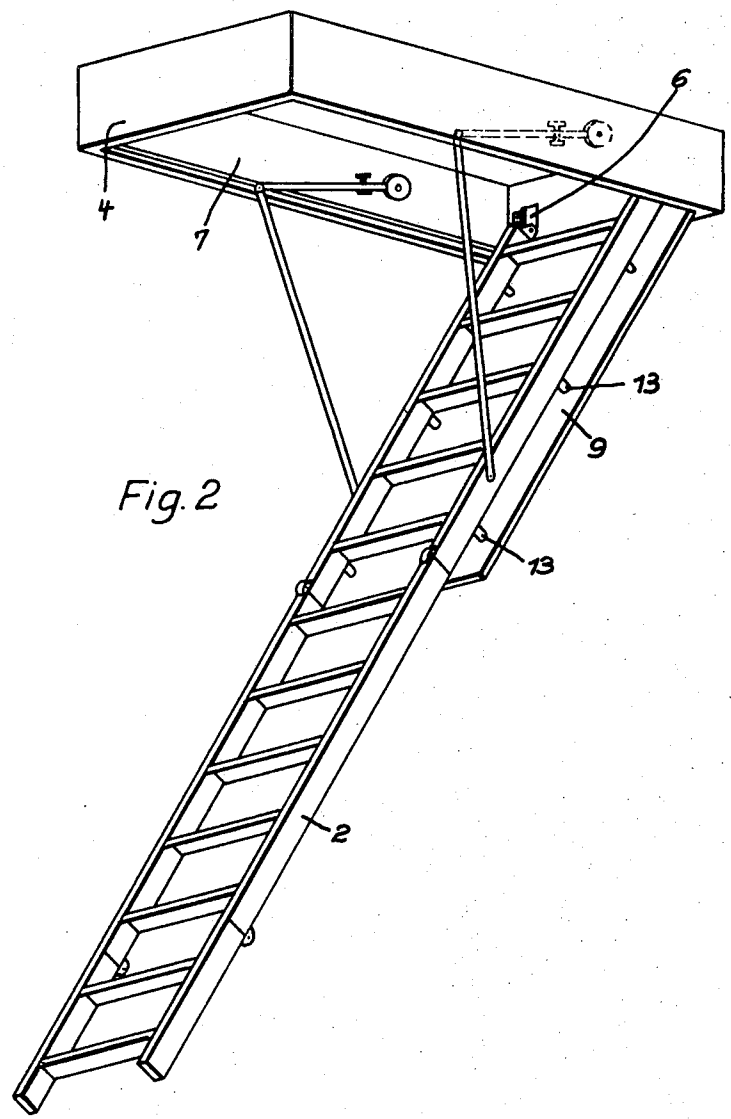


Fig. 2

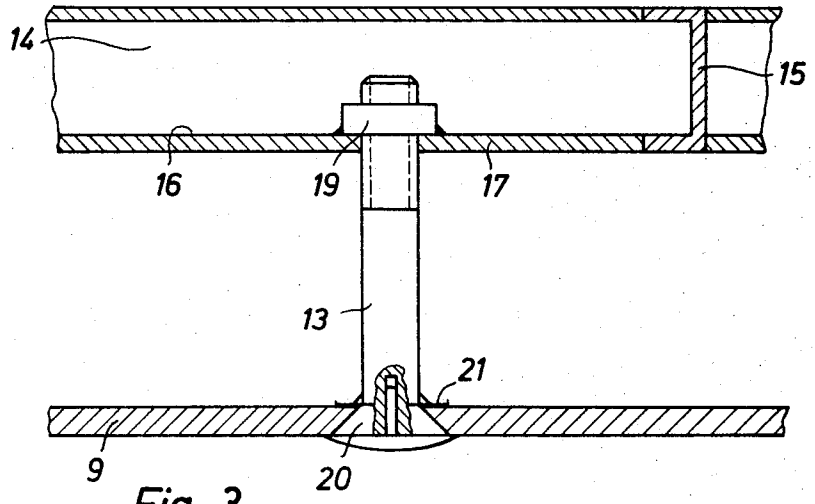


Fig. 3

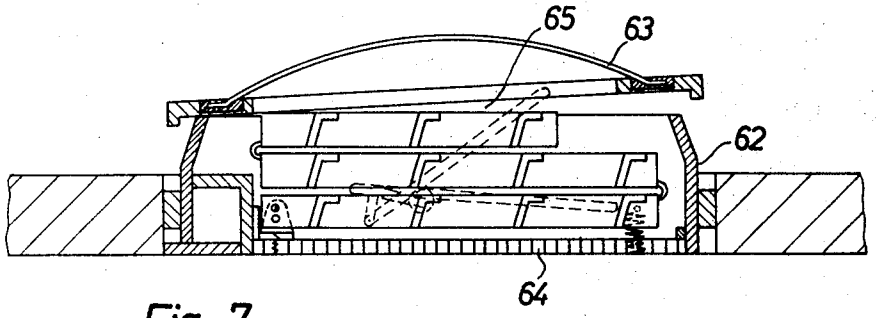


Fig. 7

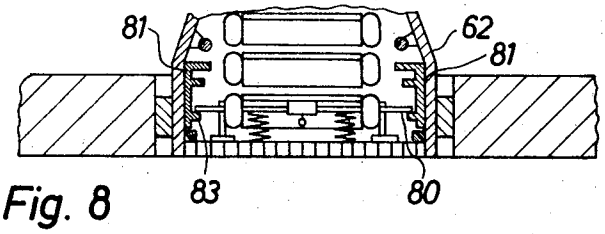
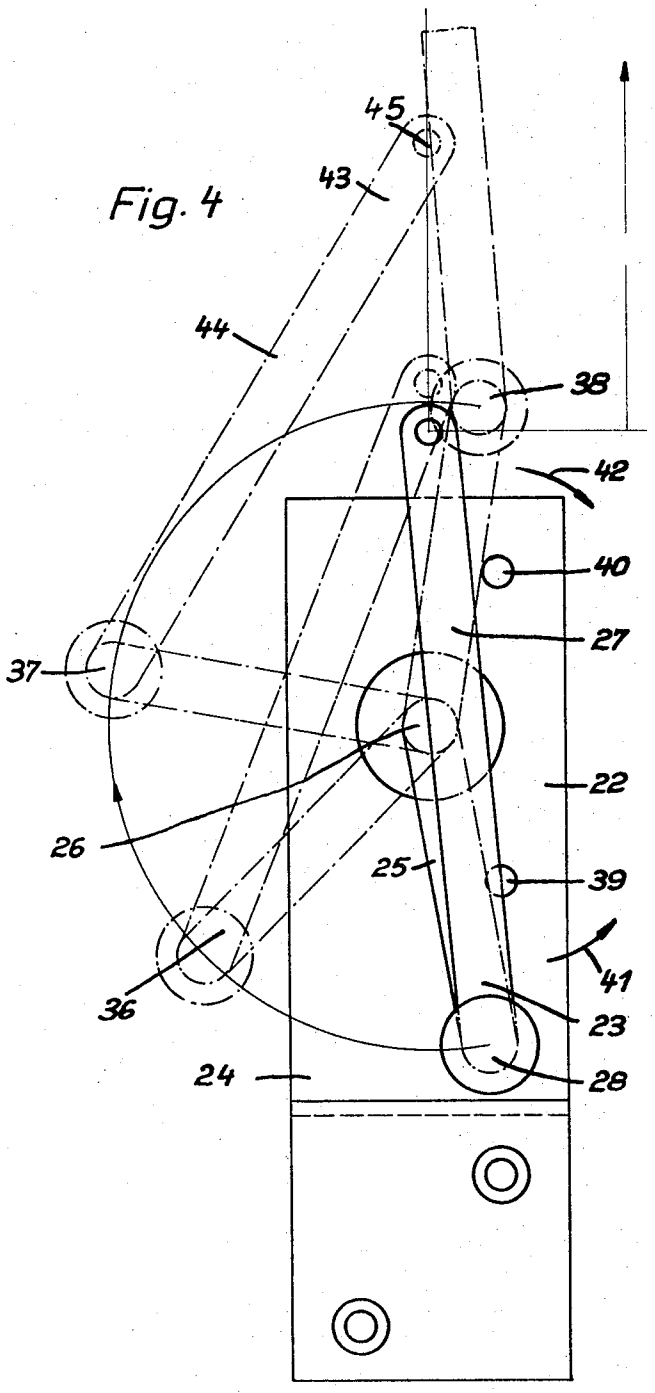


Fig. 8

Fig. 4



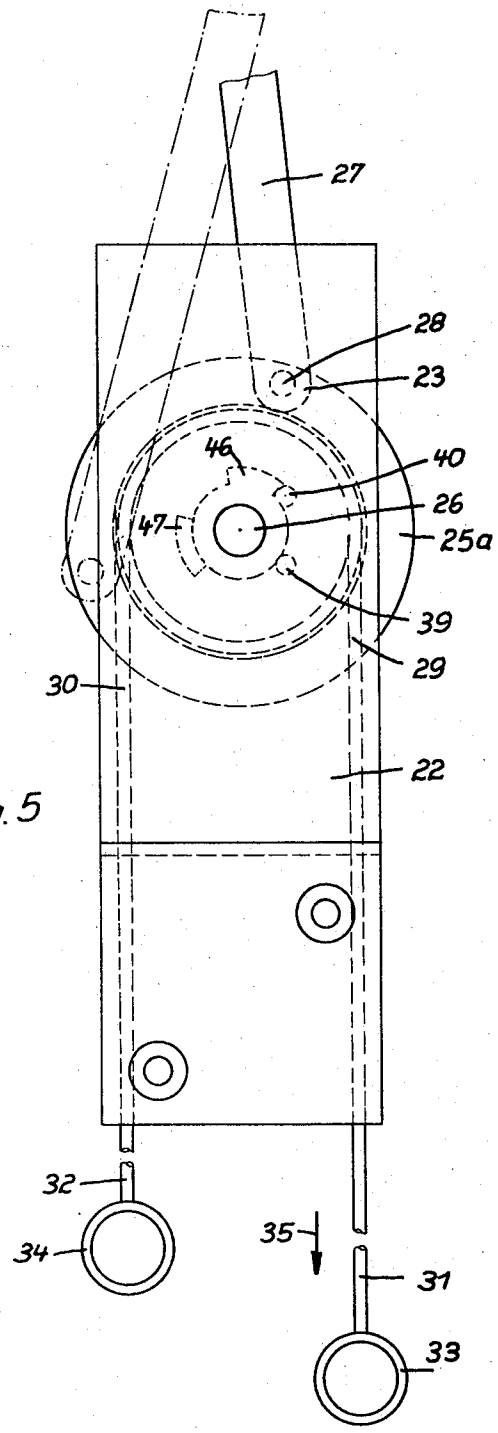
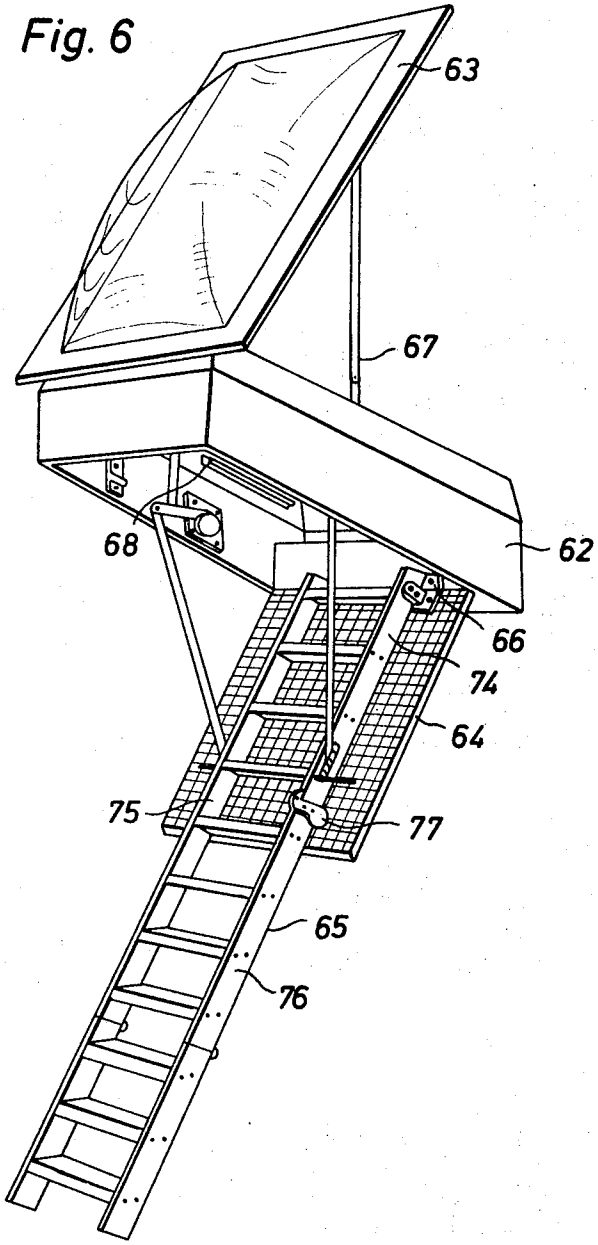


Fig. 5

Fig. 6



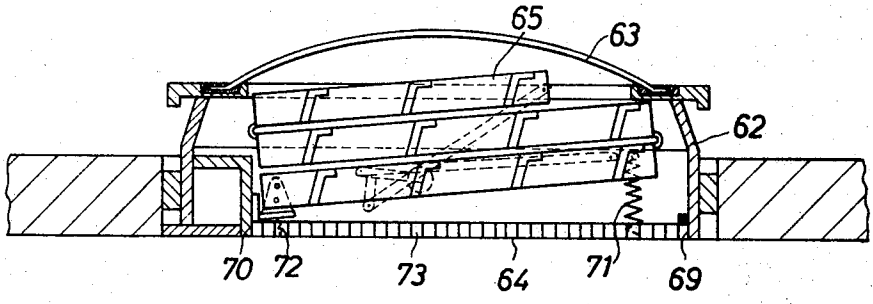


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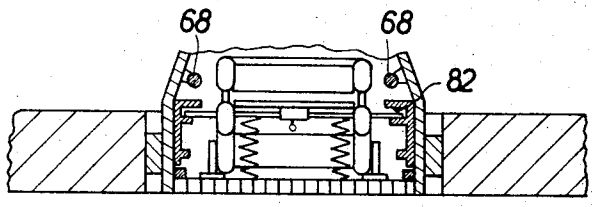


Fig. 10

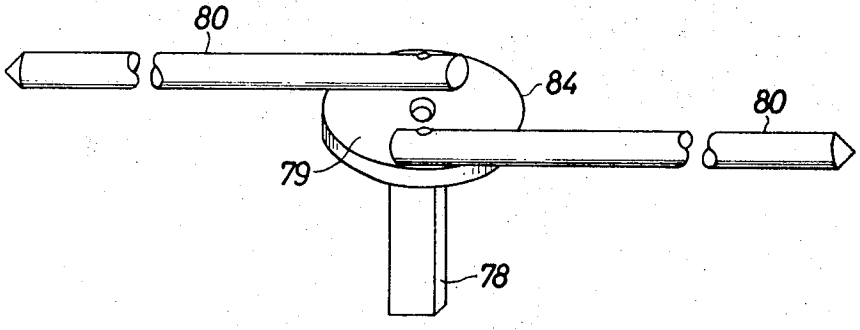
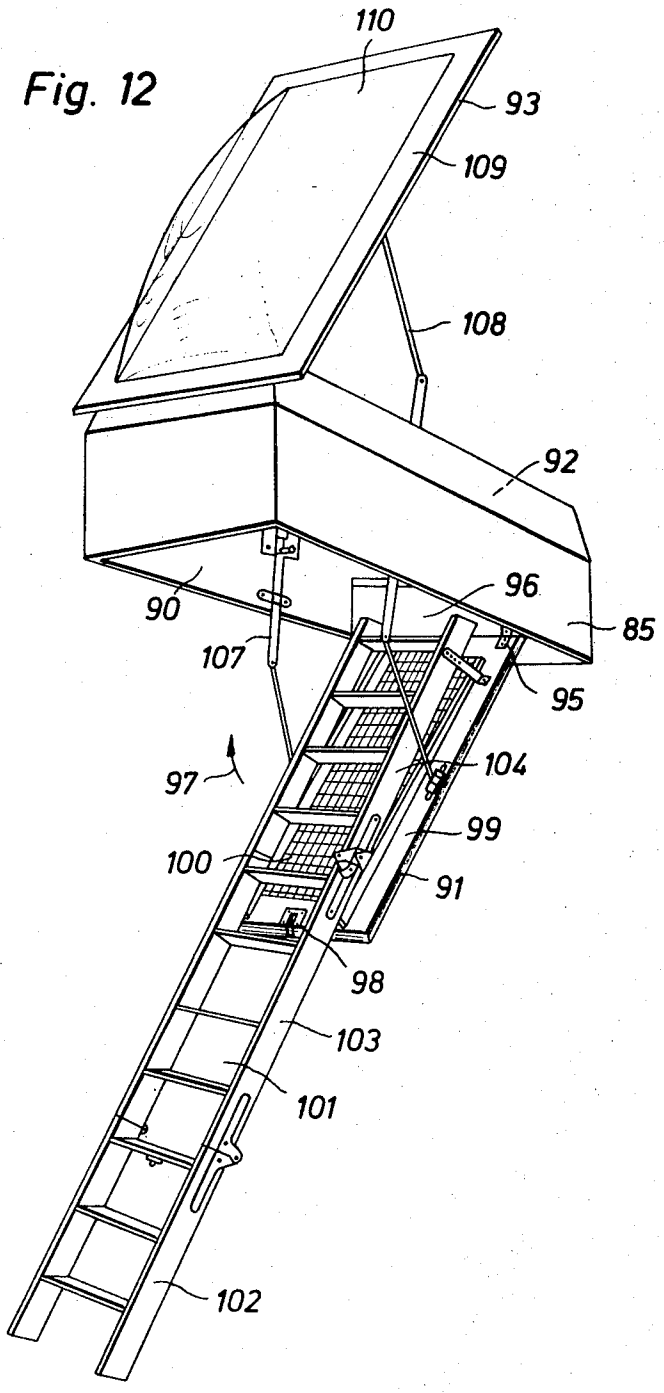


Fig. 11

Fig. 12



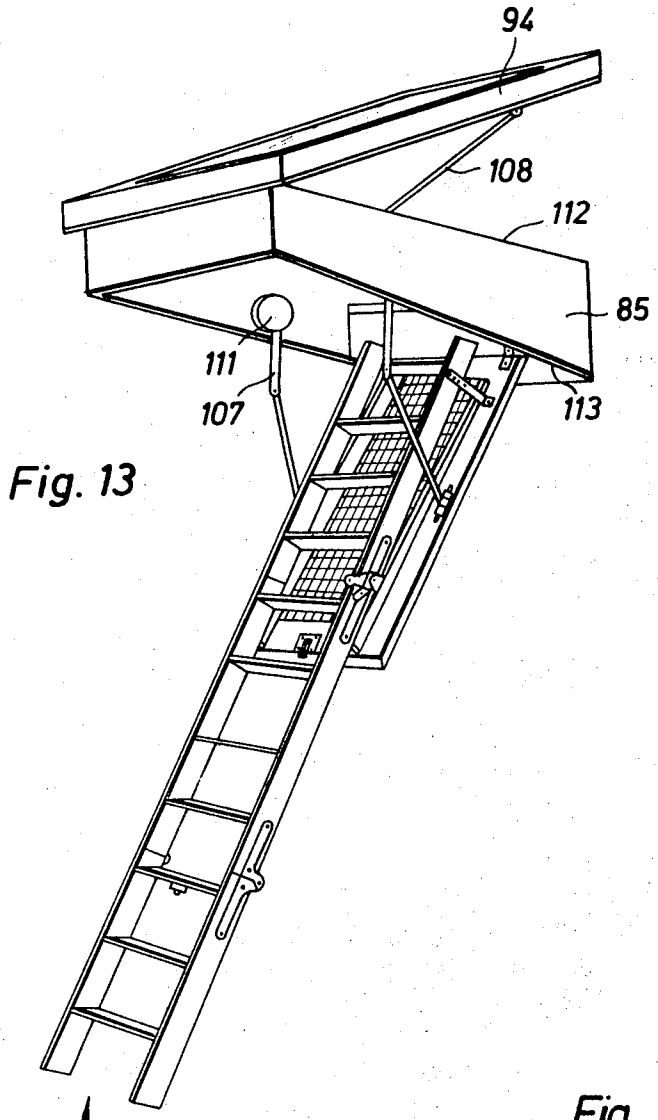


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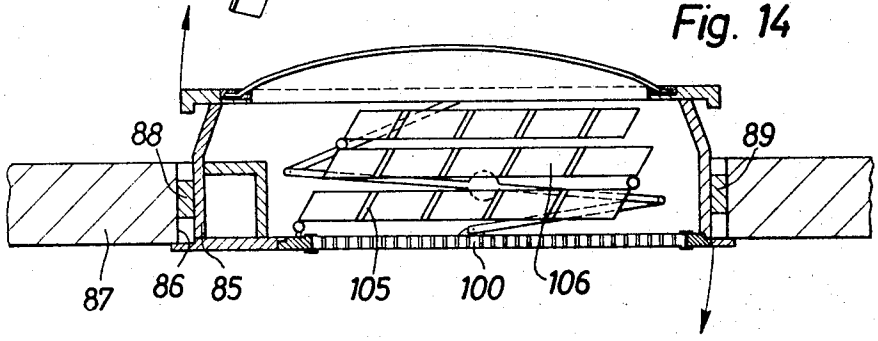


Fig. 14

Fig. 15

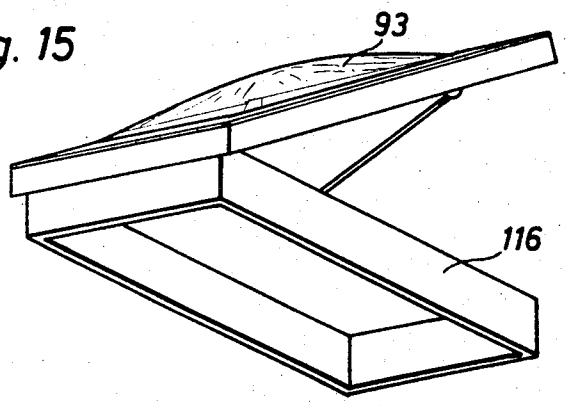


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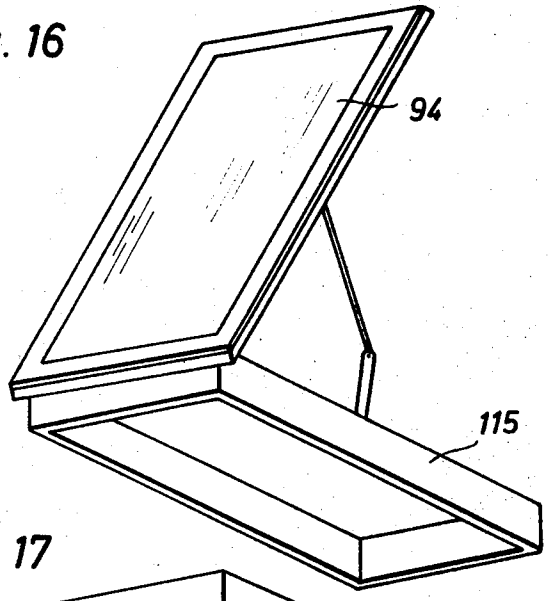
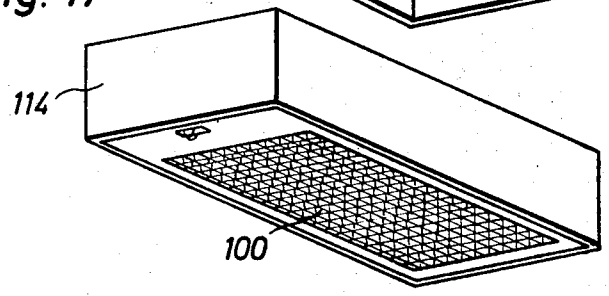


Fig. 17



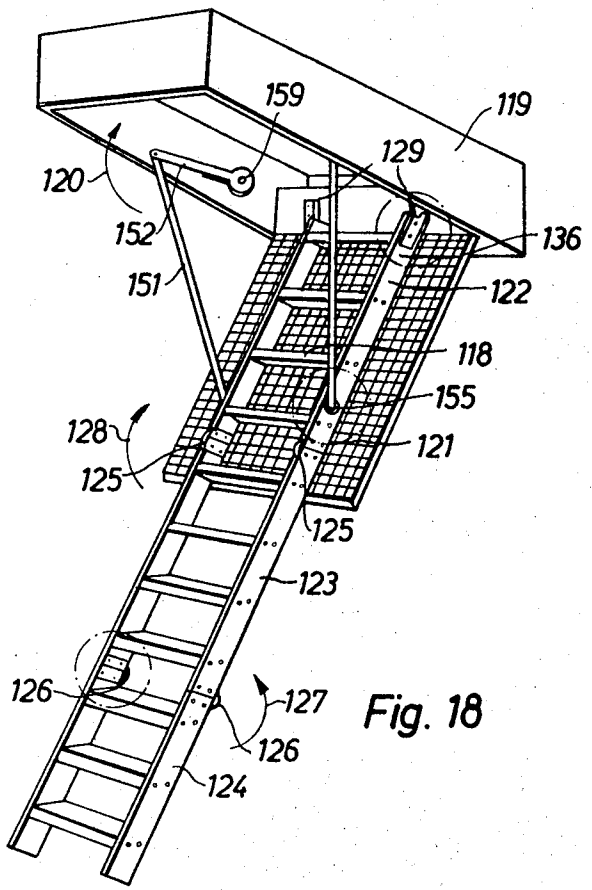

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Fig. 18

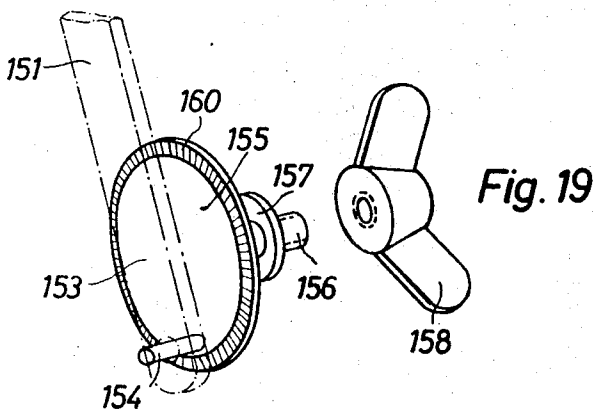

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Fig. 19

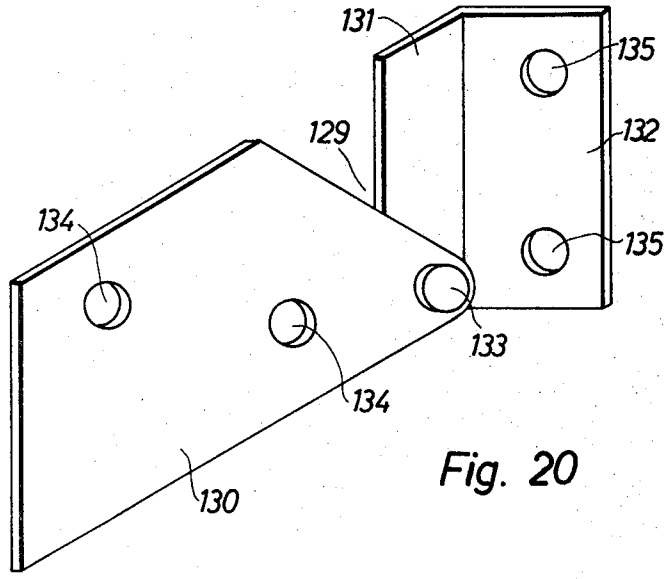


Fig. 20

Fig. 21

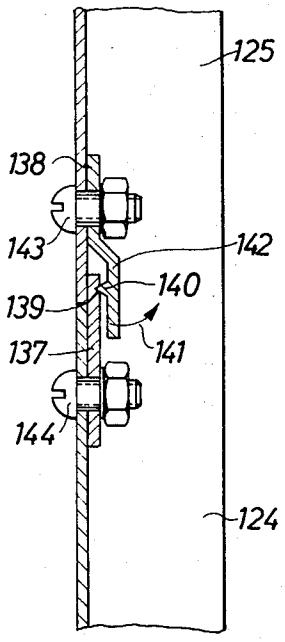
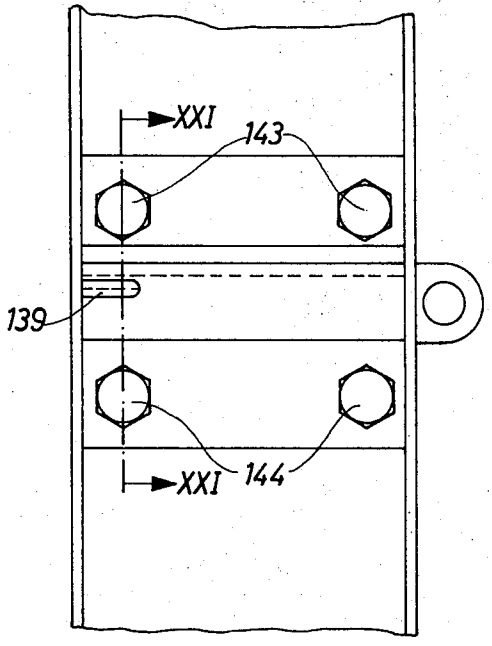


Fig. 22



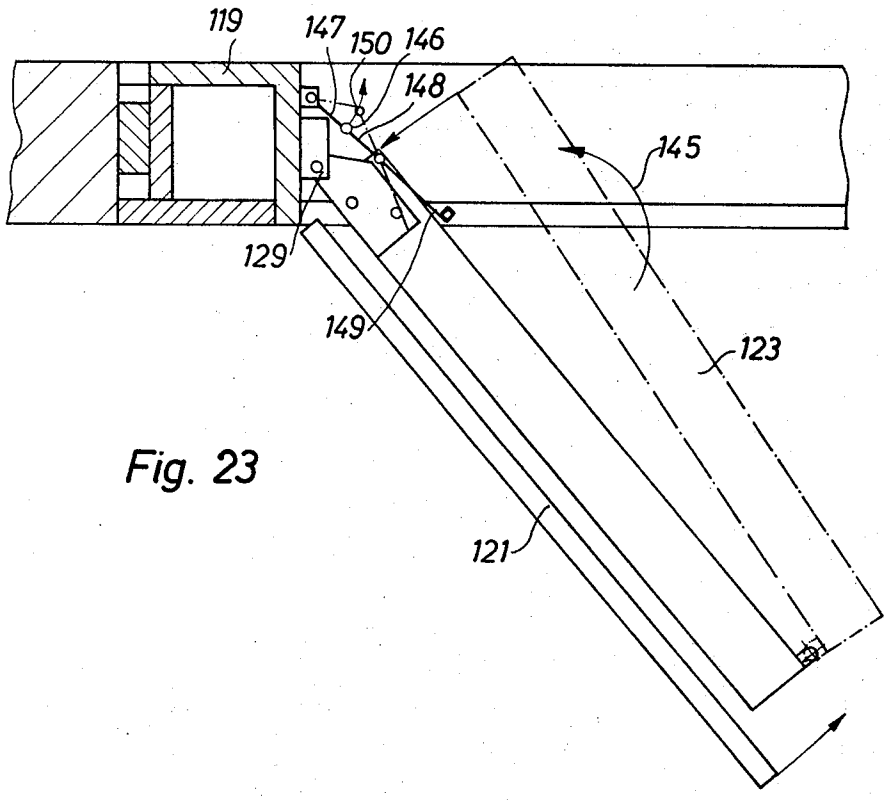


Fig. 23

COVERING AND STAIR ACCESS FOR OPENINGS IN CEILINGS, ROOFS AND SIMILAR WALL STRUCTURES

SUMMARY OF THE INVENTION

This invention relates in general to the construction of covers for roof openings and, in particular, to a new and useful combined roof cover skylight and ventilator and stair access.

The invention relates particularly to a covering for openings in ceilings and roofs which is also equipped with a pivoting ladder, staircase or the like, the ceiling opening being coverable or closable at its underside, and the roof opening being closable at least at its upper side. The task of the invention is to attach the covering or coverings so that they are easy to open and close and, in particular, when folding stairs are included, that their actuation is harmonized with their pivoting motion. The stairs, or the ladder, may either be extendable or unfoldable, or it may be of one-piece construction.

A roof covering of the type described is proposed which, according to the invention, is characterized in that a top covering or skylight is linked to the opening, or a casing or frame inserted in the opening and which is pivotable on the frame, and which also includes a bottom cover which is linked to a foldable staircase or to the opening or to a casing inserted therein. The outer covering is flipped open outwardly and the inner one pivoted into the space below it. If connected to stairs according to one of the modifications of the invention, the stairs are pivoted together with the cover. This design has the advantage that the entire load on the stairs is transmitted to the ceiling opening or, when a casing or frame is used, it is transmitted through the frame to the ceiling around the opening. Therefore, the covering is loaded only by its own weight and, consequently, can be produced of a relatively light material. If the fastening elements for the stairs penetrate the casing or frame and engage the ceiling opening, the load can, of course, be kept away from the casing and be transmitted directly to the ceiling.

When the stairs and the covering are mounted separately, the covering need not be reinforced, but the inner covering must be strongly constructed, if the stairs are mounted directly to it and are thus pivoted with it automatically.

In the case of a covering for a hatch to a flat roof, it is very advantageous for the ceiling opening to be covered on the outside by a push-open window or a skylight cupola and for the skylight cupola to be pivotable, in particular transversely to the pivot plane of the stairs, and for the covering for the lower end of the ceiling opening to be designed in the form of a light diffuser. Undoubtedly, opening the skylight cupola is much easier when it must merely be pivoted to the side rather than over the head backwards or forwards. However, in certain cases, pivoting about an axis parallel to the stair pivoting axis may be useful also.

So that the stairs are not noticeable from inside the room, the covering of the lower end of the ceiling opening is designed in the form of a light diffuser when the casing is covered by a skylight cupola. This does not interfere with the incidence of light and also, frees the view upwards only when oriented almost vertically up. From the side, therefore, which is when the view is oriented obliquely, the stairs are practically invisible from below. In addition, the light diffuser brings with it the advantage of making it possible to ventilate the room, through the opened skylight cupola with the diffuser closed in its upper end position. Transparent or translucent, perforated plates may also be used instead of the light diffuser.

According to another characteristic of the invention, when a covering with stairs or the like are operable by means of a toggle lever positioning linkage and a hoisting mechanism, the toggle lever arm connected to the hoisting mechanism or to the case is penetrated by a member movable back and forth transversely to the former's longitudinal axis in the former's pivoting plane, or it is connected to a member which can be moved past in this direction laterally. The lower end of the member and or of the toggle lever arm rests against a fixed support in the frame or in the ceiling opening when the end of the stairs is lowered to the floor. This involves a positioning device for the stairs or the like, by means of which the resting of the lower stair end of the floor is obtained even if the floor is not level. The leveling device ensures that the oblique position of the stairs in their operating position is variable to a certain extent. After the stairs are installed and adjusted, this device need not be operated any more.

Another embodiment of the invention provides a safety connection to ensure that when there is an outer and an inner covering of the roof opening, and the outer covering is in ventilating position, that the inner covering will not enter the interior of the room and have the whole access exposed thereby becoming a safety hazard. Of course, provision must be made in this implementation form for the air to be able to flow through the opening. Full opening the roof hatch of this type would make it impossible to overlook the inner covering — especially when the stairs are lowered — but a sudden rain would then be able to penetrate the interior of the house. According to the invention, this embodiment includes and opening linkage which influences the motions of both the covering and the stairs at the same time and which connects the outer articulated covering to the stairs pivoting in the frame. The inner articulated covering which is equipped with openings for the passage of air, is fastened elastically to the stairs and rests against the frame in the end position of the outer covering.

The outer articulated covering can be pivoted on its hinged connection by a certain angle by engagement through one of the air passage openings, thereby bringing about the external opening for ventilation. The air can then pass through the air passage openings of the inner articulated covering resting against the frame. The possible angle to which the outer articulated covering can be opened depends upon the distance which the outer articulated covering or the stairs have yet to travel after the elastically mounted inner articulated cover is seated. In this manner, a ventilating position is achieved which is both free of hazard and largely prevents the penetration of moisture. The stairs may be designed either to be self-supporting, or they may be attached to a base plate which, in turn, is elastically connected to an additional plate containing the air passage openings.

Where a covering includes a frame or a casing inserted in the hatch opening especially when a push-out window is used, it is divided transverse to the direction

of emergence and includes an inner part supporting the stairs and the like and the inner covering of the hatch opening, whereas the outer covering such as the push-out window or skylight cupola is linked to the outer casing part. The two casing halves are interconnected by a centering device, in particular bolts or pins. The good fit which is thus achievable may also be obtained by partly telescoping the two parts. Due to this design, the push-out window has an inclination even when the roof hatch according to the invention is used in connection with a flat roof so that rain water can drain off and snow can slide off. Opening of the push-out window is facilitated when the pivot axis of the window is located lower than the opposite closing side of the window. Moreover, this characteristic merits advantages from both a manufacturing and an installation point of view. Since, due to the division of the casing, the total weight of this roof hatch is also divided and this also facilitates transportation to and at the building site. The lighter weight parts naturally also are of advantage during installation.

As already explained, the outer covering of the roof hatch opening serves as weather protection to prevent the penetration of cold and rain. The inner covering is assigned two tasks. First, it should hide the stairs, if present, which is a purely esthetic task, but secondly, it also provides a double seal of the hatch opening in order to reduce heat losses. When both coverings of the hatch covering are open, or the lower one is air permeable, the living area below it communicates directly with the outside air. It can, therefore, as said before, be aired out or ventilated without problems through this hatch opening. Beyond this, this living area can be additionally illuminated or made brighter by the hatch opening with coverings open.

In building projects with a flat roof construction there often result, in the interest of rational room configuration, living areas which do not adjoin any outside wall of the building. To bring natural light into such living areas it is necessary to build into the roof a so-called skylight cupola or push-out window. In addition to a flat roof hatch, this skylight cupola is necessary in order to climb onto or use the roof as a terrace. The joint installation of a flat roof hatch and a juxtaposed skylight cupola naturally causes much expense because two independent components must be built into two separate breakthroughs in the roof.

Therefore, the invention is based on the further task of avoiding this drawback of the known state of the art, and also in providing a cover in combination with collapsible stairs which may be folded into the housing or frame. As a solution, it is proposed, according to the invention, for the outer covering of a passage opening, designed as roof hatch covered on the inside and on the outside, to consist at least partly of a transparent or translucent material, whereas the inner one presents at least one opening for the passage of light. The outer and the inner coverings of the passage opening is adjustable by a linkage either together or by other hardware fittings. The rungs or steps of the stair sections, in a collapsed condition are preferably aligned vertically so as to be approximately an extension of each other and to thereby permit the formation of light shafts upwardly or downwardly. The greater these passage openings and the openings of the inner covering, and the more transparent the outer covering, the greater is the light penetration advantage achievable by the invention. In the extreme case, therefore, both coverings will be manufactured with a narrow frame, and at least the unobstructed opening of the outer one will be closed by glass, plastic or a glass substitute.

This results in the essential advantages of the invention; an illumination of the living area, an escape to the flat roof and a possibility of ventilation are created by one single assembly. The additinal skylight cupola, otherwise required for illumination, can be obviated, thereby saving costs, materials, labor for installation and the like.

It is of particular advantage that the outer and the inner covering of the hatch are each adjustable by a linkage or by other hardware fittings which are commercially available.

The pivot bearings of the stairs resting against and pivotable into the openings are generally of very simple construction, and they resemble in their design the pin hinges hardware for doors or piano hinges, except that they are designed much sturdier, of course. Yet their stability in many cases is insufficient, and they are unable to withstand the occurring stresses. The flat-lying hinges often bend under the load exerted on them, thus making it impossible to swing the stairs back properly. Since the hardware is mortised into the stairs and in some instances also into the stair casing, very wide recesses are necessary with naturally great weakening of the parts involves.

Another task of the invention at hand consists in reducing these recesses and weakened parts to a minimum and in increasing the stability of the hardware, virtually without altering its dimensions. To solve this problem it is proposed, according to the invention, that each pivot bearing of pivoting stairs which are built into an opening to be covered consist of two flat rods, disposed on eand and connected by a cross bolt and that each flat rod on the stair side be fastened laterally to the vertical side plate or be mortised into the narrow side of the stair side plate. The moment of resistance of the flat rods is greater when disposed on edge than when disposed flat as heretofore. Due to the vertical arrangement of the hinges, very shallow grooves for mortising, matching their thickness, are sufficient. When fastening laterally to the side plate, mortising can be obviated altogether. Moreover, this arrangement is applicable to all types of pivoting stairs, which means foldable as well as extendable pivoting stairs.

It is particularly expedient, when sections of a pivoting staircase are interconnected by hinged joints, for the two ends of the stair sections facing each other to be equipped with a buckling safety device, the one stair section presenting a notch and the other presenting a tooth, a strip or the like engaging the former in the operating position of the stairs, and for the tooth and/or the notch to be elastically pivotable in the direction of engagement. As soon as the stairs are completely unfolded and thus in an operating condition, the tooth or the strip automatically snaps into the correlated groove or notch. The adjacent stair sections are thus rigidly connected to each other and this connection is disconnectable with a forceful pull. During the snapping in and out motion, the tooth or the strip performs a pivoting motion relative to the notch and, in addition, at least one of the parts must be moved laterally by an amount matching the height of the tooth. This lateral disengaging should take place through an elastic deflection or against the force of a return spring so that

the parts interlock with a snapping motion as soon as they are flush.

According to another characteristic of the invention, the upper end of the stairs is connected to the ceiling opening or to the stair casing through at least one elbow lever which, in the operating position of the stairs, assumes a flat attitude and which is disposed so as to be staggered in the direction of the return pivoting motion to the side of the pivot bearings. The part of the elbow lever fastened to the ceiling opening or to the stair casing is designed in the form of a single arm lever and the other one as a duel arm lever. This again involves a safety measure which prevents an unintentional swinging back of the upper stair part or of the entire stairs. It becomes effective automatically as soon as the stairs are in an operating position. One or more of the elbow levers are used, and when in a flat attitude, they resist a rotary motion of the stairs, in a closing direction. If it is intended to pivot the stairs back after they have been used, the joint of the elbow lever must be brought out of its unstable position by suitable means, possibly by hand. As soon as the two arms of the elbow joint include between them an angle deviating from 180°, they can readily be moved towards each other and, therefore, no longer hinder the pivoting back of the upper stair section or of the retracted or collapsed stair either. Preferably, the buckling is accomplished so that the center of the joint is moved forward and upward.

The leg of the dual armed lever projecting beyond the pivot bearing of the elbow lever on the stair side may be utilized as a handle for the release from the unstable locked position. By moving it towards the stairs, the joint center of the elbow lever will escape upwards.

According to another characteristic of the invention, each support lever of the pivoting stairs is mounted for weight balancing, so as to pivot about an eccentric bolt, and each eccentric bolt is eccentrically disposed in a disc mounted in each stair side plate so as to be turnable as well as axially movable and fixable. Each disc is equipped with a surface which is pressable against the stair side plate and which includes gripping elements for the side plate. The disc may be roughened, serrated, notched or the like for the formation of the gripping elements. This involves an easily adjustable and installable, cheap to produce and easy to handle adjusting device for the above lever linkage. The support levers for the folding stairs may have the shape of two elbow levers disposed to the side of the stairs. The device described makes it possible to adjust both the angle between the two arms of the elbow lever and the stairs, or the ceiling, within a range predetermined by the eccentricity. Since the lever linkage is conventionally spring loaded, it is possible, by adjusting the eccentricity and the pivoting of the elbow lever arms resulting therefrom to load or relax sais spring or springs. The gripping elements may be pressed into the usually soft wood of the stairs by tightening a nut or by other means. For readjustment, the pressure nut must be loosened and the disc removed from the stair side plate. To change the adjustment, the disc is subsequently rotated and then pressed against the stair side plate by means of the nut or other means. Of course, the gripping elements may also be caused to engage a counterplate at the stair side plate so that impressions in the stair side plate will be avoided.

The staircase, with all its advantageous embodiments, may naturally also be inserted into an opening covered neither at its upper nor at its lower end. By the same token, in order to emphasize clearly once more, the push-out window, the skylight cupola, the lower covering or the light diffuser and the casing with the stairs or the like may each be used separately by themselves.

Accordingly, it is an object of the invention to provide an improved device for fitting into and covering openings of ceilings, roofs and similar structures and which includes a top covering which may, for example, form a skylight cupola and a foldable staircase which is mounted within the opening in a manner permitting it to be extended downwardly to form a ground to ceiling passage.

A further object of the invention is to provide a covering for openings in ceilings which includes a frame which is adapted to be fitted into the opening and which includes a skylight covering pivotally mounted to the top side of the frame and a staircase mounted in the frame which may be extended downwardly and which when closed forms a passage for air ventilation and wherein the skylight may be opened or closed with the stairway closed and wherein the bottom of the staircase is closed from view by a panel or similar grid structure.

A further object of the invention is to provide a cover structure for a roof opening which includes both top and bottom coverings and which includes a staircase mounted within a frame, and which for example, may be made of an inexpensive lightweight material such as metal and which includes side runners of the staircase which are made of U-shaped construction to facilitate their being connected to the associated frame structure and further including a lever mechanism which may be operated from ground level for facilitating the opening and closing of a skylight structure covering the top of the frame for carrying the staircase and which also includes a louvre or panel cover adapted to move with the staircase and be held at a spaced location in respect thereto during its operation and which will close the access opening at the bottom to provide a louvre for facilitating the passage of light through the structure without showing the stairs contained therewithin.

A further object of the invention is to provide a staircase which is adapted to fit in a roof opening and which includes means for locking the staircase in a folded position which may be easily unlocked to permit downward folding thereof.

A further object of the invention is to provide a combined staircase, skylight cupola and louvre panel finish for a ceiling opening which is simple in design, rugged in construction, and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specifc objects attained by its uses, reference should be had to the accompanying drawing and descriptive matter in which there are illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a bottom side perspective view of a roof hatch staircase, fastened to a casing, with a skylight cupola for covering the outer end of the roof opening;

FIG. 2 is a view similar to FIG. 1 of another embodiment of a collapsible and pivotable staircase leading to an attic, with a casing somewhat differently designed, the inner end of the ceiling opening being covered;

FIG. 3 is a partial longitudinal section taken along line 3—3 of FIG. 1 of a stair side plate and the lower covering;

FIG. 4 is a schematic side view of the locking and unlocking device for the outer covering;

FIG. 5 is a view similar to FIG. 4 of another unlocking and locking device;

FIG. 6 is a bottom side-perspective view of a roof hatch with opened outer coverings of another embodiment of the invention;

FIG. 7 is a longitudinal sectional view of an outer covering for the structure shown in FIG. 6;

FIG. 8 is a vertical cross-section through FIG. 7;

FIGS. 9 and 10 are views according to FIGS. 7 and 8, with the hatch opening closed;

FIG. 11 is a top-perspective view of a spreading mechanism;

FIG. 12 is a perspective view similar to FIG. 1 of another embodiment of the invention;

FIG. 13 is a perspective view similar to FIG. 1 of still another embodiment of the invention;

FIG. 14 is a longitudinal section of a building roof with outer and inner covering according to the embodiment shown in FIG. 12;

FIGS. 15 and 16 are perspective views of two different embodiments of an upper casing half, one with a skylight cupola and the other with push-open window as an outer covering;

FIG. 17 is a perspective view of a lower frame for use with the device of FIGS. 15 or 16;

FIG. 18 is a perspective view of another embodiment of the invention with foldable pivoting stairs in an operating position;

FIG. 19 is an exploded, perspective view of another embodiment of adjusting device for the lever linkage;

FIG. 20 is a perspective view of the upper pivot bearings of the staircase, also shown perspectively;

FIG. 21 is a section taken along the line XXI—XXI of FIG. 22;

FIG. 22 is in top view, the buckling safety device disposed between two stair sectors; and

FIG. 23 is a diagrammatic side view with sectioned stair casing and the lower foldable stair sector shown in dash-dotted lines.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing in particular, the invention according to FIGS. 1 and 2, includes a device for finishing and covering passage openings with foldable stairs generally designated 1 pivotable inwardly and outwardly from a folded condition for a roof hatch (FIG. 1), or stairs 2 for access to an attic (FIG. 2). The stairs 1 and 2 are pivoted in the casings or frames 3 and 4, respectively. Fastening elements of the hardware hinges 5 (FIG. 1) and 6 (FIG. 2) penetrate an inner frame or cover and are anchored in the ceiling cut-out or passage opening (not shown). The lower portion or lower casing 7 is covered in FIG. 1 by a light diffuser or panel 8 and, in the embodiment of FIG. 2, by a thin panel 9. In the case of the embodiment of FIG. 1, the upper casing end, or roof frame 10, is closed by means of a skylight cupola 11. The casing 4 of FIG. 2 remains open at its top. In the relatively steep open position shown in FIG. 1, the skylight cupola 11 is supported by a rod 12, articulated or pivoted on the frame 10 and on the skylight cupola 11.

Since the light diffuser 8 as well as the panel 9 are under the load of their won weight only, they may be of relatively weak construction or of relatively thin thickness. To be able to align the panels 8 or 9 perfectly relative to the lower casing 7, they are suspended from the underside of the stair side plates 14, 15 by means of bolts or screws 13 variable in length. FIG. 3 shows a section of such a stair side plate 14 which is made of a metal, in particular aluminum. The profile 15 of the side plate 14 is U-shaped. A number of nuts 19, matching the number of supporting screws 13, are welded or otherwise attached secure against rotation to the inside 16 of the lower U leg 17. In both examples (FIGS. 1, 2), the lower coverings of the casing are supported by six screws 13. In order to prevent any uneven or warped panels 9 or other coverings from lifting off the screw heads 20 during alignment, they are clamped between the screw heads 20 and retaining washers 21 placed on the screw shaft. This makes it possible to pull or push down various portions of the panel or of the lower covering, thereby aligning them altogether. A greater or smaller number of screws than is evident from FIGS. 1 and 2, may be used, of course.

The skylight cupola 11 in FIG. 1 can be flipped open perpendicular to the pivoting plane of the stairs 1. By means of the devices 22 on lower frame 7 and a cupola 11, it is possible to make it assume infinitely many ventilating positions or lock it in a closed position. A first design of the locking and push-open device is pictured in FIG. 4, a second one in FIG. 5. The device of FIG. 5 comprises essentially an elbow lever 23 whose one elbow lever arm 25*a*, attached to the casing or a piece of sheet metal 24 fastened thereto, is designed as a rope pulley, whereas the corresponding lever arm 25 of FIG. 4 is of rod-shape in the usual manner. The pivot pin at the casing side is designated 26 in FIG. 4. The pivot pin 26′ provides a rotational journal for the rope pulley 25*a*. An outer elbow lever arm 27 is of identical design in both of the forms of FIGS. 4 and 5 and is connected to first arms 25 and 25*a*, respectively, through a pivot pin 28. The operating mode of both forms is the same per se, except that the design shown in FIG. 5 can be operated by means of a rope pull 29, 30 whose ends 30, 32 protrude downward through the light diffuser 8 or upon appropriate holes in the covering panel 9. Depending upon the actuation of ring 33 or 34 in the direction of arrow 35, or the opposite direction, there is produced a rotation to the right or left and, hence, an opening or closing of the skylight cupola. Various positions are shown in FIG. 4, namely, in solid lines, a first "lowered" position of this device, representing at the same time, the locked position of the skylight cupola 11. Then, in dash-dotted lines may be seen two intermediate positions 36 and 37, equivalent to a "light" and a stronger ventilating position. Shown finally, also in dash-dotted lines, is a second end position, equivalent to the maximum ventilating position. This second end position of the elbow joint, same as the first end position drawn in solid lines, represents a "beyond-dead-

center" position. In the last mentioned position, the one elbow joint arm **25** rests against the lower stop **39** or against the upper stop **40.** The lower stop limits rotary motion in the sense of arrow **41,** while the upper stop prevents continued rotation in the direction of arrow **42.** When, in the lower end position shown in solid lines, forces directed outward act against the skylight cupola **11,** they merely cause the one elbow lever arm **25** to press against the lower stop **39.** Rotary or pivoting motions of any kind do not take place. Consequently, this provides a securely locked end position. The situation is reversed when, in the upper end position, forces oriented from the outside to the inside, such as wind pressure, attack the skylight cupola **11.** Pushing the skylight cupola shut is not possible due to the beyond-dead-center position. In order to prevent the skylight cupola from being sucked up and lifted off and also in order to be able to maintain the various intermediate positions safely, the elbow joint can be compressed at the pivot pin **28** in a direction perpendicular to the plane of the drawing, in a manner not detailed. The ventilating device opens only a ventilating gap corresponding approximately to the flat position of the elbow lever. At some times, however, the skylight cupola must be swung back completely for particularly intensive ventilation or else for entering the flat roof. For this reason, the elbow lever connection at the pivot pin **28,** or else at the skylight cupola or at the casing must be disconnectable. In the implementation example, the free arm end **43** of the other elbow lever arm **44** is detachably coupled with the skylight cupola **11.** For this purpose, it is equipped with a through hole **45,** which engages with a bearing pin **46** which is fastened to the skylight cupola and extends transverse to the pivoting plane of the elbow joint. This bearing pin **46** is relatively short so that the elbow lever **44,** whose pivoting plane lies approximately in the plane of the drawing (FIG. **4**), can be pulled out perpendicular to the plane of the drawing beyond the free pin end, thereby freeing the skylight cupola. Pulling the arm **44** out is made possible by the existing clearance and by the elasticity of the components.

The one elbow lever arm **25***a* is designed in FIG. **5** in the form of a rope pulley or, more exactly, a double rope pulley. Attached in each groove is the end of a rope pull whose other end leads downward and can be pulled by means of rings **33, 34** in the direction of arrow **35** or even oblique thereto. As the two rope pulls are wound in opposing sense on their respective rope pulley, the ring not operated moves automatically up when the other ring is pulled. Here again, stop pins **39** and **40** serve as stops for the rotation of the rope pulleys. They cooperate with two cams **46, 47** which are attached to he rope pulley and are inclined at an angle relative to each other.

The stairs are linked to the casing by means of an elbow positioning linkage **38, 49** (FIG. **1**). Expressed more precisely, the upper section **50** of the stairs, designed in the form of foldable stairs, is connected to this elbow lever positioning linkage. The two hoisting devices **51** serve to balance the weight. An adjusting device **52** is provided for the precise adjustment of angle **52***a* between the longitudinal axis of the stairs and the lower edge of the casing **3.** By means of it, the angle **52***a* can be increased or decreased in order to thus assure firm seating of the lower stair end **53** on the floor. The adjusting device **52***a* consists of an adjusting screw **54** which penetrates the elbow lever arm **49** and whose protruding end **55** rests against a pressure plate fastened to an outer lining box **3.** Depending upon whether the adjusting screw **54** is being screwed in or out, the elbow lever arm **49** moves up or down.

The lowermost stair section **57** can be folded in the direction of arrow **58** against the center stair section **59.** The latter, in turn, is folded in the direction of arrow **60** against the upper stair section **50.** The stairs are then swung up in the direction of arrow **61,** taking along the covering, including the light diffuser panel **8.** The panel **8** is preferably plastic-coated on the inside and on the outside or otherwise joined to or coated with another scratch-resistant and washable material.

As shown in FIG. **6,** an exterior hinged cover **63** is pivoted in a frame or casing **62** which is built into a roof (not shown) and forms a skylight cupola. The frame **62** is closed towards the inside by an inner hinged cover **64** formed by a light diffuser. Disposed between the outer hinged cover **63** and the inner one is a self-supporting folding ladder **65,** pivoted at **66** in the frame **62.** The stairs **65** are connected to the outer hinged cover **63** by an opening linkage so that both parts will open and close simultaneously. In addition, fluorescent light bulbs **68** are provided between the outer cover **63** and the inner hinged cover **64** within the frame **62.**

As FIGS. **9** and **10** show, the two narrow sides **69** and **70** of the inner hinged cover **64** are respectively connected to the ladder **65** by means of two extension springs **71** and **72.** Fastening of the inner hinged cover **64** to the ladder **65** is accomplished so that the hinged cover **64,** as may be seen from FIG. **7,** rests against the frame **62** before the outer hinged cover **63,** or the ladder **65,** reach their end position. When the outer hinged cover **63** is pivoted upward or the ladder **65** is pivoted downward through the openings in the inner hinged cover **64,** the outer hinged cover **63** will open alright, but the inner hinged cover **64** will remain in its position for the time being, until the extension springs **71** and **72** become relaxed. This results in a ventilating position for the outer hinged cover **63** according to FIG. **7.** Air can then enter through the opening and penetrate into the living area through the air outlet openings **73** (FIG. **9**) of the inner hinged cover **64.** Since the cover **64** remains in its position during this procedure, no disturbing effect ensues through it. Moreover, due to the small opening angle of the outer hinged cover **63,** almost no moisture can enter even during a surprise rain.

The end **75** of the second stair section **76** (FIG. **6**) resting against the pivoting stair section **74** is equipped with pressure tabs **77** which keep the inner hinged cover **64,** in the unfolded position of the stairs **65,** a certain distance away from the pivoting stair section **74.** This provides for the best possible foot freedom when mounting the stairs **65.**

A spreading mechanism **84,** which is shown in FIG. **11,** serves for the fixing of the hinged covers **63, 64** and of the stairs **65** in the various positions. The spreading mechanism consists of an eccentric disc **79** which can be turned by means of a square crank **78** and to which are linked two closing rods **80, 80'.** These closing rods **80** and **80'** engage two hardware fittings **81** disposed at both sides of frame **62** of FIG. **6.** The two hardware fittings **81** have a detent **82** (FIG. **10**) for the closed position of the roof which as shown in FIG. **9,** prevents the closing rods **80** from moving, thereby also preventing the coverings of the roof hatch from moving in either

direction. The second stop **83** serves the ventilating position of the outer covering of the roof hatch as shown in FIG. **8.**

In FIGS. **12** to **14,** the casing **85** is again inserted into the escape opening **86** of a ceiling **87** of a building (not shown), and supported all around by blocks **88, 89.** The lower and the inner end **90** of the escape openings, of the casing **85,** can be closed by means of an inner covering in the shape of a flat cover. The outer end **92** of the casing **95** (FIG. **12**) is closable by means of an outer covering again designed in the form of a skylight cupola. In FIGS. **13** and **16,** the skylight cupola **93** is replaced by a flat roof window **94.**

The inner covering or cover **99** of the escape opening is pivoted in the wall **96** of the casing **85** by means of two hinges **15.** The inner cover **99** can be pivoted in the direction of the arrow **97** (FIG. **12**) by means of a not shown linkage designed in the manner of a transom opener. In its closed position, the cover with the casing is locked by means of the hardware fitting **98.** It consists of a frame **99** and a light diffuser **100.**

At the inside of the cover is again fastened an extendable and unfoldable staircase **101.** FIG. **12** shows this staircase in extended condition, whereas the retracted and folded up staircase may be seen in FIG. **14.** It consists of three stair sections **102, 103** and **104.** The length of these individual components and their connection are so chosen that the rungs or the steps **105** are at least almost flush when the ladder is retracted. In the folded conditions of the stairs of FIG. **14,** they define channels **106** for the passage of light. The light diffuser **100** consists of flat strips on edge disposed perpendicular to each other.

In FIG. **12,** the push-open linkage **107** of the inner cover is coupled as to motion with the link **108** of the outer cover **99.** The various levers of the push-open linkages **107, 108** are so attached to the inner and outer covers and to the casing **85,** respectively, and their lengths are so dimensioned that when the inner cover **100** is opened, the outer cover **99** opens simultaneously and when the outer cover is fully closed, the inner cover is fully closed too. The skylight cupola, too, consists of a frame **109** and a dome-shaped insert **110** of glass, plastic or glass substitute.

In the designs according to FIGS. **13** and **15** to **17,** the push-open linkages for the outer and inner covers are not coupled to each other as to their motion. The push-open linkage **107** is designed in the usual manner and equipped with a braking device known as such. The push-open linkage **108** is actuated separately, as mentioned before. The simplest design provides for manual operation. The lever **108,** shown schematically in FIG. **13,** may be used for ventilating purposes or as pusher for opening. FIG. **16** shows a push-open linkage approximately identical with that shown in FIG. **12.**

The outer face area **112** of the casing shown in FIG. **13** is inclined relative to the inner face area **113.** During installation, the inner face area **113** runs parallel to the ceiling **87** so that the outer face area **112** and, with it, the push-open window **94** assumes an oblique position relative to the flat roof. FIGS. **15** to **17** show a casing composed of two parts. The lower casing part **114** can be used selectively with the upper casing part **115** or **116.** As already explained, a push-open window **14** is pivoted at the upper casing part **115** and a skylight cupola **13** to the upper casing part **116.** Analogous to FIG. **13,** the upper casing part **115** of FIG. **16** may also be provided with face areas **112, 113** in oblique attitude to each other. Pins, shackles or the like may interconnect the casing parts **114, 115** and **116** to align them precisely.

In the implementation example of FIG. **18,** the pivoting staircase **118,** designed in the form of a folding ladder, is mounted on the stair casing **119,** inserted into a matching opening, not detailed, of a ceiling. These stairs are to provide access to the floor above the ceiling. As usual, the stair casing is of rectangular shape, and it is closed by means of a covering **121** when the stairs are folded up and retracted in the direction of arrow **121.** In the implementation example according to FIG. **18,** the pivoting stairs **118** consist of the upper stair section **122,** the center stair section **123** and the lower stair section **124.** Hinges **125** and **125** interconnect the various sections. They provide for the lower stair section **124** to be folded against the center section **123** in the direction of arrow **127,** while both sections together are then folded against the upper stair section **122** in the direction of the arrow **128.**

The upper stair section **122** is fastened to the stair casing **119** by means of the pivot bearings **129.** At the same time, it is also rigidly connected to the covering **121** so that when the folded stairs are pivoted back, the covering **121** is automatically brought into closed position also.

FIG. **20** shows one of these pivot bearings **129** in larger scale. In constrast to known designs, it is assembled on edge, which is in the position shown, and it consists of the flat rod **130** on the stair side, the flat rod **131** on the ceiling side, bent to form an angle. The bent leg is designated **132.** Of course, an angle profile may be used for this purpose directly. The cross-pin **133** links the two flat bars **130** and **131** together. The holes **134** permit the pines **133** to be fastened to the ladder, whereas the holes **135** serve the assembly of part **131.** As FIG. **18** shows, the flat rod **130** on the stair side is mounted laterally to the stair side plate **136,** which means that the side plate is weakened by no recesses. On the other hand, the situation is such that for mortising the flat rod on the stair side, only a very narrow slot is required in the stair side plate, in contrast to the bearings of the state of the art which are mounted flush.

As already mentioned, the stair sections **122** and **123** or **123** and **124** respectively are hinged together by hinges **125** and **126.** When the stairs rest on the floor, they represent a rigid structure, of course. But when they are pivoted in the direction of arrow **120** in an unloaded condition, the parts **123** and **124** of this embodiment will unfold. Such pivoting may occur, for instance, when the usually built-in weight balancing device is not adjusted exactly or shifted in the course of time. Now, in order to avoid such unintentional and also undesirable folding up of the stair sections, the buckling safety devices according to the invention have been provided. They consist of two screwed-on plates **137** and **138,** the lower one of which, **137,** has a notch **139,** engaged by a tooth **140** of the upper plate **138.** Accordingly, the lower stair section **124** can fold up against the upper stair section **123** only when the tooth **140** is not arrested (FIG. **21**). However, the weight of the lower stair section **124** is not sufficient to pivot the plate end **142** with the tooth **140** in the direction of the arrow **141,** thereby causing disengagement. On the other hand, however, the dimensions and the penetrat-

ing depth of the tooth **140** are so chosen that the buckling safety device can be disengaged by a forceful pull at the lower stair section **124,** by which action the plate end **142** springs elastically outward. By means of the screw connections **143, 144** the plates **138** and **137** are connected to the hinges **126** and the upper hinges **125,** respectively. Naturally, the notch **139** may also be machined directly into the appropriate part of the hinge, and it is imaginable, furthermore, to form the plate end **142** by bending a tongue out of the upper bearing half of the hinge. This saves separate assembly work.

The device according to the invention as depicted in FIG. **23** is also intended to prevent an unintentional pivoting back of the stairs in the direction of arrow **145.** Said device consists of an elbow lever or a pair of elbow levers **146,** which assume a flat attitude in the shown operating position of the stairs. Due to this flat attitude, it resists any pivoting back motion of the stairs in the direction of arrow **145.** Such a pivoting motion of the stairs is possible only when the elbow lever is taken out of its unstable position drawn in bold lines. The buckled elbow lever is shown in dash-dotted lines. Of course, this device is effective only when laterally staggered from the pivot bearing **129** of the stairs in the direction of the back pivoting motion **145.** The elbow lever part **147,** linked to the stair casing **119,** is designed in the form of a single arm lever, whereas the lever **148** linked to the stairs involves a dual-arm lever. The free lever arm **149** of the elbow lever part **148** serves as a releasing device. When pivoted clockwise, the joint **150** of the elbow lever migrates upward counterclockwise. The relase motion may either be triggered by hand or else, as shown in FIG. **23** in dash-dotted lines, automatically by the folded up stair section **12.3**

As already mentioned, this type of stairs is usually equipped with a lever linkage **151, 151** for weight balancing of the type shown in FIG. **19.** Weight balancing is achieved by means of a not detailed spring mechanism. The end **153** of link **151** is mounted so as to pivot about an eccentric pin **154.** The pin **154** consists of a cylindrical pin eccentrically attached to the disc **155** which can turn in the stair side plate. The disc **155** is rigidly connected to a threaded bolt **156** which is stuck from the outside into an appropriate hole in the stair side plate **136.** A washer **157** rests against the inside of the stair side plate and it is charged axially by the wing nut **158.**

The disc **155** is equipped with teeth extending in radial direction which dig into the wood of the outer surface of the stair side plate **136** when the wing nut **158** is tightened, thereby securing the disc **155** against rotation. The link **151** is placed on the pin **154.** If it is intended for the eccentric pin to assume a different position, through which the lever linkages **151, 152** and the spring mechanism **159** are shifted, too. Of course, it is first necessary to disengage the disc **155** from the external surface of the stair side plate **136** and then turn it about its axis **156** and then to effect the subsequent refastening. Naturally, the gripping elements **160** may cooperate with a separate counterdisc instead of the stair side plate **136.** Said counterdisc may be of metal, if applicable.

All the characteristics described and illustrated are essential to the invention singly and in any combination.

While specific embodiments of the invention have been shown and described in detaiil to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A covering for roof openings in ceilings, roofs and similar structures, comprisng a top cover panel closing the upper end of the opening and being pivoted at its one side and being movable about its pivotal connection to close and open the roof openings, a foldable stairs having an upper end pivotally connected within the opening and being pivotable upwardly into the opening recess for storage and pivotal downwardly from its opposite end to lower this end to the ground to define a stair passage upwardly from the ground to the top of the ceiling or a roof and a panel connected to said stairs and movable therewith upwardly to close the recess and downwardly to open it, said panel and said stairs defining a light passage opening, a frame adapted to be fitted into the opening with its outer periphery sealed with the structure surrounding the opening, said top cover panel being pivoted to said frame, said foldable stairs having an upper end pivotally connected to the interior of said frame, said panel being secured directly to and supported only by said stairs and covering the bottom of said stairs and the opening when said stairs are in a retracted folded position, said stairs being made of a metal material particularly aluminum, and including side walls of U-shaped construction, having a supporting bolt extending through the bottom and a bottom panel secured to said bolt.

2. A covering for roof openings in ceilings, roofs and similar structures, comprising a top cover panel closing the upper end of the opening and being pivoted at its one side and being movable about its pivotal connection to close and open the roof opening, a foldable stairs having an upper end pivotally connected within the opening and being pivotal upwardly into the opening recess for storage and pivotal downwardly from its opposite end to lower this end to the ground to define a stair passage upwardly from the ground to the top of the ceiling or roof and a panel connected to said stairs and movable therewith upwardly to close the recess and downwardly to open it, said panel and said stairs defining a light passage opening, a frame adapted to be fitted into the opening with its outer periphery sealed with the structure surrounding the opening, said top cover panel being pivoted to said frame, said foldable stairs having an upper end pivotally connected to the interior of said frame, said panel being secured directly to an supported only by said stairs and covering the bottom of said stairs and the opening when said stairs are in a retracted folded position, said top covering comprising a window which may be pivoted upwardly and downwardly and which is pivotally connected to one side of said frame so that it may be swung upwardly about an axis perpendicular to said stair pivot axis to provide access through said frame.

3. A covering for roof openings in ceilings, roofs and similar structures, comprising a top cover panel closing the upper end of the opening and being pivoted at its one side and being movable about its pivotal connection to close and open the roof opening, a foldable stairs having an upper end pivotally connected within the opening and being pivotal upwardly into the opening recess for storage and pivotal downwardly from its

opposite end to lower this end to the ground to define a stair passage upwardly from the ground to the top of the ceiling or roof and a panel connected to said stairs and movable therewith upwardly to close the recess and downwardly to open it, said panel and said stairs defining a light passage opening, a frame adapted to be fitted into the opening with its outer periphery sealed with the structure surrounding the opening, said top cover panel being pivoted to said frame, said foldable stairs having an upper end pivotally connected to the interior of said frame, said panel being secured directly to and supported only by said stairs and covering the bottom of said stairs and the opening when said stairs are in a retracted folded position, wherein said top covering comprises a skylight cupola, said cupola being pivoted to one side of said frame, and lever means connected to said cupola to raise and lower said cupola, said lever means comprising a rotatable pivot adapted to be operated from ground level, a first lever arm carried on said pivot and being rotatable therewith, a second lever arm connected to the outer end of said first lever arm and connected to said cupola, said first lever arm being movable beyond the center of rotation of said pin and said second lever arm extending upwardly from said first lever arm in engagement with said cupola when in a locked closed position, said first lever arm being rotatable to an uppermost position beyond dead center extending upwardly and said second lever arm extending upwardly from said first lever arm to said cupola in a fully opened and locked position.

4. A covering, according to claim **3,** wherein said lever mechanism includes a rotatable pulleymember adapted to be engaged by a rope from below and a lever member articulated to the periphery of said pulley member and extending upwardly and being connected to said cupola.

5. A covering, according to claim **4,** including a stop arranged above and below said pivot at a location to engage said first lever arm when in a raised fully opened position and when in a closed locked position.

6. A covering, according to claim **3,** wherein said bolt may be fixed in any particular rotatable position, means for fixing said bolt in a rotatable position comprising a hand wheel forming the axis of said bolt.

7. A covering for roof openings in ceilings, roofs and similar structures, comprising a top cover panel closing the upper end of the openings and being pivoted at its one side and being movable about its pivotal connection to close and open the roof opening, a foldable stairs having an upper end pivotally connected within the opening and being pivotal upwardly into the opening recess for storage and pivotal downwardly from its opposite end to lower this end to the ground to define a stair passage upwardly from the ground to the top of the ceiling or roof and a panel connected to said stairs and movable therewith upwardly to close the recess and downwardly to open it, said panel and said stairs defining a light passage opening, a frame adapted to be fitted into the opening with its outer periphery sealed with the structure surrounding the opening, said top cover panel being pivoted to said frame, said foldable stairs having an upper end pivotally connected to the interior of said frame, said panel being secured directly to and supported only by said stairs and covering the bottom of said stairs and the opening when said stairs are in a retracted folded position, a lever linkage pivotally connected to said frame and to said stair and including setting member (**54**) arranged in said frame and bearing against said lever linkage, and positioning one lever of said linkage at a predetermined angular orientation for fixing the angular inclination of said stair when in an opened position.

8. A covering, according to claim **7,** wherein said lever linkage includes a first lever arm pivoted at its inner end to said frame and having an outer end connected to a second lever arm, said second lever arm extending downwardly to said stairs, said means for fixing the angle of inclination of said lever linkage including a member bearing against said first lever arm.

9. A covering for roof openings in ceilings, roofs and similar structures, comprising a top cover panel closing the upper end of the opening and being pivoted at its one side and being movable about its pivotal connection to close and open the roof opening, a foldable stairs having an upper end pivotally connected within the opening and being pivotal upwardly into the opening recess for storage and pivotal downwardly from its opposite end to lower this end to the ground to define a stair passage upwardly from the ground to the top of the ceiling or roof and a panel connected to said stairs and movable therewith upwardly to close the recess and downwardly to open it, said panel and said stairs defining a light passage opening, a frame adapted to be fitted into the opening with its outer periphery sealed with the structure surrounding the opening, said top cover panel being pivoted to said frame, said foldable stairs having an upper end pivotally connected to the interior of said frame, said panel being secured directly to and supported only by said stairs and covering the bottom of said stairs and the opening when said stairs are in a retracted folded position, said top cover panel being transparent and wherein said foldable stairs include individual sections with steps, the steps of adjacent sections being aligned vertically so as to define a maximum light passage space therebetween, the axis of pivot of said foldable stairs being substantially transverse to the axis of pivot of said top cover panel.

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