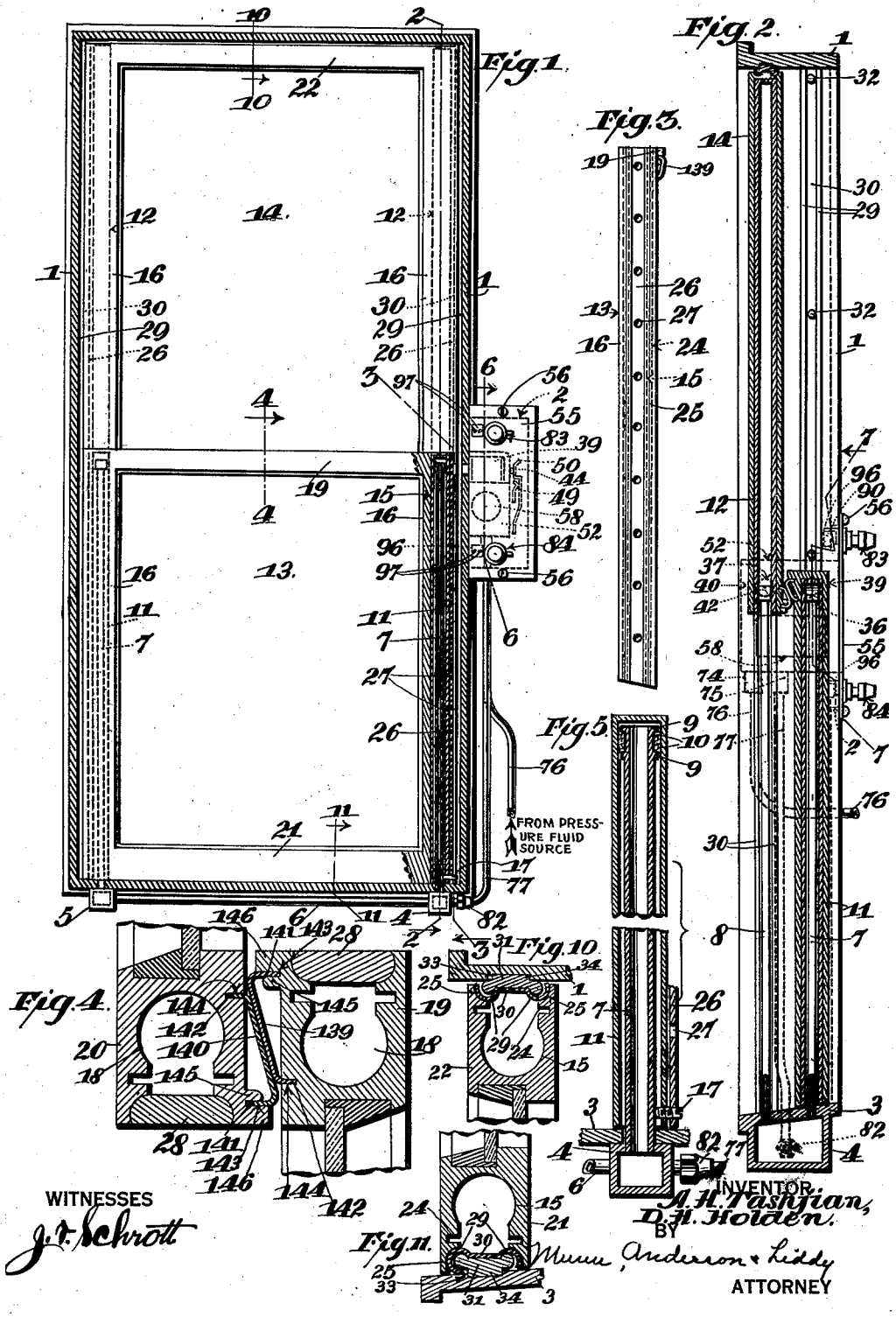
Jan. 5, 1937. A. H. TASHJIAN ET AL 2,067,106

ELECTROPNEUMATICALLY OPERATED WINDOW

Filed Sept. 24, 1934 2 Sheets-Sheet 1



WITNESSES

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Filed Sept. 24, 1934 2 Sheets-Sheet 2

Fig. 6.

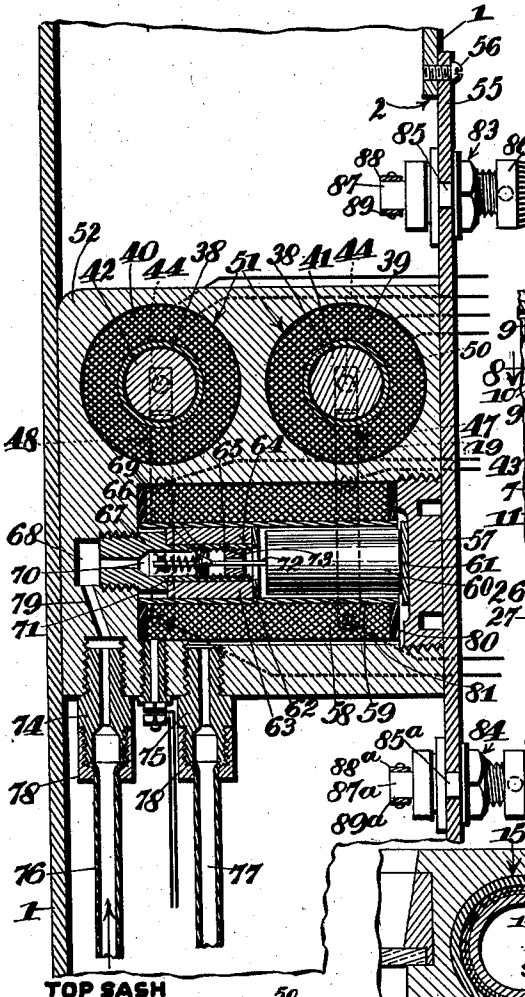


Fig. 7.

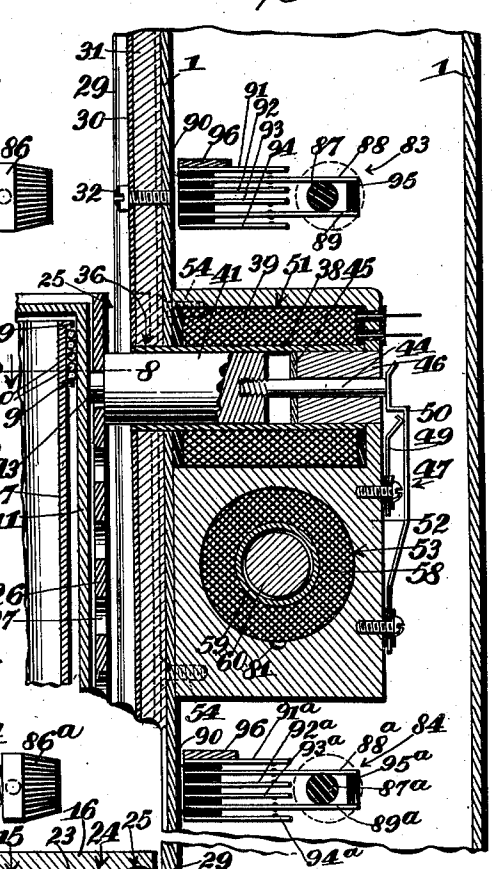


Fig. 8.

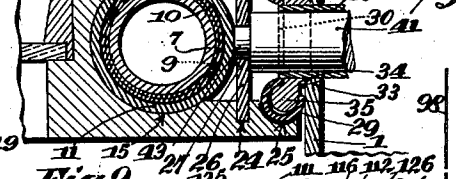


Fig. 9.

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Patented Jan. 5, 1937

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UNITED STATES PATENT OFFICE

2,067,106

ELECTROPNEUMATICALLY OPERATED WINDOW

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Application September 24, 1934, Serial No. 745,338

9 Claims. (Cl. 268—125)

This invention relates to improvements in pneumatically operated double hung windows, and its objects are as follows:—

First, to provide an electro-pneumatically operated double hung window of simple and inexpensive construction, operable by the turn of a local or remote switch, irrespective of size or weight of sash or location of window.

Second, to provide an electro-pneumatic double hung window with concealed lock, inaccessible to outside prowlers.

Third, to provide an electro-pneumatic double hung window either sash of which can be locked automatically at any desired position.

Fourth, to provide a simple, compact and inexpensive mechanism for raising or lowering either sash of a window or any group of windows, mechanically using compressed air or other pressure fluid for power and electrical means for automatically controlling the same.

Fifth, to lower either sash by gravity yet with retarded acceleration on a cushion of air of accurate amount, said amount being controlled automatically by the weight of the sash to be lowered.

Sixth, to prevent the withdrawal of sash lock plungers until air in sufficient amount has been introduced into sash cylinders to balance the weight or gravity of the sash before lock plungers are automatically withdrawn.

Seventh, to operate either sash of a window or group of windows either by local control, as by switches emplaced on the window frames or by a remote control situated elsewhere in the room or at some more distant point.

In the drawings:—

Figure 1 is a partially sectional and front elevational view of a window constructed in accordance with the invention.

Figure 2 is a vertical section taken on the line 2—2 of Figure 1, particularly illustrating the sash cylinders and the stationary pistons.

Figure 3 is an end view of the lower sash as seen on the line 3—3 of Figure 1, particularly illustrating the lock strip fixedly carried thereby.

Figure 4 is a cross section taken on the line 4—4 of Figure 1, particularly illustrating the meeting rails of sashes and their weather stripping.

Figure 5 is a sectional view of the sash cylinders and piston at the right of Figure 1, illustrating the details on a slightly larger scale.

Figure 6 is a vertical section taken on the line 6—6 of Figure 1, particularly illustrating details of what might be called the control mechanism.

Figure 7 is a vertical section taken on the line 7—7 of Figure 2 illustrating other details of the control mechanism from another position.

Figure 8 is a cross section taken on the line 8—8 of Figure 7, particularly illustrating the combined sash slide and weather strip, and showing how the lock plunger of the lower sash interengages with the respective lock strip.

Figure 9 is a diagram of the electrical wiring involved in the apparatus.

Figure 10 is a detail cross section taken on the line 10—10 of Figure 1.

Figure 11 is a detail cross section taken on the line 11—11 of Figure 1.

The underlying purpose of the invention is to provide a simple inexpensive double hung window of simplified features, such as elimination of weights, cords, pulleys, box-frames and exposed locks, operable irrespective of size or weight of sash or location of the window by the mere turn of a pair of switches located at the window for local control or a corresponding pair of switches located at a distant point for remote control.

In addition to reducing the effort required in raising and lowering the sashes the sashes are automatically locked at any rest position by concealed locks inaccessible from outside.

Attention is directed to the drawings. 1 (Fig. 1) is a window frame of simple solid cross section welded at corners to form an inexpensive rectangular frame. On the inner face of frame 1, grooves 33 are provided to receive sash slides and weather strips.

This window frame and its weather strips, as well as the meeting rail weather strips (later described), are the subject of a copending divisional application filed by A. H. Tashjian and Dean H. Holden, February 7, 1935, Serial No. 5,473.

The sashes are preferably constructed of extruded metal of a cross section well represented in Figures 4, 8, 10 and 11, Figure 4 illustrating the meeting rails, 19, 20 of the two sashes, Figures 10 and 11 the respective top and bottom rails of the top and lower sashes, and Figure 8 side rails of sashes. In practice the various rails are mitred or coped and welded at the corners. Bores 15 in the side rails 16 receive in tight fit cylinders 11, 12, while bores 18 of the meeting rails 19, 20 are closed by the tightly fitting closure metal members 28 (Fig. 4). Bore 15 of the top rail 22 of the top sash 14 and bore 15 of the bottom rail 21 of the lower sash 13 are left open as shown (Figs. 10 and 11, or if de-

sired may be closed with a strip of metal slid into grooves 24 merely as a closure. Figures 10 and 11 illustrate how the top and bottom rails 22, 21 may close upon weather stripping of a type presently described.

Circular grooves 25 of side rails and top rail upper sash and bottom rail lower sash engage over in snug fit the cylindrical laterals 29 of a sash weather strip 30 (Figs. 8, 10 and 11). These strips run full length both sides and across the head and sill of frame 1. The strips 30 ride over the metal backing 31, the back ribs 34 of which are made to fit into grooves 33 of frame 1; Strips 30 and backing 31 are secured to the frame 1 by screws 32, of which one is shown in Figure 7. Strips 30 with their circular laterals 29 snugly fit into corresponding grooves 25 of rails providing a very effective barrier against air infiltration between sash and frame. Strips 30 and backing 31 at top and bottom act as weather strips when both sash are in closed position while at sides act as sash-slide or track, as well as weather-stripping at the same time, thus eliminating the usual separate parting strip and sash-stop of conventional double hung window construction.

Parallel vertical beads 35 (Fig. 8) of backing 31 fit the cylindrical laterals 29 of strips 30 loosely. The laterals are resilient, and the space therebetween and the beads 35 provides for any necessary relative movement when the sash is slid up and down, and at the same time insures a sufficiently snug friction fit in the circular grooves 25 to prevent the passage of air.

The cylindrical laterals 29 (Fig. 8) of the weather strip 30 together with the beads 35 of backing 31 at two sides of frame act as resilient and conformable tracks or slides for the sash side rail grooves 25.

As shown in Figure 8 the vertical grooves 24 of sash side rails 16 receive the vertical margins of lock strips 26 extending full height of sash. The lock strips are permanently secured to the sash rails 16, welded in place in the manufacture of the sash. The lock strips have a plurality of holes 27 (Figs. 3 and 7) for the reception of the point of a sash lock plunger.

For meeting rail weather-stripping and extending full width of each sash metallic membranes 139, 140 (Fig. 4) are provided carried by the meeting rails 19, 20 of the lower and top sashes. The longitudinal sides of these membranes are bent at 141, 142 so that each has a substantial U-shape. These bent edges are set in grooves 143, 144 arranged in confronting and parallel positions along the adjacent surfaces of the meeting rails.

Immediately to the inside of the bends 141 which jut out farthest from the respective meeting rail toward the other meeting rail there is a lip 145. This assists in the support of the respective bend 141, and inasmuch as it falls short of the place where the bend turns into the membrane proper there occurs a space which allows for any necessary flexing of the membrane toward the meeting rail. The membranes are flexible, as just indicated. They stand on a bias to the meeting rails, and when the sashes are closed, as shown in Figure 4, the membranes come together and make a mutually conforming contact their entire length for a very effective weather-stripping at the meeting rails of the two sashes. The remote parts of the meeting rails have projections 146 which come as close to the opposite meeting rail as possible. These projections substantially enclose metallic membranes when the sashes are closed, and so add to the function of the membranes themselves in excluding draughts.

From the foregoing description of the construction of the window it will be noted that we have produced a double hung window of simpler assembly having eliminated weights, cords, pulleys, box-frames, and separate sash slides and sash stops, as a decided economy in cost of manufacture.

To operate the sash a flexible tubing 76 (Figs. 1 and 6) is extended from a conventional compressed air tank located where wanted and connected to a control mechanism 52 mounted to side of frame 1 at about meeting rail height.

Under and at the two corners of the sill 3 (Fig. 2) of the window frame there are welded hollow blocks 4, 5 connected with the return air supply tubing 77 from control mechanism 52. These blocks are connected by a common pipe 6. Each block has connected to it a pair of tubular piston rods 7, 8 (Fig. 2) extending into corresponding cylinders 11 and 12, thus providing a continuous open air raceway from air tubing 77 to cylinders 11 and 12.

The pair of piston rods shown in Figure 2 are those at the right side of the window, looking at it from the inside. The pair of piston rods at the left are of identical form and function. The piston rods are of substantially equal height. Each is open at the top, and adjacent to the opening they have heads herein shown as formed by flanges 9 (Figs. 5, 7) between which there is a wrapping of packing 10.

Sash cylinders 11, 12 (Fig. 2) contain the piston heads 9, 10. These cylinders are long enough to prevent the piston heads from coming out of their open ends when the respective lower and top sashes 13 and 14 are in their fully raised positions. The upper ends of the sash cylinders are closed, and the cylinders are fixedly fitted in bores 15 (Fig. 8) in the vertical side rails 16 of each of the sashes. A set screw 17 (Fig. 5), carried in part by one of the sash cylinders 11, projects into that cylinder far enough to strike the nether part of the respective piston head 9, 10 and so limit the up travel of the lower sash.

Each of the side strips 30 and backing 31 for the sashes 13 and 14 at the right of the window frame here shown, has a hole about midway of its height, in juxtaposition with a similar hole in frame 1. The holes are designated 36, 37 (Fig. 2). These holes receive the exposed ends of center tubes 38 (Fig. 7) of lower and top sash lock solenoids 39, 40 (Fig. 6). These tubes guide the respective lock plungers 41, 42.

The plungers ride the holes adjacent to their free ends (Fig. 7). Each plunger has a point 43 to engage one of the lock strip holes 27 and so lock the respective sash in practically any position within its range of movement. The holes 27 are slightly over-size in comparison with the diameter of the point 43, enabling the sash to rest on the plunger point 43 holding said plunger from withdrawing, and also enabling a slight preliminary raising of the sash in order to take the weight of the sash from the lock plunger preparatory to the retraction of the plunger.

Each plunger has a pin 44 (Fig. 6) which extends through a felt washer 45 and an iron stop 46 in the tube 38. The back end of each pin 44 is adapted to open a switch 47, 48, each switch comprising a fixed contact 49 and a movable spring contact 50, the latter being moved to

the circuit-opening position when the respective solenoid is energized and its plunger is permitted to be drawn in upon the relief of the weight of the respective sash.

The solenoids 39, 40 are contained by bores 51 in a block 52. This block has another bore 53 at right angles to the others. The block is secured to the frame 1 by screws 54 (Fig. 7) thereby supporting the block and covering the previously inserted solenoids. The block 52 carries a suitably affixed face plate 55, secured to the window frame by screws 56 (Figs. 1, 2 and 6). The block 52 and its carried parts are conveniently called the control mechanism.

A screw plug 57 (Fig. 6) holds an air valve solenoid 58 in the bore 53 (Fig. 7). The solenoid has a central tube 59 which slidably guides a plunger 60. The opposite ends of the plunger alternately abut felt washers 61, 62 respectively against the plug 57 and an iron stop 63 of the tube 59. This stop is centrally bored at 64 to receive the hollow stem 65 of an air valve 66. This valve controls the passage of air, it being understood that other pressure fluids might be employed in the operation of the window.

A hub 67, formed as part of the stem 65, abuts the stop 63 and so limits the position of the stem in the stop. The hub has threads by which it is screwed into an air inlet chamber 68. The valve 66 is held engaged with a seat 69 in the center passage 70 of the stem 65 by a spring 71. One end of the spring engages the valve, the other a stop in the passage. The valve has a pin 72 which extends through a guide 73 into contact with the plunger 60. The spring is strong enough to push the plunger to the right (Fig. 6) after a deenergization of the solenoid 58, thus shutting off the air supply to sash cylinders through supply tubing 77.

Air nipples 74, 75 (Fig. 6) have the near ends of tubes 76, 77 connected to them by means of couplings 78. 76 is the inlet air tubing, admitting air to chamber 68 through a duct 79 from a conventional compressed air tank located elsewhere, while 77 is the air outlet tubing to sash cylinders. Upon energization of the solenoid 58, the plunger 60 is pulled to the left against pin 72 opening valve 66, allowing the inlet air to pass around the plunger 60 through a port 80 in the plug 57 (Fig. 6) through channel 81 and nipple 75 into tube 77 which in turn is connected to the hollow block 4 (Fig. 1) by a coupling 82, and to hollow block 5 through tubing 6. When the foregoing passage of air occurs, all four cylinders 11 and 12 are instantly filled with compressed air through the hollow rods 7, 8 attached to hollow blocks 4 and 5 respectively.

There are two electrical switches 83, 84 (Figs. 6 and 7) of identical construction to control the passage of electrical current to the various solenoids for the operation of the sashes. The switch 83 is herein known as the top sash switch and the switch 84 as the lower sash switch. One of these switches is specifically described. The other bears the same reference numerals in the drawing with the exponent letter *a* for the purpose of distinction. The switch 83 is known to the trade as a jack switch. Its specific construction is not intended to be covered herein.

It has a shaft 85 (Fig. 6) with a turn button 86 on the outer end and an eccentric 87 on the inner end. The eccentric works between a pair of contactors 88, 89. One end of these is clamped in an insulating block 90 in common with contacts 91, 92, 93 and 94, while the other ends are connected by an insulating bridge 95. The block 90 is carried by a bracket 96 (Fig. 2) which, in turn, is secured to the face plate 55 by suitable means 97 (Fig. 1).

Attention is directed to the electrical wiring diagram in Figure 9. The line 98 separates the part labeled "Local control" from the part labeled "Remote control". The local control includes the switches 83, 84 which are mounted either directly on the window frame as shown, or near by in the room. The remote control goes to a more distant point. For the present set up there are four buses 99, 100, 101, 102. The first two are power buses and they derive current from any suitable source 103. The others are respectively known as the lower "Down" bus and lower "Up" bus as labeled on the drawing.

A wire 104 commonly connects one end of the solenoids 39, 40 and 58 to the negative or return bus 100. A wire 105 connects the other end of the solenoid 40 to the contact 92, a bridge 106 connecting the said wire to the contact 91. A wire 107 connects the other end of the solenoid 39 to the contact 92^a, one branch 108 of that wire making connection with the contact 91^a and another branch 109 making connection with a wire 110 which commonly connects the contact points 111, 112 of the respective down and up relays 113, 114. A wire 115 connects the other end of solenoid 58 to the companion contact point 116 of the relay 114, one branch 117 of that wire making connection with the contact 94, another branch 118 making connection with the contact 94^a.

A wire 119 connects the movable contact 50 of the switch 48 with the contact 93. A wire 120 commonly connects the fixed contacts 49 of the switches 47, 48 and is ultimately connected with the branch 117. The movable contact 50 of the switch 47 is connected by a wire 121 with the companion contact point 122 of the relay 113, a branch 123 of that wire making connection with the contact 93^a. A wire 124 commonly connects the contactors 88, 89, 88^a, 89^a with the positive bus 99.

The respective relays 113, 114 include armatures 125, 126. They also have switches 127, 128. The armatures and the coils of the respective relays are connected to the return bus 100 by wires 129, 130. The other ends of the coils are connected with the movable points of the switches 127, 128, the fixed points of the latter being connected by wires 131, 132 with the respective "Down" and "Up" buses 101, 102. The remote control has "Down" and "Up" master switches 133, 134. Wires 135, 136 connect the positive bus 99 with the movable points of the respective switches. The fixed points of the latter are connected with the down and up buses 101, 102 by wires 137, 138.

The operation is readily understood. According to the showing in the drawings both sashes are closed. Assuming it to be desired to raise the lower sash 13 the procedure is as follows: Turn the button 86^a of the lower sash switch 84 counterclockwise (arrow *a*, Fig. 9). The eccentric 87^a depresses the pair of contactors 88^a, 89^a so that they engage the contacts 92^a, 94^a. Current from the positive bus 99 flows over wire 124, contactor 89^a, contact 94^a, wires 118, 115, solenoid 58, wire 104 to the return bus 100. The energization of the solenoid 58 (Fig. 6) moves the plunger 60 to the left, opening the valve 66 so that compressed air can flow from the tube 76 to the tube 77 (Fig. 1) and so into both hol-

low blocks 4, 5 and each set of sash cylinders 11, 12 by way of the tubular piston rods 7, 8, but up to this point in the description the lock plungers 41, 42 (Fig. 6) of the lower and top sashes are still in the locking position. Simultaneously with the foregoing flow of current there is also a passage of current from the positive bus 99 and wire 124 to the contactor 88a (Fig. 9), contact 92a, wires 102 and 107 to the lower sash solenoid 39, wire 104 and return bus 100.

While the energization of the solenoid 39 (Fig. 7) tends to withdraw the lock plunger 41 so as to free the lower sash 13, plunger 41 will not withdraw until the foregoing influx of air has just raised the lower sash from the point 43, so that when the point 43 is relieved of the weight of the sash the plunger 41 is free to be retracted. The air pressure then in the cylinders 11, 12 causes the lower sash 13 to be raised. The top sash remains in locked position, as its lock solenoid is not energized, with the exception of the slight raising action allowed by the oversized hole 27 in which the respective lock plunger point fits at the time.

The retraction of the lock plunger 41 (Fig. 7) causes the pin 44 to open the switch 47, but without any effect this time in the electrical circuit. Later, when the solenoid 39 is de-energized, the movable contact 50, which is a spring, returns the plunger 41 to its locking position. The lower sash 13 continues to rise as long as the button 86a is held to the counter-clockwise turn, and when it reaches the proper position the operator turns the button 86a back to the neutral position. This restores the switch 34 (Fig. 9) to its original position and cuts off electrical power from both solenoids 58, 39 de-energizing same. The lock plunger 41 returns to the locking position, as previously stated, its point 43 entering one of the holes 27 and so supporting and locking the lower sash in the then open position.

Upon desiring to lower the bottom sash the procedure is as follows: Turn the button 86a of the switch 84 clockwise (arrow *b*, Fig. 9). The eccentric 87a raises the pair of contactors 88a, 89a so that they engage the contacts 91a and 93a. Current then flows from the positive bus 99 over wire 124 to contactor 99a, contact 93a, wires 123, 121 through the switch 48, wires 120, 117, 115 to the solenoid 58, and wire 104 to the return bus 100.

The resulting energization of the solenoid 58 opens the valve 56 and admits air to the sash cylinders as before just enough to lift the lower sash from the point 43 (Fig. 7) as previously explained. Simultaneously with the foregoing passage of current there is also a flow from positive bus 99 and wire 124 to the contactor 88a (Fig. 9), contact 92a, wires 102 and 107 to the solenoid 39, and wire 104 to the return bus 100. The resulting energization of the solenoid 39 (Fig. 7) withdraws the then freed lock plunger 41.

Simultaneously with the withdrawal of the lock plunger 41 its pin 44 presses back on the contact 50 opening the switch 47 and automatically breaking the circuit through the solenoid 58. The resulting closure of the valve 66 (Fig. 6) cuts off the air supply to the lower sash cylinders. The switch 47 (Fig. 7) is, therefore, responsible for charging the lower sash cylinders 11 with a measured quantity of air; enough to preliminarily lift the sash from the locking point 43 and then supplying an air cushion on which the sash will gently ride down as leakage of the fluid occurs past the piston packing 10 or through an auxiliary bleed hole (not shown) to atmosphere.

The sash 13 continues to lower as long as the button 86a is held to its clockwise turn. This is necessary to keep the solenoid 34 energized and the lock plunger 41 in the retracted position. As soon as the switch 34 is returned to neutral, the breaking of the circuit through the solenoid 39 causes the lock plunger 41 to move into the locking position by the spring 50 of switch 47 holding the lower sash locked in whatever position may be desired.

Upon desiring to lower the top sash 14 the procedure is as follows: Turn the button 86 of the top sash switch 83 clockwise (arrow *c*, Fig. 9). This raises the contactor pair 88, 89 so that the contacts 91, 93 are engaged. Current then flows from the positive bus 99 over wire 124 to contactor 89, contact 93, wire 119, through switch 48, wires 120, 117, 115 to the solenoid 58 and wire 104 to the return bus 100. The resulting energization of the solenoid 58 (Fig. 6) draws the plunger 60 inward, opening valve 66 so that there is an air flow into the sash cylinders.

Simultaneously with the foregoing there is also a current flow from bus 99 and wire 124 to contactor 83, contact 91, wires 106, 105 to the solenoid 40 and wire 104 to the return bus 100. The resulting energization of the solenoid 40 (Fig. 6), withdraws its plunger 42 from the locking position (compare with the plunger 41, Fig. 7), the withdrawal of that plunger being permitted by the preliminary raising action of the top sash by the influx of air into its cylinders.

Following the withdrawal of the lock plunger 43, its stem 44 presses back on the movable spring contact 50 of the switch 48, automatically breaking the circuit of the air valve solenoid 58. The switch 48, is therefore, responsible for the introduction of a measured quantity of air to the cylinders of the top sash. The top sash gradually lowers on the diminishing air as the later leaks to atmosphere past the piston heads of the rods 8 (Fig. 2) or through the auxiliary bleed hole previously mentioned. Lowering continues as long as the button 86 is held to its clockwise turn. When this is restored to neutral the resulting de-energization of the solenoid 40 permits the respective spring contact 50 to move the lock plunger 42 to the locking position, holding the top sash locked wherever it may be caught.

Upon desiring to again raise the top sash the procedure is as follows: Turn the button 86 counter-clockwise (arrow *d*, Fig. 9). The contactor pair 88, 89 is depressed so that the current flowing from the positive bus 99 over wire 124 reaches wire 117, 115 by way of the contact 94, flows through the solenoid 58 and by wire 104 to the return bus 100. The resulting energization of the solenoid 58 (Fig. 6) opens the valve 66 so that air is admitted to the sash cylinders. Simultaneously with the foregoing current also flows from bus 99 and wire 124 to the contactor 88, thence to contact 92, wire 105 to the solenoid 40 and wire 104 to the return bus 100. The relief of the weight of the sash 14 from the lock plunger 42 by the initial introduction of air enables the retraction of the lock plunger 42 upon the resulting energization of the solenoid 40.

The lower sash 14 continues to rise as long

as the button 86 is held to its counter-clockwise turn. When the switch 83 is restored to the neutral position, the resulting breaking of the circuits of the solenoids 58, 40 cuts off the flow of air to the sash cylinders and permits the lock plunger 42 to reassume its locking position. This holds the top sash locked in the desired position.

As to the operation by remote control it is desired to explain that the master switches 133, 134 (Fig. 9) are only for the operation of the lower sash 13. There would only be a duplication of these switches and the addition of two buses such as 101, 102 for the operation of the top sash 14 by remote control. Note that this master control by switches 133, 134 may control as many windows as desired simultaneously.

Assuming it to be desired to raise the lower sash 13 by remote control, the procedure is as follows: Close switches 127, 128. Ordinarily these switches remain open when the sashes are operated by local control only as described before. Switches 127, 128 are closed on all windows to be operated by master control. Those sashes which are not to operate have these switches left open. Close the up master switch 134. Current from the positive bus 99 flows through the switch by way of wire 136, reaching the bus 102 by way of wire 138, whence it flows over wire 132, through switch 128, the coil of the up relay 114 returning to the return bus 100 by way of wire 130.

The energization of the coil attracts the armature 126 so that the contacts 112, 116 are bridged. A division of the current at the coil enters the armature, passes contact 116 and flows over wire 115 to the solenoid 58 and wire 104 to the return bus 100. The resulting energization of the solenoid 58 (Fig. 6) opens the air valve 66 as before. The lower sash 13 is preliminarily lifted so that its lock plunger 41 (Fig. 7) is freed of the weight.

Current also enters wire 110 by way of contact 112, flowing over wires 109, 107 to the solenoid 39, and by way of wire 104 to the return bus 100. The energization of the solenoid 39 (Fig. 7) retracts the lock plunger 41 so that the lower sash 13 is free to rise as long as the operator keeps the master switch 134 closed. Opening of the switch deenergizes the two solenoids so that the sash is stopped and locked.

Upon desiring to lower the sash 13 from the foregoing position by remote control, the procedure is as follows: Close the master switch 133. Current flows from the positive bus 99 over wires 135, 137 to the bus 101, over wire 131 past switch 127 and through the coil of the down relay 113 from whence it returns to the negative bus 100 by way of wire 129. The energization of the coil attracts the armature 125 so that the contacts 111, 122 are bridged. A division of the current enters wire 121 by way of contact 122, flowing through switch 47 and wires 120, 117 and 115 to the solenoid 58, then over wire 104 to the return bus 100.

The resulting energization of the solenoid 58 admits air to the sash cylinders 11. Current also enters wire 110 by way of contact 111, flowing over wires 109, 107 to the solenoid 39 and then by way of wire 104 to the return bus 100. The energization of the solenoid 39 retracts the lock plunger 41 so that the sash 13 is free to lower on a cushion of air as described for local control.

The foregoing retraction of the lock plunger 41 opens the switch 47 so that the circuit of the solenoid 58 is broken. Only a measured quantity of air enters the sash cylinders 11. As this air cushion leaks past the piston heads the sash 13 gradually gravitates to the closed position. It can be stopped and locked in any desired position within its range of movement by opening the switch 133.

From what has been stated it must be clear that the raising of either sash is caused by the continuous application of air pressure as long as the respective switch 83, 84 is in the proper position. When the sash is raised as high as desired, the neutralization of the switch causes an automatic locking. The lowering of each sash is also caused by turning the respective switches 83, 84 to the proper position, but the switches 47, 48 are involved in the lowering operation, and these serve to automatically cut off the air so that automatically only an amount of air is admitted to the sash cylinders in direct proportion to the sash weights, first for raising the sash off of the lock plunger, second to form a gradually leaking cushion on which the sash gravitates to the closed position. At this time the switches 47, 48 supersede the switches 84, 83.

We claim:—

1. A sash, a lock plunger on which the sash is capable of being supported in a raised position, means into which a definite amount of pressure fluid is admissible to preliminarily lift the sash from the lock plunger and then form a diminishing cushion by leakage from said means, and means to withdraw the lock plunger during the preliminary lifting of the sash.

2. A sash, a lock plunger to support the sash in a raised position, electrical means which is energizable to retract the plunger, said means being insufficiently strong to retract said plunger while bearing the weight of the sash, and means into which a definite amount of pressure fluid is admissible to preliminarily lift the sash so that the plunger can be withdrawn, said means providing for the leakage of the fluid so that the sash can slowly lower on a diminishing fluid cushion.

3. A sash, a lock plunger to support the sash in a raised position, electrical means adapted to be energized to withdraw said plunger, a pressure fluid valve, electrical means to open it and so enable the passage of fluid from a pressure fluid source, a source of current and a control by which to energize both electrical means from said source thereby opening the fluid valve but the electrical means of the lock plunger being insufficiently strong for its withdrawal while supporting the weight of the sash, means into which the fluid released at the valve is admissible to lift the sash from the lock plunger, the respective electrical means then operating to withdraw said plunger, and a switch then operated by the withdrawal of the plunger to de-energize the electrical means of the fluid valve and so cut off the flow of fluid.

4. A sash, a lock plunger to support the sash in a raised position, electrical means by which to retract the plunger, a pressure fluid valve, electrical means by which to open the valve for the flow of fluid from a pressure fluid source, a manual control by which to simultaneously energize both electrical means thereby to open the valve, the electrical means of the plunger being insufficiently strong to withdraw the plunger while supporting the sash, means into which the

fluid is admissible to raise the sash and so enable the electrical means of the plunger to withdraw it from a locking position, and means actuated by the withdrawing movement of the plunger to de-energize the electrical means of the valve so as to close the valve and entrap a measured quantity of fluid, the electrical means of the plunger remaining energized as long as the manual control is held.

5. A sash, a lock plunger in position to hold the sash, means by which to apply the force of pressure fluid to the sash so as to lift it, means by which to pull on the lock plunger and cause its retraction in the initial lift of the sash at the application of pressure, and means automatically operated by the retracting movement of the plunger to cut off the pressure fluid.

6. In a sash carrying a cylinder which contains a piston rod and piston fixed relatively to the sash, and means to admit pressure fluid into the cylinder above the piston, a lock plunger on which the sash rests by gravity, means operating automatically upon the initial lift of the sash by the influx of fluid to retract the plunger, and means acting by the retraction of the plunger to then cut off the influx of fluid to the cylinder, the resulting entrapped volume of fluid in the cylinder being adapted to leak past the piston to lower the sash on a diminishing cushion.

7. A sash, a lock plunger on which the sash rests by gravity, a lock strip carried by the sash and having a hole for the plunger, the hole being over-sized to provide loose play, means to exercise a pull on the plunger in readiness for its withdrawal, and means to preliminarily lift the sash and thereby utilize the loose play for enabling the withdrawal of the plunger.

8. A pair of sashes each having at least one sash cylinder, hollow piston rods and pistons of substantially equal altitude and situated in the cylinders, a hollow block fixed relatively to the sashes to which the rods are secured, a lock plunger for each sash and electrical retracting means for each plunger, a fluid valve and means by which it communicates with the block, electrical actuating means by which to open the valve so as to cause a fluid flow from a source of pressure fluid and so introduce fluid into both cylinders, and a switch for each sash, the closing of either switch energizing the electrical means of the valve but only the electrical means of the respective lock plunger.

9. A sash, means in the sash by which to apply the force of pressure fluid for its raising and lowering, a valve through which the fluid must flow for either purpose, electrical means to open the valve, a lock plunger to hold the sash either down or up, electrical means by which to retract the plunger, an automatic switch and plunger-operated means to open it on each retraction of the plunger, three circuits the first including the electrical means of the valve, the second including the electrical means of the lock plunger and the third including the automatic switch and the electrical means of the valve, and a manual switch movable into one position to energize the first and second circuits for a continuous application of pressure fluid to raise the sash and to retract the plunger while the manual switch is held in the one position to energize the second and third circuits, the plunger-operated means automatically de-energizing the electrical means of the valve to cut off the pressure fluid for the lowering of the sash after a preliminary lift and the immediate retraction of the lock plunger.

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