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AUTOMATIC SHUTTER FOR VENTILATORS

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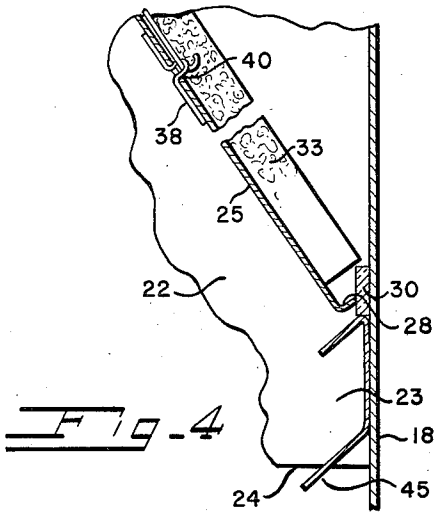



Fig-4

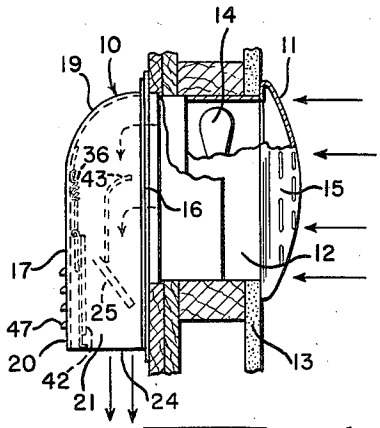



Fig-1

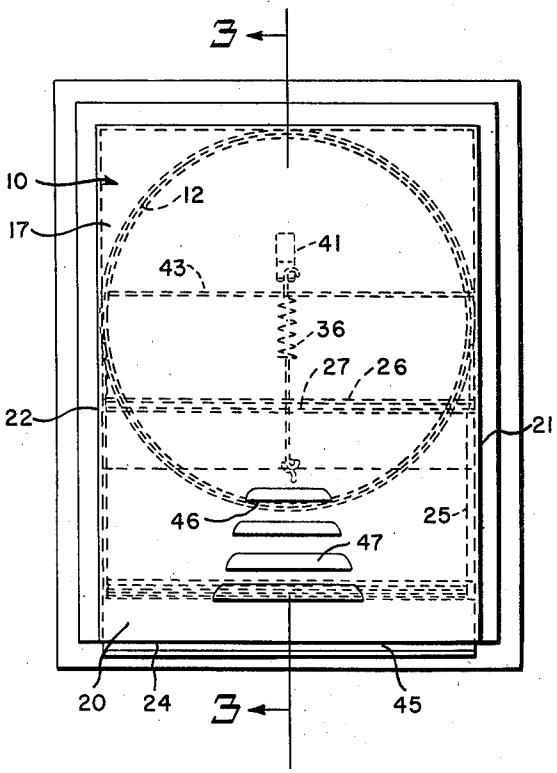



Fig-2

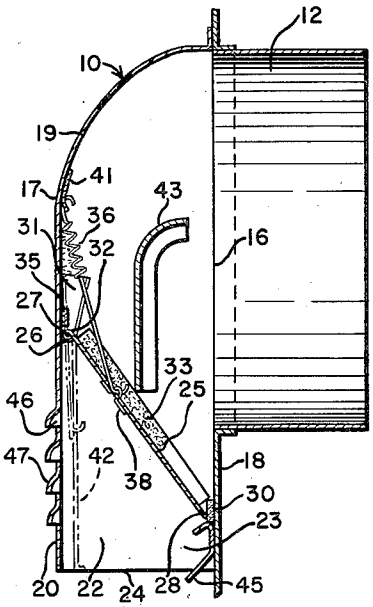



Fig-3

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# AUTOMATIC SHUTTER FOR VENTILATORS

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5 Claims. (Cl. 98—116)

This invention relates to ventilating devices, and is more particularly directed to a shutter for automatically sealing off a ventilating duct when the ventilator blower is not in operation.

The present automatic shutter is particularly adapted for use with wall ventilators of the type commonly employed to exhaust stale air from kitchens. While the shutter is disclosed in connection with such a unit, it will be understood that the present shutter can also be used advantageously in connection with a ceiling type fan in which air is exhausted through a ventilating duct interconnecting the fan and an outside wall opening. Both ceiling and wall type ventilators present the problem of sealing the outside wall opening when the exhaust blower is not in operation. If an effective seal is not provided, cold air enters the room through the fan, causing objectionable drafts and heat loss.

In the past, two basic types of ventilator shutters have been proposed; i. e. the manual type and the automatic type. The manually operated type is opened and closed each time the exhaust fan is turned on or off by manipulating a chain or other element connected to the shutter. Manually operated shutters have not proven to be completely satisfactory for several reasons. In the first place, many blowers are mounted above and behind a kitchen stove, so that the shutter actuating element is relatively inaccessible and difficult to operate. Furthermore, the control chain or the like quickly accumulates a heavy coating of grease so that both the chain and adjacent wall area become quite unsightly.

In contrast, an automatic type of damper requires no separate actuating means, rather the damper is forced open whenever the blower is operated by the stream of air exhausted by the blower. When the ventilator blower is stopped, as by manipulating a convenient wall switch, the damper is automatically returned to its closed position by a biasing element, such as, a spring or counterweight. In the past, these automatic ventilator shutters have also been less than completely satisfactory. In many cases, the shutters have not provided a weather tight seal so that especially during windy or stormy periods, objectionable blasts of cold air have entered the dwelling through the ventilator. Furthermore, on windy days previously available shutters have fluttered to such an extent that loud and objectionable noises were created.

In other cases, certain shutters have been provided with sufficiently strong biasing means in the form of a heavy spring or the like, to hold the shutter tight, but these shutters are disadvantageous since the spring or other biasing means prevents the shutter from being fully opened when the fan is in operation. Consequently, the shutter constricts the air discharge passage and substantially reduces the volume of air exhausted by the fan.

The principal object of the present invention is to provide an automatic fan shutter which does not flutter and is effective to provide a weather tight seal when the fan is not in operation; and yet, facilitates securance of a



maximum exhaust air volume when the blower is in operation.

The present invention is predicated upon the concept of providing an exhaust hood having a spring biased automatic shutter, the hood and shutter being constructed and arranged so that irrespective of the external wind conditions, the wind cannot open the shutter or cause it to flutter. More specifically, I have observed that there are two distinct types of wind conditions causing a damper to open or flutter. The first of these conditions occurs when an air stream blows against the wall on which the hood and damper are mounted. Such an air stream causes pressure to be exerted on the outer face of the damper. In previous constructions this positive air pressure overcomes the spring biasing means and forces the damper open. The second type of wind condition occurs when wind is blowing substantially parallel to the wall of a building and by a venturi effect draws air from the hood, causing a suction on the outer surface of the shutter. This reduced pressure results in the shutter's being forced open, the shutter remaining open until the pressure on the inner face of the shutter is reduced; after which the shutter closes and the flutter cycle is repeated.

The present hood and shutter construction are such that any gusts of outside air entering the hood tend to force the shutter more tightly closed, while any lateral winds are prevented from creating a vacuum within the exhaust hood. More particularly, a preferred form of ventilating hood and shutter constructed in accordance with the present invention comprises a downwardly opening hood mounted on the outside of the building wall over the fan discharge opening. A shutter is provided for automatically sealing off the discharge opening when the blower is not in operation. The shutter extends across the downwardly opening section of the hood; and is pivotally mounted along the outer wall of the hood remote from the wall opening. In its closed position, the shutter extends downwardly from its pivotal support at an angle to the outer wall, the lower edge of the shutter abutting the opposite wall of the hood. The side edges of the shutter reside in contact with resilient sealing strips mounted along the side walls of the hood. Consequently, a completely weather-tight seal is formed and no air can enter the wall opening.

The shutter is biased toward its closed position by means of a spring, one end of which is fastened to the shutter and the other end of which is secured to the outer wall of the hood above the pivotal shutter mounting. By virtue of this arrangement, the spring exerts a maximum force on the shutter when the shutter is in its closed position. When the shutter is in its open position, the spring is substantially on center and exerts only an extremely small biasing force on the shutter. When the blower is in operation, the air pressure created by the blower exhaust forces the shutter to pivot outwardly to a completely open position in which it extends adjacent to the outer wall of the hood. The shutter is readily held in this position by the relatively slight pressure of the exhausting air stream; since in its open position, the shutter is subjected to a minimum spring biasing force. However, when the blower is turned off, this small spring force urges the shutter toward its closed position; and as the shutter rotates, the spring force becomes greater so that when the shutter is completely closed it is firmly held in position under substantial spring pressure.

When the present hood and shutter are subjected to strong updrafts of wind, these updrafts cannot force the shutter open and in fact, their entire force tends to close the shutter even more tightly, since the wind urges the free end of the shutter upwardly against the inner wall of the hood. The present hood construction also in-

corporates an air deflecting strip mounted along the inner wall of the hood below the line of engagement of the damper. This deflector strip prevents any stream of air from passing between the free end of the damper and adjacent wall.

The present hood is further provided with one or more apertures, or louver openings, formed beneath the shutter. These louver openings function to prevent the creation of a negative pressure within the hood beneath the shutter in the presence of swift moving streams of air flowing across the bottom of the hood. In the present hood a portion of this rapidly moving stream of air enters the hood through the louver openings replacing air drawn outwardly through the bottom opening of the louver. The inflowing air maintains a substantially constant pressure beneath the damper so that the damper is not forced open; and a completely weather tight seal is provided irrespective of the wind condition prevailing.

A further advantage of the present hood and shutter construction is that it is extremely simple and rugged so that it provides years of trouble-free use. The shutter is formed of sufficiently heavy sheet stock so that it retains its shape even after it has been opened and closed a large number of times. While such a shutter requires a somewhat heavier spring than a lighter, more easily damaged shutter, means are provided for overcoming the additional spring force so as not to interfere with the discharge of air from the blower. As explained above, once the shutter is in its open position, the spring exerts only a minimum closing force, so that only a very small pressure is needed to hold the damper open. To aid in initially opening the shutter against the maximum spring force exerted upon it in its closed position, the present hood is provided with an arcuate air directing baffle which deflects a substantial portion of the air stream against the free end of the damper where this impinging air stream has the greatest leverage on the damper and is thereby most effective to open the damper against the spring force.

These and other objects and advantages of the present invention will be more readily apparent from the following detailed description of the drawings illustrating a preferred embodiment of the invention.

In the drawings:

Figure 1 is a side elevational view of a wall ventilator provided with a hood and shutter of the present invention, a portion of the ventilator housing being broken away to illustrate details of construction.

Figure 2 is an elevational view of the outer wall of the discharge hood.

Figure 3 is a cross sectional view taken along line 3—3 of Figure 2.

Figure 4 is a partial enlarged view of the shutter and inner wall of the hood.

As shown in Figure 1, an automatic shutter and hood unit **10** constructed in accordance with the present invention is installed in conjunction with a wall type ventilator **11**. It is to be understood, however, that the hood and shutter can also be employed with a ceiling or other ventilator which is mounted remote from an external wall of the dwelling and is connected to the wall by suitable ductwork. The particular details of the ventilator construction constitutes no part of the present invention. Briefly, however, one suitable form of ventilator comprises a cylindrical casing **12** having telescopic sections adapted to pass through a suitable opening provided in an exterior wall **13** of a building. An electric motor (not shown) and rotatable fan blades **14** are mounted in casing **12**. The inner face of casing **12** is covered by any suitable grill **15** adapted to permit air to be withdrawn outwardly from the room into the casing. The discharge opening **16** of the ventilator casing is covered by a hood **17** which includes an arcuate section **19** extending over the discharge opening and an inner wall **18** in engagement with the outer surface of the house wall.

Discharge hood **17** is preferably formed of sheet metal,



and in addition to inner wall **18**, includes an outer wall **20** extending parallel to wall **18** and two side walls **21** and **22** interconnecting the inner and outer walls to form a downwardly directed discharge passageway **23** of substantially rectangular configuration. The bottom **24** of the hood is open to permit air to be exhaused in a downward direction from the hood as indicated by the arrows in Figure 1.

A shutter, or damper **25**, is mounted within the hood for sealing off the discharge opening from the outside air when the blower is not operating to prevent cold outside air from entering the building through the ventilating unit. This shutter is formed of sheet metal which is preferably galvanized or otherwise treated to render it corrosion resistant. Shutter **25** is of rectangular configuration and includes a rolled upper edge **26** adapted to receive an elongated pin **27** for pivotally supporting the upper edge of the shutter. The free edge of the shutter is configurated to include a right angle flange **28** adapted for sealing engagement with a resilient sealing strip **30**, formed of felt or the like, mounted along the inner surface of wall **18** of the hood.

In the preferred embodiment, the upper edge of the shutter is mounted well up within the hood in line with the discharge opening of the ventilator. Pivot pin **27** is journaled in mounting brackets **31** which are welded or othewise secured to side walls **21** and **22** of the hood and are provided with suitable hinge pin receiving apertures **32**. In its closed position, as shown in Figure 3, the shutter extends downwardly at an angle across the discharge hood with the free end of the shutter residing in engagement with resilient strip **30** at a point slightly below discharge opening **23** of the ventilator. When the shutter is in this position its side edges abut sealing strips **33** adhesively secured to the inner surface of side walls **21** and **22**. A fourth sealing strip **35** is preferably mounted on the outer wall **20** directly above rolled edge **26** so that when the shutter is closed, a substantially weather tight seal is provided.

The shutter is biased toward its closed position by means of coil springs **36**. One end of this spring is joined to the shutter, preferably in the upper portion thereof, by means of a cotter pin **38** which receives the lower end of the spring and passes through a suitable aperture **40** provided in the shutter. The upper end of the spring engages an aperture formed in bracket **41** secured to the outer wall **20** of the hood above the pivotal connection of the hood and shutter. It is readily apparent that spring **36** exerts a maximum closing force upon the shutter when the shutter is in its closed position as shown in Figure 3. When the shutter pivots to its open position, indicated by dotted lines **42** in Figures 1 and 3, the spring is substantially on center and exerts only a minimum force tending to close the shutter.

Spring **36** stretches when the shutter or damper **25** swings from the closed position, shown in full lines in Figure 3, to the open position, shown in dot-dash lines in this figure. Under any circumstances, the stretching of a spring increases its tension. In the present instance, the tension of the spring does increase progressively from the closed position to the open position, but it may be seen that the spring is not elongated to any great extent in moving from one position to the other and the increase is not a substantial one. Actually, in the ventilator shown, this increase has little significance; because it is more than offset by other forces which become effective as the result of changes in the relative positions of the plane of the shutter and the line upon which the spring exerts its force. Resolving the force of the spring into two components, one extending along the plane of the door toward the pivot pin **27** and the other extending up toward the right, as shown in Figure 3, along a line at right angles to the plane of the door, it will be seen that the first force directed toward the pivot pin is absorbed at the pin and that the second force (the

force tending to close the shutter) is the only effective one of the two. The first force, against the pin, increases as the shutter swings open. The second force, tending to close the shutter, decreases as the shutter swings open. The second force is greatest when the angle between the plane of the door and the line of the spring is greatest. This occurs when the shutter is closed. The second force is smallest when the angle between the plane of the door and the line of the spring is smallest, and this occurs when the door is open. The tension of the spring increases progressively as the door swings open, but this increase is small. The significant fact is that more and more of the spring's force is directed toward the pivot pin during opening movement, so that the force exerted upon the shutter tending to close it decreases progressively from closed to open position; and, when the open position is reached the closing force is so small that it has little effect upon the passage of air past the shutter.

The interior of the hood also houses an air directing vane **43**. This vane is of arcuate shape and is welded or otherwise secured to the two side walls of the hood. The upper edge of the straightening vane is preferably aligned with the central area of the discharge opening **16** while the bottom edge of the straightening vane is disposed adjacent to the central portion of the shutter when the shutter is in its closed position. The function of the air straightening vane is to deflect the air downwardly against the free end of the shutter, where because of the large leverage available, the air pressure exerts a maximum force upon the shutter to open that member when the fan is placed in operation.

The hood is also provided with one or more air deflectors **45** mounted upon inner wall **18** of the hood. One of the deflectors is disposed adjacent to the resilient strip **30** engaged by the free end of the shutter. This deflector strip extends at an angle downwardly away from the wall to permit the strip to be placed closely adjacent to the end of the shutter. Deflector **45** functions to deflect any updraft of outside air away from the line of contact of shutter flange **28** and resilient strip **30**. This prevents air from slipping under flange **28** and opening the shutter.

Outer wall **20** of the hood is provided with a plurality of vertically spaced pressure equalizing apertures or louver openings **46** disposed beneath the pivotal connection of the shutter and wall. These louver openings are preferably punched from the housing wall in such a manner that arcuate louvers **47** extend outwardly over the openings to prevent entrance of rain, snow or the like into the hood.

When the blower is not in operation, shutter **25** is normally held closed due to the force exerted by spring **36**. As explained above, due to the engagement of the peripheral portions of the shutter with the flexible sealing strips, a substantially weather tight seal is obtained, preventing passage of sold air through the ventilator into the room. If a strong gust of wind blowing toward the house wall should be encountered, causing an updraft within the hood, this updraft contacts the entire undersurface of the shutter and urges that member into even tighter sealing engagement with the sealing strips. Air is prevented from passing between the free end of the shutter and inner wall **18** by deflector **45**. If on the other hand, a strong transverse gust of wind, blowing parallel to the house wall, is encountered the air pressure in the hood beneath the shutter is not lowered since a portion of the air stream enters the hood through the pressure equalizing openings to replace any air drawn outwardly from the bottom of the hood by the venturi action of the flowing stream. Consequently, the present shutter remains tightly sealed under any weather conditions and does not flutter or rattle.

When the ventilating fan is started, as by actuating a suitable wall switch or the like, air is drawn outwardly from the room through inlet grill **15** and is discharged through opening **16**. A substantial portion of the air



stream strikes air straightening vane **43** which deflects the air downwardly against the free end of the shutter. This air pressure acts on a maximum lever arm and forces the shutter to pivot clockwise to the open position as shown in Figure 3. As the shutter pivots toward its open position the restoring force of the spring rapidly decreases so that only a minimum pressure is required to hold the shutter adjacent to the outer wall wherein its does not impede air discharge.

Having described my invention, I claim:

1. A ventilator unit adapted to be used in conjunction with a fan to exhaust air from a building, said unit comprising a mounting plate adapted to be secured to the exterior of a building, a substantially large opening in said mounting plate, a duct secured to said plate at the opening and adapted to direct air exhausted from the building by the fan outwardly through the opening, a hood secured to the outside of said plate surrounding said opening and including side walls, an inner wall and an outer wall, the outer wall extending outwardly and downwardly away from the mounting plate to define with the two side walls and the inner wall a vertical passageway which is substantially rectangular in cross section and which opens to the atmosphere below the opening, a rectangular shutter in the passageway, means hinging the shutter to the outer wall of the hood on a horizontal line which is opposite to said opening for swinging movement between an open position in which the shutter extends downwardly substantially parallel to the outer wall and a closed position in which the shutter is angulated downwardly across the passageway with its free edge in contact with the inner wall along a horizontal line which is below the opening, an elongated coil spring having one end thereof attached to the outer wall of the hood at a point substantially above the hinged edge of the shutter and having the opposite end thereof fastened to the shutter at a point which is closer to the hinged edge thereof than it is to the free edge thereof, the spring being under tension when the shutter is in closed position to hold the shutter in said position against the pull of gravity, and a deflector vane mounted within the passageway and disposed to direct a substantial portion of the air issuing from the opening downwardly against the portion of the shutter which is adjacent to the free edge thereof to exert the greatest leverage force thereon tending to swing the shutter toward the open position, in which position the axis of the spring is substantially aligned with the plane of the shutter so that a minimum amount of resistance to the flow of air is offered by the shutter.

2. A ventilator unit adapted to be used in conjunction with a fan to exhaust air from a building, said unit comprising a mounting plate adapted to be secured to the exterior of a building, a substantially large opening in said mounting plate, a duct secured to the inner face of said plate at the opening and adapted to direct air exhausted from the building by the fan through the opening, a hood secured to the outside of said plate surrounding said opening, said hood including side walls, an inner wall and an outer wall, the outer wall extending outwardly and downwardly away from the mounting plate to define with the two side walls and the inner wall a vertical passageway open to the atmosphere below the opening, a shutter in the passageway, means hinging the shutter to the outer wall of the hood for swinging movement between an open position in which it is substantially parallel to the outer wall and a closed position in which it is angulated downwardly across the passageway with its free end in contact with the inner wall, a spring having one end attached to the upper face of the shutter and having the opposite end thereof fastened to the outer wall of the hood at a point substantially above the shutter, said spring being disposed relative to the closed shutter such that the angle between the axis of the spring and the plane of the shutter is less than 45 degrees,

whereby more of the spring's force is exerted against the means hinging the shutter to the outer wall of the hood than is exerted upon the shutter tending to close it, and whereby the latter force upon the shutter decreases from the closed position of the shutter to the open position of the shutter, in the latter position said spring being substantially aligned with the plane of the shutter such that the force of the spring tending to close the shutter is at a minimum, and a curved deflecting vane extending across the passageway between the side walls of the hood and being disposed with the concave face thereof positioned to intercept air issuing from the lower portion of said opening and to direct said air downwardly against the portion of the shutter adjacent to the free edge thereof to exert the greatest leverage on the shutter to swing it open against the holding force of the spring.

3. A hood and an automatic damper unit for a ventilator fan, said hood being adapted for mounting on the exterior of a building in communication with said ventilator fan, said hood having an inner wall disposed adjacent to the building, an outer wall spaced from the inner wall, side walls interconnecting the inner and outer walls to define a downwardly directed air discharge passageway, a shutter disposed within said hood, means pivotally mounting one edge of the shutter to the outer wall of the hood for pivotal movement between an open position in which the shutter extends down along said outer wall and a closed position in which the shutter slants downwardly across the passageway with the free edge thereof in contact with said inner wall, an elongated coil spring having one end thereof attached to the outer wall of the hood at a point substantially above the pivoted edge of the shutter and having its opposite end attached to the shutter, said spring being under tension when the shutter is in its closed position to hold said shutter in the closed position against the pull of gravity, and a deflector vane within the hood above the shutter positioned to deflect a substantial portion of the air issuing from the fan downwardly against the portion of the shutter which is adjacent to the free edge thereof to exert the greatest leverage force on the shutter to open it against the tension of the spring.

4. In a ventilator hood adapted to be used in conjunction with a fan to exhaust air from a building, said hood having a downwardly directed passageway which is open to the atmosphere, an automatic damper unit to prevent the entrance of outside air into the building through said passageway, said damper unit comprising a shutter, means to hinge one edge of the shutter to a side of the hood within said passageway such that the shutter is adapted to swing from a closed position in which it extends downwardly at an angle across the passageway with its free edge in contact with the opposite side of the hood in the passageway to an open position in which it hangs substantially straight down from said hinged edge, an elongated coil spring having one end attached to the wall of the



hood at a point substantially above the hinged edge of the shutter and having the lower end thereof attached to the upper face of the shutter at a point which is nearer to said hinged edge than it is to said free edge of the shutter, said spring being under tension when the shutter is in closed position to hold the shutter closed against the downward pull of gravity, and a directing vane within said hood adapted to intercept air issuing from the fan and to direct said air toward the portion of the shutter adjacent to the free edge thereof to exert the greatest leverage force upon the shutter to open it against the tension of the spring.

5. A ventilator unit adapted to be used in conjunction with a fan to exhaust air from a building through an opening, said unit comprising a hood adapted to be mounted at the outside of the building surrounding said opening, said hood including side walls, an inner wall, and an outer wall, the outer wall extending outwardly and downwardly to define with the two side walls and the inner wall a vertical passageway which opens to the atmosphere below said opening, a shutter in the passageway, means hinging the shutter to the outer wall of the hood on a horizontal line for swinging movement between an open position in which the shutter extends downwardly substantially parallel to the outer wall and a closed position in which the shutter is angulated downwardly across the passageway with its free edge in contact with the inner wall, an elongated spring having one end thereof attached to the outer wall of the hood at a point substantially above the hinged edge of the shutter and having the opposite end thereof fastened to the upper face of the shutter, the spring being under tension when the shutter is in said closed position to hold the shutter in said position against the pull of gravity, the point of attachment for the upper end of the spring being related to the hinged edge of the shutter such that when the shutter is in open position the effect of the spring's tension upon the shutter tending to close it is at a minimum, a deflector vane mounted within the passageway above the shutter and disposed to direct a substantial portion of the air issuing from the opening downwardly against the portion of the shutter which is adjacent to the free edge thereof to exert the greatest leverage force thereon tending to open the shutter against the tension of the spring.

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