March 12, 1957 M. STROBEL-FUCHS 2,784,465

AUTOMATIC DISINFECTING DEVICES FOR PUBLIC PLACES

Filed July 19, 1955 3 Sheets-Sheet 1

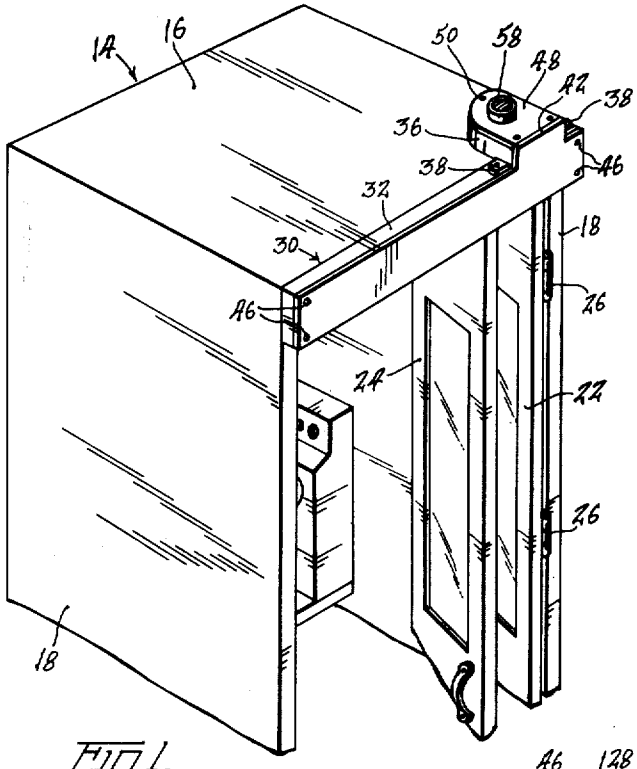


FIG. 1.

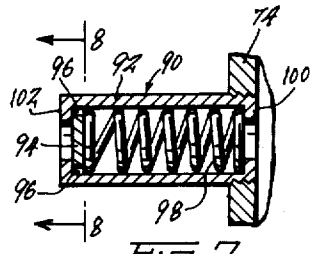


FIG. 7.

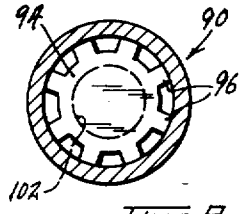


FIG. 8.

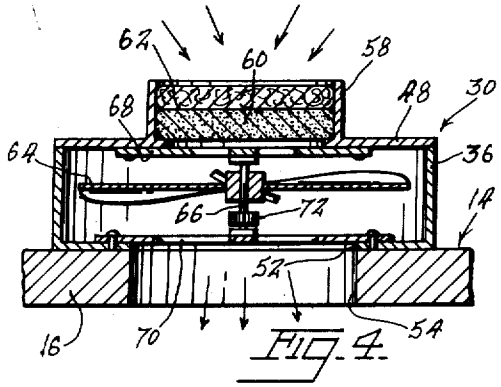


FIG. 4.

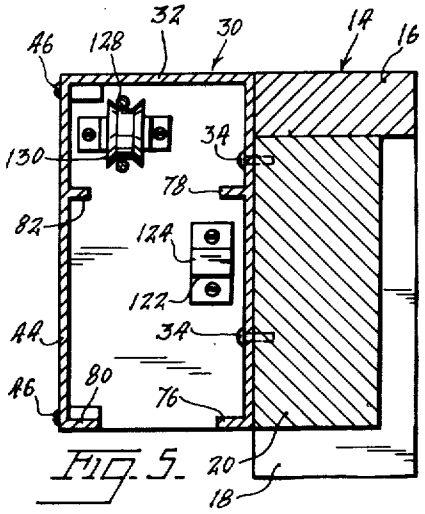


FIG. 5.

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AUTOMATIC DISINFECTING DEVICES FOR PUBLIC PLACES

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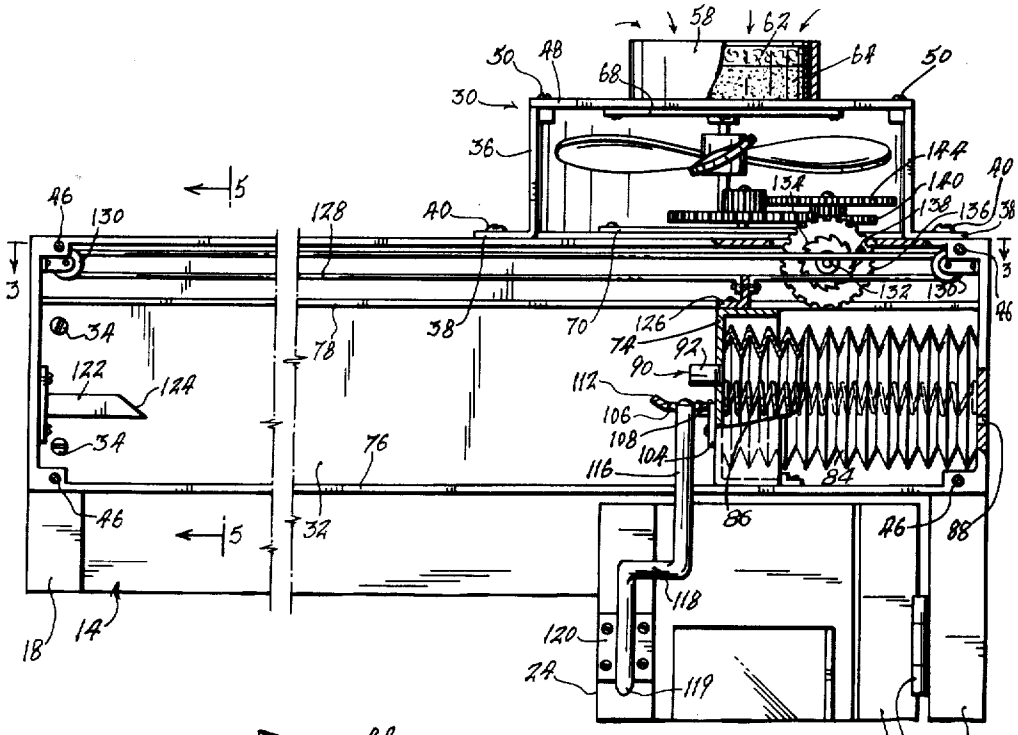


FIG. 2.

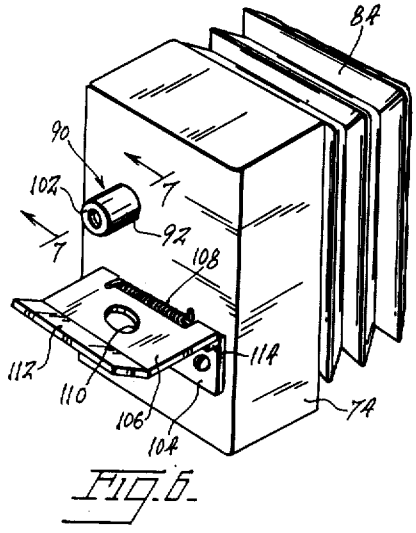


FIG. 6.

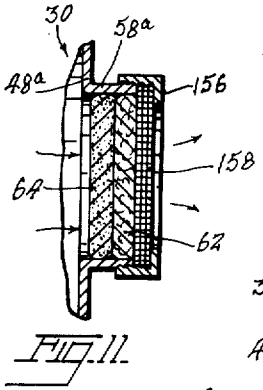


FIG. 11.

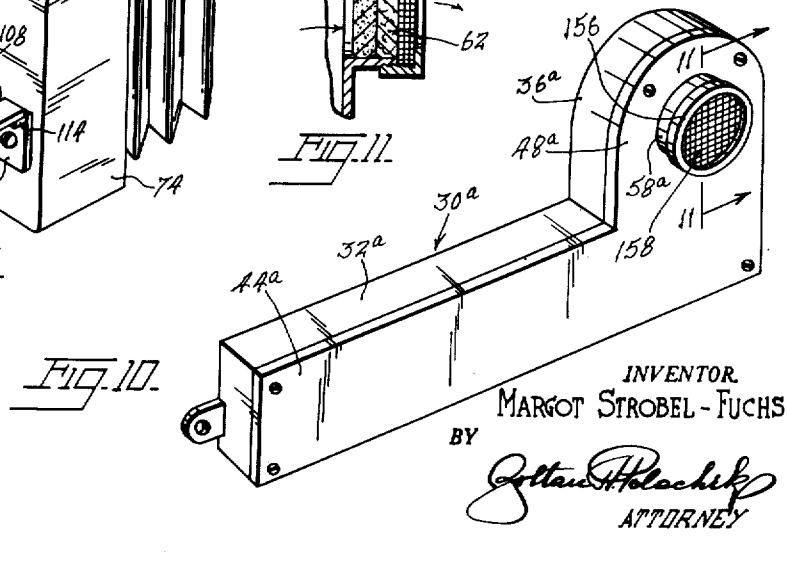


FIG. 10.

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AUTOMATIC DISINFECTING DEVICES FOR PUBLIC PLACES

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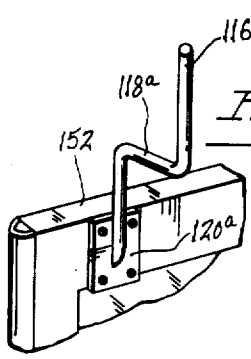


Fig. 12.

Fig. 3.

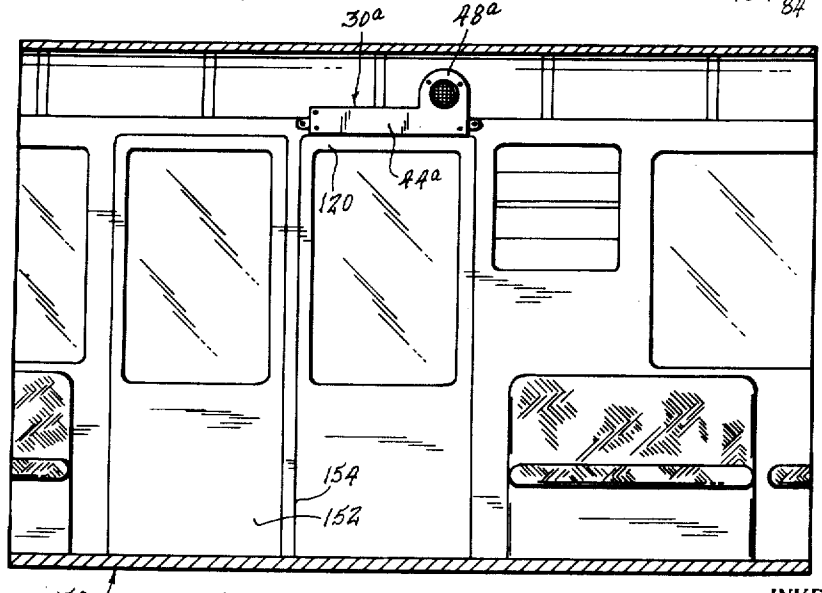


Fig. 9.

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United States Patent Office 2,784,465 Patented Mar. 12, 1957

2,784,465

AUTOMATIC DISINFECTING DEVICES FOR PUBLIC PLACES

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Application July 19, 1955, Serial No. 522,975

4 Claims. (Cl. 21—77)

This invention relates to an automatic disinfecting device, and more particularly, has reference to a device of the type referred to, operable automatically responsive to the closing of a door to direct, for a predetermined period of time following the closing of the door, a supply of filtered, chemically disinfected air into an enclosure to which access is had through said door.

The present invention constitutes a novel improvement over the automatic disinfecting device shown in Patent 2,180,967, issued to me on November 21, 1939, and in accordance with the present invention, a novel means for rotating a fan responsive to closing of the door is provided.

It is one important object of the present invention, in this regard, to provide a mechanically acting fan-rotating means particularly adapted to be used with a door having straight line sliding movement. A door falling within this category would be, for example, a door of a subway train. The invention is thus, in its new embodiment, well adapted for mounting in each car of a subway train, to direct filtered, chemically disinfected air into the car each time the door above which the device is mounted closes.

Another object of importance is to so design the door-actuated fan-rotating means as to place it in operation not only when connected to a door having straight line sliding movement, but also when connected to a hinged door, one edge at least of which can be guided in a straight line as, for example, the outer section of a hingedly foldable door of a telephone booth.

Still another object is to so design the door-actuated means as to facilitate its mounting above a door with which it is to be operatively associated. To this end, the invention is a wholly self-contained, mechanically acting unit, that can be preassembled, and swiftly connected to a wall of the structure on which the door is mounted.

Yet another object is to so form the fan-rotating means as to cause it to effect rotation of the fan at substantially high speed, for a relatively prolonged time interval following the closing of the door, thus to direct a maximum amount of treated air into the enclosure each time the door is closed.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a fragmentary perspective view showing the upper portion of a telephone booth on which has been mounted one form of the present invention.

Fig. 2 is an enlarged front elevational view of the device with the front cover removed, portions being shown in section, the telephone booth being shown fragmentarily in front elevation.

Fig. 3 is a sectional view substantially on line 3—3 of Fig. 2.

Fig. 4 is a transverse sectional view through the fan housing substantially on line 4—4 of Fig. 3.

Fig. 5 is a transverse sectional view, the scale being enlarged still further, on line 5—5 of Fig. 2.

Fig. 6 is an enlarged, fragmentary perspective view of a bellows assembly included in the invention.

Fig. 7 is a detail sectional view, still further enlarged, on line 7—7 of Fig. 6, showing a check valve in the bellows assembly.

Fig. 8 is a transverse sectional view, the scale being enlarged above that used in Fig. 7, substantially on line 8—8 of Fig. 7.

Fig. 9 is a fragmentary, longitudinal sectional view through a subway car, showing in front elevation a modified form of the invention.

Fig. 10 is an enlarged perspective view of the form of the invention shown in Fig. 9, per se.

Fig. 11 is an enlarged, sectional view on line 11—11 of Fig. 10.

Fig. 12 is an enlarged, fragmentary perspective view showing the upper portion of a subway door equipped with an actuating finger used in the form of the invention shown in Fig. 9.

In the form of the invention shown in Figs. 1–8, the device is adapted for use on a telephone booth. A conventional booth is illustrated and has been generally designated at 14. The booth includes the horizontal top wall 16, opposed side walls 18, and a horizontally extending header 20 (Fig. 5) extending across the open front of the booth at the upper end thereof. The booth is equipped with a sectionally constituted, foldable door including an inner door section 22 and an outer door section 24. The inner door section is hingedly connected at 26 to the adjacent side wall 18 of the booth, and as shown in Fig. 3, the outer door section 24 is hingedly connected at 28, along its inner side edge, to the inner side edge of the inner section 22.

The automatic disinfecting device constituting the present invention has been generally designated at 30, and is adapted to be mounted at the upper end of the booth, extending across the front thereof, as best shown in Fig. 1. The disinfecting device 30 includes an elongated main casing 32 of rectangular outer configuration having, as shown in Fig. 5, a rectangular cross section. The main casing 30 can be formed from sheet metal or the like, and is closed at its top, back, and ends. The casing is formed for its full length with an open bottom, and also is open at its front to facilitate assembly and maintenance of the parts confined therein. The main casing is adapted to extend in contact with and in front of the header, over the full width of the telephone booth, and is readily connected to the booth by means of screws 34 extending through the back wall of the casing 32 adjacent the opposite ends of the casing.

The device also includes a fan casing 36 which, as shown in Fig. 1, in the embodiment of Figs. 1–8 is horizontally disposed, against the top wall 16 of the booth. The fan casing 36 has a front end portion overlying the top wall of the main casing, said front end portion being of rectangular cross section. At its back end, the fan casing has a rounded rear wall extending (see Fig. 3) through substantially 180 degrees of a circle. Formed at opposite sides of the fan casing, at its front end, are outwardly directed ears 38 apertured to receive screws 40 engaged in the top wall of the main casing, thus to secure the main and fan casings together.

Closing the open front of the main casing is a rectangular, flat cover plate 44 secured at its several corners to the corner portions of the main casing by screws 46 threadedly engaged in corner lugs formed in the main or body portion of the main casing (see Fig. 2). The cover plate 44, adjacent one end, has an upwardly projecting extension 42 closing the open front of the fan casing (see Fig. 1).

The fan casing is provided with a cover plate **48**, secured by screws **50** to the side wall of the fan casing. The cover plate **48** of the fan casing closes the open top of the fan casing, and at its front end abuts against the upper edge of the extension **42** of the main casing cover plate **44**.

Referring to Fig. 4, prior to mounting of the device upon the telephone booth, an opening of substantial diameter is cut in the top wall **16**. The fan casing, in this connection, has a bottom plate integrally formed with the side wall thereof, having an opening **52** of substantial diameter registering with the opening **54** cut in the top wall **16**. The opening **52** constitutes a discharge opening, into which filtered, chemically disinfected air is forced into the interior of the booth when the door is closed, for a predetermined interval of time following the closing of the door.

Integrally formed upon the fan casing cover plate **48** is an upstanding cup member **58**, formed open at its upper end to provide an inlet for air to be supplied to the interior of the phone booth. At its lower end, the member **58** has an inwardly directed circumferential flange, supporting a flat, circular, cake **60** of a chemical disinfectant of the type adapted to treat air impinging upon the same. The cake **60** is fully pervious to the passage of air therethrough, and supported above the disinfectant cake is a flat, circular air filtering pad **62** also fully pervious to air. Thus, air drawn into the fan casing in the direction of the arrow shown in Fig. 4 will be compelled to pass through the filtering means **62** and disinfecting means **60**, as it enters the casing. In this connection, the fan casing cover plate **48** has an opening registering with the open lower end of the cup member **58**, through which air may enter the fan casing.

Concentric with the cup member **58** is a fan **64**, secured fixedly to a vertically disposed shaft **66**, journalled at its upper and lower ends in spiders **68** and **70** secured to the fan casing cover plate **48** and bottom plate respectively, over the inlet and outlet openings of the fan casing. A pinion **72** is also secured fixedly to the shaft **66**, and on rotation of the pinion, the fan will rotate to draw air into the casing through the disinfecting and filtering means **60**, **62**, and to blow the air into the telephone booth through the registering openings **52**, **54**.

Reference should now be had to Figs. 2, 3 and 6, wherein is shown the means adapted to effect rotation of the pinion **72** responsive to closing of the door. A bellows assembly is mounted to move longitudinally of and within the main casing **32**, and includes a slide **74** of rectangular shape, having an open back. The slide is shown to particular advantage in Fig. 6. Referring now to Fig. 5, the slide is mounted for movement longitudinally of the casing upon guide flanges carried by the back wall of the main casing **32** and by the main casing cover plate **44**. Integral with the back wall is a lower guide flange **76** and an upper guide flange **78**, and integral with the cover plate **44** is a lower guide flange **80** and an upper guide flange **82**. These extend the full length of the main casing, projecting inwardly thereof to provide a trackway for slide **74**.

Connected at one end to the back surface of the slide **74** is an expansion or return spring **86**. At its other end, the spring **86** is connected to that end wall of the main casing adjacent the fan casing **36**. The spring **86** is shown in Fig. 2 in its normally contracted position. When the slide **74** is shifted to the left in Fig. 2, to the opposite end of the casing, the spring **86** will be placed under tension, effective to return the slide **74** to its normal position shown in Fig. 2.

An accordion bellows **84** is also connected at its opposite ends to the slide **74** and end wall of the main casing, and surrounds the spring **86**. Air is adapted to enter and be discharged from the interior of the bellows through a small port **88** formed in the end wall of the

main casing to which the bellows and spring are connected. Air is also adapted to enter the bellows, but not to leave the same, through a check valve assembly generally designated **90**, mounted in the slide **74** in communication with the interior of the bellows and shown in detail in Figs. 7 and 8. The inlet check valve assembly **90** includes a cylindrical housing **92** threaded at one end for engagement in a complementarily threaded opening formed in the slide **74**. A flat valve disc **94** is shiftable longitudinally of and within the housing **92**, and has a peripheral series of notches **96**. A spring **98** is held under compression between end flanges **100** and **102** formed upon the respective ends of the housing **92**. The flanges define openings at the opposite ends of the housing, the opening defined by the flange **102** constituting an inlet opening for the check valve assembly and the opening about which the flange **100** extends providing a discharge aperture through which air may pass from the check valve assembly into the bellows. Normally, the spring **98** presses the valve disc **94** against the flange **102**, so as to prevent air from passing through the check valve assembly, and it will be understood that whenever the bellows **84** is contracting to its position shown in Fig. 2, the valve disc **94** will be forced against the flange **102** so that all air confined within the bellows must be forced out of the small port **88**.

By reason of this arrangement, during the contraction of the bellows, air can be discharged from the bellows only at a highly restricted rate, thus causing the contraction of the bellows to take place slowly. When, however, the bellows is being expanded by movement of the slide **74** to the left in Fig. 2, the spring **98** yields due to the creation of vacuum conditions within the bellows, causing the valve disc **94** to be shifted away from the flange **102**. Thus, during the expansion of the bellows, air can enter the bellows both through the port **88** and through the check valve assembly, thus permitting the expansion of the bellows to take place rapidly.

Mounted upon the front surface of the slide **74** is a bracket **104**, carrying a plate element **106**, projecting forwardly from the slide. The plate element **106** is hingedly connected to the bracket **104** by a spring hinge **108** tensioned to normally swing the plate element **106** downwardly to its normal, horizontal position shown in Fig. 6.

An opening **110** is formed centrally in the plate element **106**, and at its outer edge, the plate element has an upwardly inclined edge portion **112** defining a cam surface.

To prevent movement of the plate element **106** under the force of the spring hinge downwardly beyond the horizontal position shown in Fig. 6, a stop lug **114** is formed upon the bracket **104**.

The opening **110** of the plate element is adapted to receive the upper, free end of a finger **116** formed at its lower end with an offset portion **118** merging into a vertical lower end portion **119** of the finger integral or otherwise made rigid with a mounting plate **120** secured by screws or the like to the outer or free side edge of the outer door section **24**. The offset **118** is extended obliquely to the plane of the door section as shown in Fig. 3, so that when the door section is shifted fully to its closed position across the open front of the telephone booth, the finger **116** will still be located medially between the opposite sides of the main casing **32**, the finger traveling longitudinally and centrally of the casing during the movement of the door section to a closed position.

Fixedly secured to that end wall of the main casing remote from the fan casing **36** is a cam bar **122** having an inclined cam surface **124** at its free end. The cam bar **122** projects longitudinally of the main casing adjacent the inner side wall of the main casing as shown in Figs. 3 and 5, and is disposed in the path of the inclined leading edge of the plate element **106** carried by the slide **74**.

It will be seen, from the description so far provided,

that with the finger **116** engaged in the opening **110** of the plate element, and the door section **24** in open position, a user of the phone booth, in closing the door of the booth in a normal manner, will cause the finger **116** to be shifted to the left in Fig. 2, to a location adjacent that end wall of the main casing carrying the cam bar **122**. As a result, the slide **74** will be pulled to the end of the casing at which the cam bar **122** is located, expanding the bellows and the spring **86**. As the bellows expands, air will be drawn thereinto through the check valve assembly and through the restricted port **88**. The check valve assembly, it will be understood, can be of any desired size, it being preferred that the size of the air inlet provided by the check valve assembly be such as to permit air to freely enter the bellows during the expansion thereof.

As the door nears its fully closed position, the inclined surface **124** will engage the inclined free edge of the plate element **106**, and the plate **106** will accordingly be swung upwardly against the restraint of its spring hinge **108**. This will cause the plate element to be disengaged from the finger **116**, as the finger **116** moves further to the left until the door is fully closed. With the plate element disengaged from the finger **116**, the spring **86** is free to contract, and will cause the slide **74** to be returned to its normal position shown in Fig. 2 while the telephone booth is in use. The movement of the slide **74** back to its normal position will be effected quite slowly, due to the fact that the check valve assembly is now closed, and all air forced out of the bellows must pass through the restricted orifice **88**.

Secured to and projecting upwardly from the slide **74** at the top thereof, is an angular bracket **126** to which is connected the opposite ends of a cord **128**. The cord **128** passes, at opposite ends of the main casing, around pulleys **130** rotatably mounted upon the end walls of the main casing.

The upper flight of the cord **128** is extended about a small roller **132**, journalled upon a shaft extending transversely of the main casing between the main casing cover plate and the back wall thereof. The roller **132** is secured fixedly to a ratchet wheel **134**, disposed adjacent a relatively large gear wheel **136** freely rotatable upon the roller-carrying shaft.

Gear wheel **136** has a spring-loaded pawl **138** and, accordingly, when the roller **132** rotates in one direction, the ratchet wheel and gear wheel will be connected in driving relationship, to cause rotation of the gear wheel. When, however, the roller **132** is rotated in an opposite direction, the pawl will ratchet over the teeth of the ratchet wheel **134**, and the gear wheel **136** will not turn under these circumstances.

The driving of the ratchet wheel is arranged to occur only during the retraction of the slide **74** caused by contraction of the spring **86**. When the slide **74** is being shifted to the left in Fig. 2 during the closing of the door, the gear wheel **136** will not be driven.

It will thus be seen that during the contraction of spring **86** at the previously mentioned slow rate, the gear wheel **136** will be driven by the wheel **134**, said gear wheel rotating for a substantial period of time, due to the prolonged interval occurring before the spring **86** is fully retracted.

The gear wheel **136** is in mesh with a gear wheel **140**, rotating in a plane at right angles to the plane of rotation of the gear wheel **136** and extending into the fan casing. It will be understood, in this connection, that the top wall of the main casing, at the location of the gear wheel **136** and ratchet wheel **134**, has a longitudinal slot (Fig. 2) to permit the peripheries of these wheels to extend into the interior of the fan casing.

Referring now to Fig. 3, the gear wheel **140**, which is rotatably supported upon an upwardly projecting stub shaft carried by the bottom plate of the fan casing, meshes with a small diameter pinion **142** secured fixedly to a large diameter gear **144** meshing with a pinion **146** secured to a large gear **148** that is in mesh with the fan drive pinion **72**. It will be seen that a speed step-up gear train results, so that for each rotation of the roller **132** there is a substantial number of revolutions of the pinion **72**, thus causing the fan to be driven at high speed during the slow retraction of the slide **74**, the fan rotating throughout the period of time that the slide is being retracted to its normal position.

The time interval during which the fan rotates to force treated air into the phone booth during use of the booth can, of course, be set by selection of a suitable train of gears so as to cause the fan to rotate, for example, for a period of one minute, after which the fan stops rotating. During each use of the phone booth, a supply of filtered, treated air will be directed into the interior thereof, to prevent undesirable odors from permeating the enclosure.

Subsequently, when the door is opened following use of the booth, the finger **116** will ultimately engage against the underside of the inclined outer edge portion **112** of the plate element **106**, and will bias the plate element upwardly against the restrain of the spring hinge, to permit the finger **116** to engage in the opening **110**. The device is thus ready for its next use, and will operate automatically once again, on the next closing of the door, to supply filtered, treated air to the interior of the booth.

In the form of the invention shown in Figs. 9–12, the invention has been applied to a conventional car **150** of a subway train. The car has the usual sliding doors **152** disposed at opposite sides of a center post **154**.

In this form of the invention the device has been generally designated at **30ª**, and includes a main casing **32ª** and a fan casing **36ª**. The invention is similar to the first form of the invention, except for the fact that the fan casing is vertically disposed above the main casing, rather than horizontally disposed. Since the fan casing is vertically disposed, the several gears used for supplying drive for the fan are also vertically disposed, and the gear wheel **140**, instead of being at right angles to gear **136** will rotate in a vertical plane. Further, the blades of the fan will be pitched oppositely to the fan shown in Fig. 2, so that air will be forced out of the cylindrical cup member **58ª**, instead of being drawn into the cup member.

Apart from these changes, and apart from the formation of the fan casing **36ª** integrally with the main casing, the invention will be the same as previously described. Since the fan casing is integral with the main casing, a single cover plate **44ª**, having a vertical extension **48ª**, can be used to close the open fronts both of the main and fan casings.

Since the cup member **58ª** extends horizontally instead of vertically in the form of the invention shown in Figs. 9–12, it is desirable to provide a removable cap **156** therefor, the cap having a large center opening and a threaded flange engaging complementary threads formed upon the cup member. A screen **158** extends over the center opening of the cap, to confine within the cup member the air filtering means **62** and chemically disinfecting cake **64**.

Further, since the door **152** has straight line sliding movement, it is not necessary that the offset **118ª** of the finger **116ª** carried by the door **152** be disposed obliquely to the plane of the door. Instead, the offset portion **118ª** extends perpendicularly to the plane of the door as shown in Fig. 12.

The finger **116ª** is rigid with a mounting plate **120ª** secured to the upper end of the door adjacent the outer side edge of the door, and the device is mounted upon the upper edge portion of the door opening as shown in Fig. 9. If desired, the inlet opening of the fan casing can be extended into communication with the surrounding atmosphere, but this is not essential, since the air within the car can be recirculated through the device to be regularly filtered and disinfected, each time the door **152** closes.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that

I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. An automatic disinfecting device for use with a door a portion at least of which has straight line movement, comprising: a casing means mountable above said door, a finger attachable to said door portion to shift in a straight line therewith, a slide having straight line movement in said casing means, an element on the slide engageable with the finger in the open position of the door, for shifting of the slide by the finger in one direction during the closing of the door, means in the casing means for disengaging the element from the finger on movement of the door to a closed position, thus to free the slide for return movement, slow-acting means connected between the casing means and slide for effecting the return movement of the slide, a fan rotatably mounted in the casing means, said casing means having an inlet and an outlet for air to permit passage of air therethrough on rotation of the fan, an air-pervious disinfecting means in the path of air flowing through the casing during rotation of the fan, and a motion-translating drive linkage extending between the slide and fan for rotating the fan during the return movement of the slide, said casing means comprising an elongated, main casing and a fan casing connected therewith, the slide being mounted for movement within the main casing and the fan being mounted in the fan casing, said slow acting means comprising a bellows connected between the slide and main casing and an expansion spring also connected between the slide and main casing, said bellows having a restricted outlet port, whereby to cause contraction of the bellows, during the contraction of the spring, to take place at a slow rate of speed.

2. An automatic disinfecting device for use with a door a portion at least of which has straight line movement, comprising: a casing means mountable above said door, a finger attachable to said door portion to shift in a straight line therewith, a slide having straight line movement in said casing means, an element on the slide engageable with the finger in the open position of the door, for shifting of the slide by the finger in one direction during the closing of the door, means in the casing means for disengaging the element from the finger on movement of the dor to a closed position, thus to free the slide for return movement, slow-acting means connected between the casing means and slide for effecting the return movement of the slide, a fan rotatably mounted in the casing means, said casing means having an inlet and an outlet for air to permit passage of air therethrough on rotation of the fan, an air-pervious disinfecting means in the path of air flowing through the casing during rotation of the fan, and a motion-translating drive linkage extending between the slide and fan for rotating the fan during the return movement of the slide, said casing means comprising an elongated, main casing and a fan casing connected therewith, the slide being mounted for movement within the main casing and the fan being mounted in the fan casing, said slow acting means comprising a bellows connected between the slide and main casing and an expansion spring also connected between the slide and main casing, said bellows having a restricted outlet port, whereby to cause contraction of the bellows, during the contraction of the spring, to take place at a slow rate of speed, the bellows including a check valve assembly arranged to permit air to enter the bellows during the expansion of the bellows responsive to closing of the door.

3. The automatic disinfecting device of claim 2 wherein the check valve assembly comprises a tubular housing carried by said slide and communicating with the interior of the bellows, a valve disc in the housing adapted to close the opening at one end of the housing and a coil spring in the housing normally urging said disc into closing position, said coil spring being adapted to contract upon creation of a vacuum within the bellows upon expansion of said bellows.

4. The automatic disinfecting device of claim 2 wherein the translating drive linkage comprises a cord connected at its opposite ends to the slide, the main casing at opposite ends thereof having pulleys about which the cord is trained, a roller engaged with the cord for rotation thereby, and a gear train having a driving connection to said roller and fan respectively.

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