Jan. 7, 1969 K. ESSER 3,420,000

OPENING DEVICE FOR LIGHT DOMES, SKYLIGHTS, ETC.

Filed July 29, 1966 Sheet 1 of 2

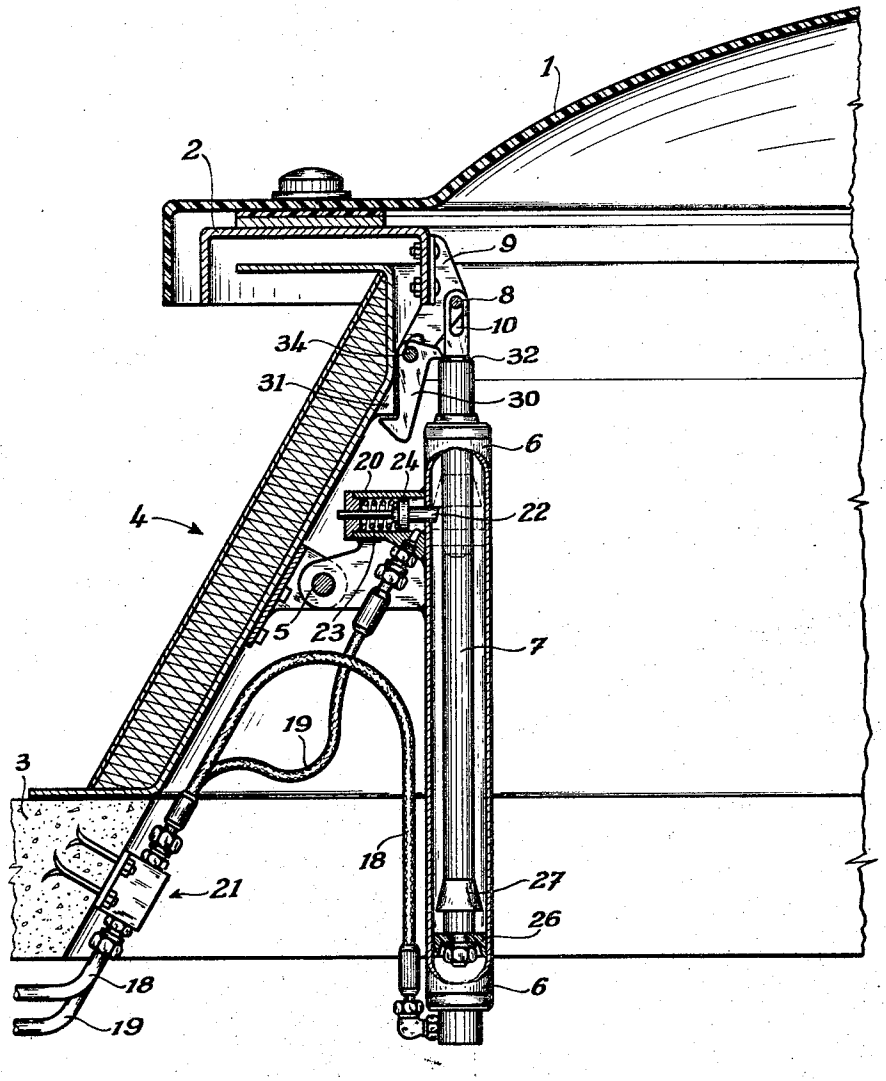


FIG. 1

OPENING DEVICE FOR LIGHT DOMES, SKYLIGHTS, ETC.

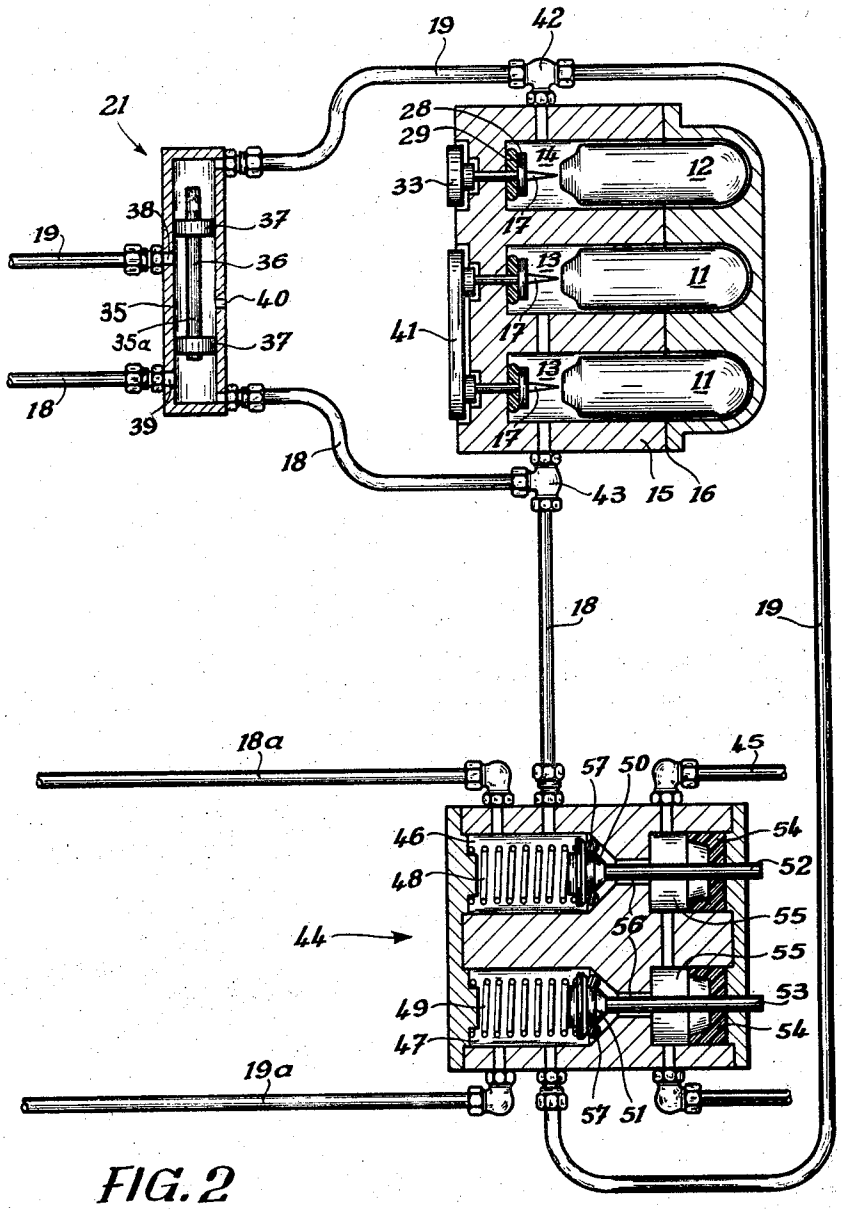


FIG. 2

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OPENING DEVICE FOR LIGHT DOMES, SKYLIGHTS, ETC.

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ABSTRACT OF THE DISCLOSURE

A device for pivoting skylight means and the like into opening and closing positions by means of a first fluid operable piston pivotally connected to said skylight means and provided with a collar having an outer conical surface tapering in the direction of the opening movement of said piston and slidably engageable by the correspondingly inclined end face of a second piston which is spring urged into sliding engagement with said conical surface and automatically slips below said collar into locking position for locking said first piston when the latter occupies its skylight means opening position, said second piston being adapted by fluid means to be withdrawn from said locking position to commit said skylight means to move by its non-weight to its closing position while returning said first piston to its skylight means closing position.

The present invention relates to opening devices for light domes, skylights, or the like. Various designs of devices of this type are known. Of these devices, those have proved particularly satisfactory which comprise two or more spindles threaded into each other and operable manually or mechanically, and which are adapted to open and close unilaterally hinged light domes, skylights, or the like. Also, when a motor is provided for actuating opening devices of the heretofore known above-mentioned type, the opening action is effected at a relatively slow speed.

The heretofore known opening devices of the type involved are, therefore, unsuitable when, for instance, in a case of emergency such as a fire or a sudden smoke development, it is necessary to open the light domes or skylights very quickly.

In order to effect a fast opening of a light dome or skylight, it has already been suggested to provide a counter weight of a spring for acting upon the light dome or skylight, and to provide a cable line by means of which in the case of an emergency, the pin or pivot is pulled out by means of which the opening device is linked to the light dome or skylight so that the same will jump open when desired. However, inasmuch as the cable line has to be moved or pulled around a number of corners, there exists the danger that the cable gets stuck or jams, whereby the emergency opening operation fails. Moreover, there exists the drawback that following the emergency opening operation the light dome or skylight has to be closed again manually.

It is, therefore, an object of the present invention to provide an opening device for light dome, skylights and the like, which will overcome the above-mentioned drawbacks.

It is another object of this invention to provide an opening device for light domes, skylights, and the like, which will permit a fast opening of the light dome or skylight in a case of emergency, and will also permit closing the light dome or skylight by means of essentially the same mechanism.

These and other objects and advantages of the invention

will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIGURE 1 illustrates partially in section an opening device according to the invention for a light dome or skylight.

FIGURE 2 illustrates on a smaller scale than that of FIG. 1, partially in section, a mechanism according to the present invention which includes a fast venting valve, pressure gas cartridges and a valve arrangement in the pressure gas conduit system.

The opening device according to the present invention is characterized primarily in that in a cylinder there is displaceably mounted a pneumatically operable piston which is linked to the light dome or skylight and which when occupying its moved-out end position is arrested by a spring-urged pin displaceable in a further cylinder in a direction transverse to the moving-out direction of said piston.

The said arresting pin reaches behind a collar on said piston for holding said dome light or skylight open. When it is desired to close said dome light or skylight, the said arresting pin is against the thrust of said spring pneumatically moved out of its arresting position while said piston is moved inwardly. For actuating said piston and withdrawing the arresting pin, there are respectively provided at least two pressure gas cartridges. Both cartridges may be arranged independently of each other in one chamber each which are respectively associated with cylinders and conduit means respectively pertaining to said piston and said arresting pin. Each of said pressure cartridges may have associated therewith a penetration pin arranged in a housing.

In this way a device has been created by means of which a light dome or skylight can be quickly opened in case of emergency, and then from the same point again be closed whenever desired.

As pressure gas cartridges, there may be employed the well-known CO_2 cartridges for home syphons, or also the driving gas cartridges known in connection with cooling installations which contain, for instance, monofluortrichloromethane. When from the outside pressing upon a penetration pin which pierces the cartridge, the pressure gas passes from the cartridge into the chamber surrounding the same, and from this chamber the cartridge gas flows through pressure conduits into the cylinder and acts upon the piston. In this way a quick opening of the light dome or skylight is effected.

When the said lifting piston has reached its outermost end position, it is latched in this position by means of an arresting pin which is reciprocable in a second cylinder and latches behind the collar of the lifting piston.

For purposes of closing the light dome, the penetration pin of the second cartridge is actuated for piercing the latter. The pressure gas of said second cartridge then flows into the chamber associated therewith and passes through a pressure conduit into a cylinder where it acts upon the arresting pin. The pin will then against the thrust of the spring acting upon said arresting pin be moved out of its latching position so that the lifting piston is freed and due to the weight of the light dome or skylight moves back into its starting position.

If desired, also any desired number of pressure gas cartridges can be arranged in parallel so as to furnish the possibility of opening and closing the light dome or skylight from different areas of the building.

When the building possesses a compressed air network it is, of course, also possible to employ said network for actuating the opening devices according to the invention. In this instance the actuation is effected by at least one rebound-safe adjusting valve by means of which the pressure compressed air network may selectively be connected

with one of the lifting cylinders and with one of the arresting cylinders.

The light dome or skylight can in this instance at will be opened and closed regardless of the pressure gas cartridges provided for the emergency.

In order to effect a particularly fast closing of the light dome or skylight, a fast venting valve may be interposed in the pressure conduits leading to the two cylinders. This venting valve will be able, when conveying gas under pressure into the arresting cylinder, to close the light dome or skylight while said valve establishes a connection of the gas under pressure below said lifting piston with the atmosphere.

Referring now to the drawings in detail, FIGURE 1 shows that portion of a light dome or skylight **1** which is located opposite to its hinge connection in its closing position in which it surrounds the mount **4** on roof **3** by means of its supporting frame **2**.

As will be seen from the drawing, a cylinder **6** is by means of a pivot **5** pivotally connected to the mount **4** of the light dome **1**. Reciprocably mounted in cylinder **6** is a lifting piston **7** which protrudes from cylinder **6** and, through the intervention of a pivot **8** and fitting **9**, is linked to the supporting frame **2** of the light dome **1**. For a further purpose which will be described below, the link connection between piston **7** and pivot **8** is established through the intervention of the oblong opening **10**.

For purposes of actuating the lifting piston **7**, a pressure gas is introduced into the cylinder **6** at the bottom thereof. As pressure source, in the embodiment of FIGURE 2 there are employed the pressure cartridges **11** or the pressure gas conduit **45**. In the first instances, cartridges are involved as they are employed in the well-known home syphons. The pressure gas cartridge **12** or the pressure gas conduit taking its place is provided in order to bring about the closing of the light dome **1**.

The cartridges **11** and **12** are received independently of each other in chambers **13** and **14** respectively, of the housing **15**. For purposes of insertion of said cartridges, the housing **15** is partitioned at **16**. Each chamber **13, 14** communicates through a conduit **18** and **19** respectively with the lifting piston **7** and the arresting cylinder **20** (see FIG. 1). Conduits **18, 19** extend through the fast venting valve **21** which is connected to the edge of the bore in the roof opening.

The arresting cylinder **20** is arranged at the upper end of lifting cylinder **6** in a direction transverse to the longitudinal direction of said lifting cylinder. Guided in the arresting cylinder **20** is an arresting pin **22** which likewise forms a piston and is adapted by means of its inclined front end to extend into the cylinder **6**.

From the rear, the arresting pin is biased by a spring **23** continuously urging said arresting pin to move into its arresting position. Conduit **19** leads into that section of the cylinder chamber which is located in front of the collar **24** of the arresting pin **22**.

Additional structural details will become evident in connection with the now following description of the operation.

For purposes of opening the light dome, plate **41** with the penetration pins **17** is depressed so that the latter pierce the cartridges. As a result thereof, the pressure gas flows into the chambers **13** and through conduit **18** passes into the cylinder **6** to thereby cause the lifting piston **7** to move outwardly for opening the skylight **1**.

The piston sleeve **26** of lifting piston **7** forms a tight closure with regard to the cylinder wall. Above the piston sleeve **26**, the lifting piston **7** has a conical collar **27**. Shortly, prior to reaching its outermost end position, the conical collar **27** slides along the inclined surface at the free end of the arresting pin **22** and presses said pin radially outwardly against the thrust of spring **23**. Immediately thereafter, the arresting pin **22** latches behind the shoulder formed by the conical collar **27** on lifting piston **7** and thus holds the piston in its outermost end position. This is indicated in FIG. 1 by dash lines.

For purposes of closing the light dome **1**, the third penetration pin **17** is pressed into the cartridge **12** by means of the actuating knob **33**. Gas under pressure then passes into chamber **14** and through conduit **19** flows into that space of the arresting cylinder **20** which is located in front of the collar **24** of the arresting pin **22**. As a result thereof, the arresting pin **22** is against the thrust of spring **23** pressed out of its arresting position whereby the lifting piston **7** becomes free. The light dome or skylight **1** will then close by its own weight, the air from conduit **18** escaping through a venting bore or exhaust **40** (FIG. 2) referred to in detail later.

The reliable function of the device according to the invention requires additional steps which will now be set forth.

When for purposes of opening the light dome or skylight **1**, the penetration pins **17** by means of plate **41** are pressed into the cartridges **11**, immediately a high pressure builds up in chambers **13**, which high pressure also acts upon the end face of collar **28** on penetration pin **17** and through the latter acts upon the sealing ring **29**. The sealing ring may, for instance, be a so-called O-ring.

When lifting piston **7** moves upwardly (with regard to FIG. 1), the air present above the piston sleeve **26** escapes through the upper piston guiding means towards the atmosphere.

For purposes of locking the light dome in its closing position, there is provided a pawl **30** which is of substantially Z-shape and which is linked to the fitting **9** at **34**. This pawl by means of its lower legs extends below the nose **31** on the mounting **4** and is held in its locking position by a spring (not shown). The upper leg of pawl **30** when the latter is in its locking position rests upon the shoulder **32** at the upper end of lifting piston **7**. The light dome or skylight can then not be opened from the outside and the latch is freed only when the lifting piston moves upwardly.

The link connection of the lifting piston **7** with supporting frame **2** of the light dome or skylight is, as mentioned above, established through the intervention of pivot **8** connected to the fitting **9** and by the oblong opening **10**. When the lifting piston **7** moves upwardly, its shoulder **32** first moves the pawl **30** out of its locking position. Only then when the adjustment has been effected within the oblong opening **10**, the light dome **1** is lifted. After the light dome has been closed, and after the lifting piston **7** has reached its lowest position, pawl **30** is by means of the spring thrust acting thereupon returned to its locking position.

When a building, for instance, a factory is equipped with a compressed air network **45** the opening mechanism according to the invention may additionally be connected to the compressed air network **45**, and the light dome **1** can without actuation of the cartridges **11** or **12** be opened or closed at random. The compressed air network **45** thus serves for the normal opening and closing of the light dome **1**, whereas the pressure gas cartridges **11** and **12** will serve in emergencies when the compressed air network **45** fails, i.e. is without pressure.

For the pressure conduits employed in this instance, thin pipes of polyamide-S or copper have proved particularly satisfactory. For the described purpose, conduits **18** and **19** with an effective diameter of two millimeters have proved highly advantageous.

The fast venting valve **21** shown in FIGURE 1 is illustrated in section in FIGURE 2. Said valve **21** comprises a cylinder **35** with valve spool **35***a* freely reciprocable therein. This valve spool comprises the piston sections **37, 37***a*, and also comprises a piston rod **36** interconnecting said two valve spools. Pressure gas conduits **18** and **19** lead into the cylinder **35** and lead out of the cylinder **35** through openings **38** and **39** in such a way that when the valve spool **35***a* occupies a correspond-

ing position, either the passage for the pressure conduit **18**, or the passage for the pressure conduit **19** is free.

According to FIGURE 2, valve spool **35***a* occupies one of its end positions in which the gas under pressure passes through conduit **18** and cylinder **35** below the lifting piston **7** in cylinder **6**. In the moved out position, the arresting pin **22** catches below the conical collar **27** on lifting piston **7**, so that the lifting piston **7** is arrested in the moved-out position.

When gas under pressure passes through conduit **19**, it displaces valve spool **35***a* downwardly, so that the pressure gas through opening **38** leaves cylinder **35** and can act upon collar **24** on the arresting pin **22** so that the arresting pin **22** will be moved radially outwardly against the thrust of spring **23**. In this way, lifting piston **7** is unlatched and due to the weight of the light dome **1**, may move into the cylinder **6** in downwardly direction. As a result thereof, the pressure gas below the sleeve **26** in cylinder **6** will pass through conduit **18** into the cylinder **35** and will leave the latter through its venting bore **40** which is located between the two piston discs **37**. In this way, the piston **7** can be quickly lowered, whereby the light dome **1** can relatively quickly close.

The supply of pressure gas conduits **18** or **19** with pressure gas is effected selectively by means of the pressure gas cartridges **11** and **12** in the chambers **13** and **14**, while the pressure chambers **13** for the opening operation communicate with each other. The gas cartridges **11** will be pierced together by the penetration pins **17** which are interconnected by the actuating plate **41**. The connection of the pressure chamber **14** with the pressure gas conduit **19** is established by the connecting piece **42**, whereas the connection with the pressure gas conduit **18** is effected through the connecting member **43**.

The two pressure gas conduits **18** and **19** additionally communicate with the pressure gas conduit **45**, i.e. the compressed air network, by a valve arrangement generally designated **44**. The said compressed air network extends through the valve arrangement **44**. The conduits **18** and **19** lead into the valve chambers **46** and **47** of the valve arrangement **44**, into which also the conduits **18***a* and **19***a* lead. These conduits **18***a* and **19***a* establish a communication with further opening devices of other light domes (not shown), so that the simultaneous activation of a plurality of opening devices can be effected by a common opening unit.

Springs **48** and **49** are provided in valve chambers **46** and **47**. Resting on said springs are valve heads **50** and **51** of the valve pushrods **52** and **53** which pushrods can be depressed manually and the ends of which are provided with or designed as actuating knobs. All the way around the valve lifters **52** and **53** there extend cylinder chambers **55** which are sealed toward the outside by sealing means **54**. The cylinder chambers **55** communicate with the valve chambers **46** and **47** through bores **56**. The diameter of bores **56** is greater than the diameter of the valve lifters **52** and **53**. By means of the thrust of springs **48** and **49**, the valve heads **50** and **51** are pressed against the annular seals **57** so that normally the valve chambers **46** and **47** are sealed relative to the cylinder chambers **55**. When, for instance, the valve lifter or pushrod **52** is depressed, valve head **50** is lifted off the sealing **57**, and the pressure gas of conduit **45** can pass through cylinder chamber **55** and bore **56** into the valve chamber **46** from where it will distribute itself into the conduits **18** and **18***a*. Consequently, the pressure gas passes through cylinder **35** of the fast lifting valve **21** and passes below the piston **7** which is lifted together with the light dome **1**. In its uppermost position, the light dome **1** is arrested by means of the arresting pin **22**. If, for purposes of closing, the pushrod **53** is depressed, the pressure gas passes from the cylinder chamber **55**, associated with the lifting member **53** through bore **56** into the valve chamber **47** and from the latter passes into the conduits **19** and **19***a*, and finally flows through cylinder **35** after the displacement of valve spool **36**, **37** to the collar **24** of the arresting pin **22**. As a result thereof, pin **22** is displaced radially outwardly whereby the piston **7** is freed. Piston **7** will then together with the light dome **1** move downwardly while the pressure gas below the sleeve **26** in cylinder **6** will escape from the venting bore **40** through cylinder **35**.

If the pressure gas conduit **45** should fail, or if for other reasons, a fast opening of the light dome **1** is to be effected, this can be realized by means of gas cartridge **11** which are opened by means of the penetration pins **17**. To this end, the actuating plate **41** associated with the two cartridges **11** is depressed. The out-flowing gas passes on one hand into the pressure conduit **18**, and on the other hand passes through valve chamber **46** of the valve arrangement **44** into the conduit **18***a* leading to additional opening devices. The pressure gas of cartridges **11** then brings about an opening operation in the manner described above.

When the light dome is to be closed, the penetration pin **17** associated with the gas cartridge **12** is actuated by the actuating head **33** so that pressure gas enters the conduit **19**, **19***a* respectively. As a result thereof, by means of the pressure gas of the cartridge **12**, arresting pin **22** is moved radially outwardly, and the piston is freed for the downward movement while the pressure gas below sleeve **26** of piston **7** escapes from bore **40** of cylinder **35**.

It is, of course, to be understood that the present invention is, by no means, limited to the particular arrangements set forth above, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In combination with supporting frame means adapted to be connected to a roof: skylight means having a first portion pivotally connected to said frame means, pressure fluid operable first piston means supported by said frame means and operatively connected to another portion of said skylight means for selectively moving the same into a skylight means opening position and into a skylight means closing position, said first piston means being provided with a collar having an outer conical surface tapering in the direction of the opening movement of said first piston means for opening said skylight means, second pressure fluid operable piston means arranged adjacent said first piston means and comprising rod means having one end face facing said first piston means and inclined in the same direction as said conical surface for sliding engagement therewith during a portion of said opening movement of said first piston means, spring means associated with said second piston means and continuously urging said rod means into engagement with said collar, said rod means being operable automatically in response to said first piston means reaching its skylight means opening position to engage said collar from below to thereby lock said first piston means, housing means, first conduit means leading from said housing means to said first piston means and operable to convey pressure fluid to the latter for causing the same to move to skylight opening position, second conduit means leading from said housing means to said second piston means and operable to convey pressure fluid thereto for moving said latching means out of said latching position against the thrust of said spring means, control means interposed between said first and second conduit means for selectively venting either one of them, first pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid into said first conduit means, and second pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid to said second conduit means.

2. An arrangement according to claim **1**, in which said first and second conduit means form part of a compressed air network, and check valve means interposed in said network and normally preventing the delivery of com-

pressed air from said network to said first and second cylinder piston means, said check valve means selectively being operable manually for respectively supplying said first and second cylinder piston means with compressed air from said network.

3. An arrangement according to claim 2, which includes two valves interposed in said first and second conduit means and comprising spring means continuously urging said valves into closing position, and means operatively connected to said valves and operable manually against the thrust of said springs for selectively opening said valves independently of each other.

4. An arrangement according to claim 1, in which said skylight means is provided with a pivot, and in which said first fluid operable cylinder piston means includes a piston rod having its outer end provided with an oblong hole pivotally engaging said pivot.

5. An arrangement according to claim 1, in which said control means includes a valve operable in response to the supply of pressure fluid to said second conduit means to vent said first cylinder piston means through said first conduit means to the atmosphere.

6. An arrangement according to claim 5, in which said valve comprises a cylinder having its opposite end portions respectively in communication with said first and second conduit means and having an intermediate portion in communication with the atmosphere, and a valve spool reciprocable in said cylinder for governing said communications.

7. In combination with supporting frame means adapted to be connected to a roof: skylight means having a first portion pivotally connected to said frame means, presure fluid operable first piston means supported by said frame means and operatively connected to another portion of said skylight means for selectively moving the same into a skylight means opening position and a skylight means closing position, second pressure fluid operable piston means arranged adjacent said first piston means and including latching means movable into a latching position to hold said first piston means in a position in which the latter holds said skylight means in open position, spring means associated with said second piston means and continuously urging said latching means into its latching position, housing means, first conduit means leading from said housing means to said first piston means and operable to convey pressure fluid to the latter for causing the same to move to skylight opening position, second conduit means leading from said housing means to said second piston means and operable to convey pressure fluid thereto for moving said latching means out of said latching position against the thrust of said spring means, control means interposed between said first and second conduit means for selectively venting either one of them, first pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid into said first conduit means, second pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid to said second conduit means, said first and second pressure liquid storage means respectively comprising compressed gas containing cartridges, and piercing pins respectively operable to selectively pierce said cartridges.

8. In combination with supporting frame means adapted to be connected to a roof: skylight means having a first portion pivotally connected to said frame means, pressure fluid operable first piston means supported by said frame means and operatively connected to another portion of said skylight means for selectively moving the same into a skylight means opening position and a skylight means closing position, pawl means linked to said skylight means and operable automatically in response to said first piston means reaching its skylight closing position to interlock with said frame means to thereby lock said skylight means in its closed position, said pawl means automatically being unlatched by said first piston means when the latter moves to its skylight means opening position, second pressure fluid operable piston means arranged adjacent said first piston means and including latching means movable into a latching position to hold said first piston means in a position in which the latter holds said skylight means in open position, spring means associated with said second piston means and continuously urging said latching means into its latching position, housing means, first conduit means leading from said housing means to said first piston means and operable to convey pressure fluid to the latter for causing the same to move to skylight opening position, second conduit means leading from said housing means to said second piston means and operable to convey pressure fluid thereto for moving said latching means out of said latching position against the thrust of said spring means, control means interposed betwen said first and second conduit means for selectively venting either one of them, first pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid into said first conduit means, and second pressure fluid storage means arranged in said housing means and operable selectively to release pressure fluid to said second conduit means.

9. An arrangement according to claim 8, in which said pawl means consist of a Z-shaped lever having one leg in operative engagement with a movable member of said first cylinder piston means while the other leg is in locking engagement with said frame means.

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U.S. Cl. X.R.

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