

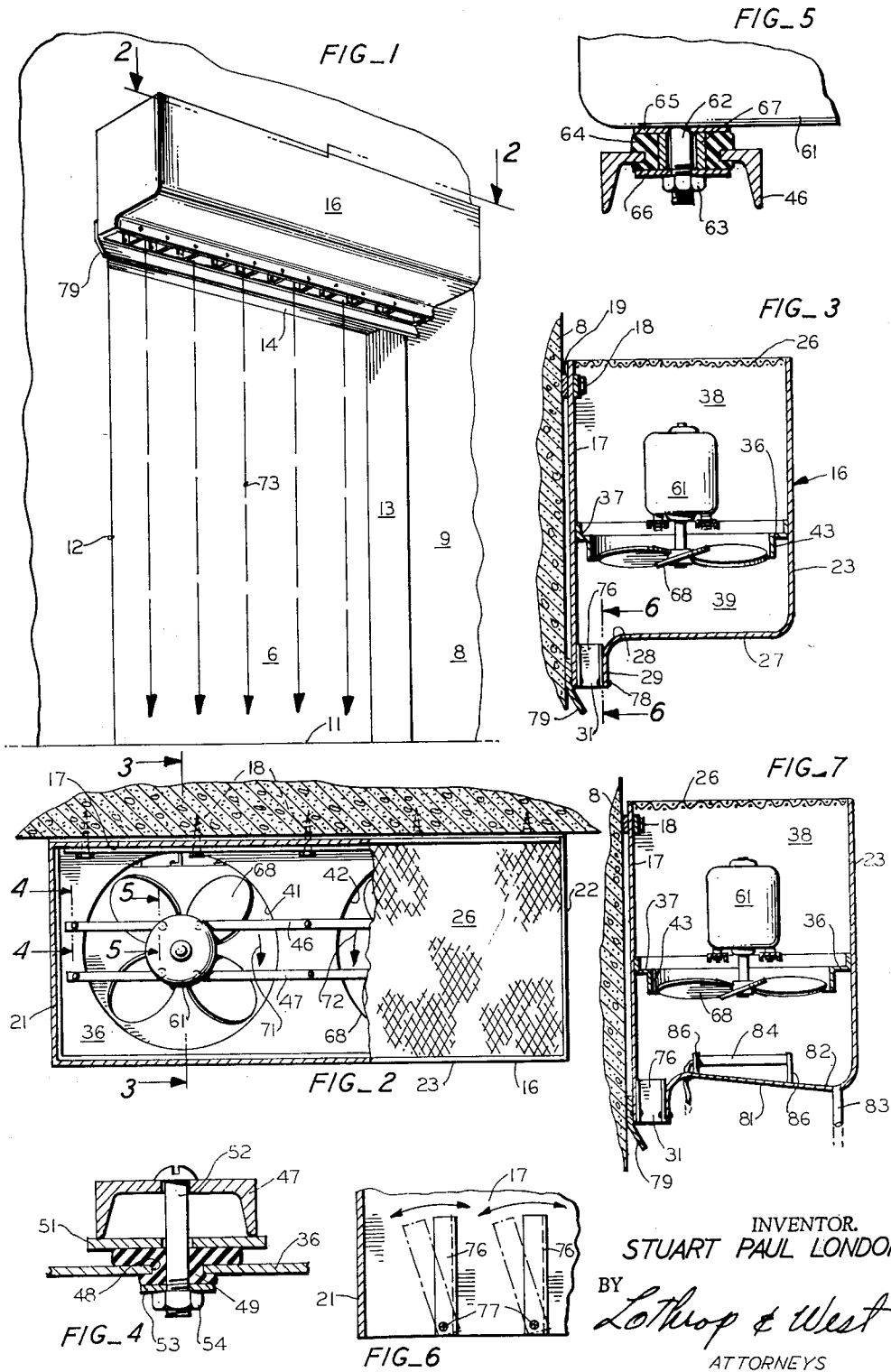
April 23, 1963

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3,086,441

AIR CURTAIN DEVICE

Filed Oct. 6, 1961



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3,086,441

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Filed Oct. 6, 1961, Ser. No. 143,456
7 Claims. (Cl. 98—36)

My invention relates to means for providing a curtain of air over an opening such as a doorway and is of the class of devices shown in the copending application of Eugene Larson, Serial No. 53,456 filed September 1, 1960, and entitled Air Curtain Device for Doorways.

In many different locations it is necessary to have an enclosure such as a building with an access door which must be left open. In such an environment it is essential to keep out extraneous contaminating elements such as flies or insects. Sometimes the enclosure is a cold room and it is desirable to keep the outside atmosphere from entering the room in order to preclude excessive formation of frost. In hospitals it is often desirable to afford an air screen in order to prevent substantial transfer of atmospheric elements from one room into another while leaving an open passage between them.

For installations such as the foregoing and for other instances in which it is desired to provide an effective barrier between different rooms yet to afford ready access by people and equipment therebetween, the invention provides an air curtain of considerable effectiveness. The air curtain is produced by an air circulating mechanism.

It is therefore an object of the invention to provide an air curtain mechanism readily installed in or on existing structures with a simple technique and effective when installed to afford a satisfactory air curtain.

Another object of the invention is to provide an air curtain device which will move a substantial quantity of air yet will be relatively quiet and reliable in its operation and will require a small amount of supervision and maintenance.

Another object of the invention is to provide an air curtain device in which the driving power is efficiently utilized.

Another object of the invention is to provide an air curtain device especially useful in connection with cold rooms and capable of operating without deleterious frost.

Another object of the invention is in general to provide an effective, versatile, economical and reliable air curtain device.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings in which:

FIGURE 1 is a perspective view showing an air curtain device constructed in accordance with the invention and installed over a conventional doorway;

FIGURE 2 is a cross section, the planes of which are indicated by the lines 2—2 of FIGURE 1;

FIGURE 3 is a cross section, the plane of which is indicated by the line 3—3 of FIGURE 2;

FIGURE 4 is a cross sectional detail, the plane of which is indicated by the line 4—4 of FIGURE 2;

FIGURE 5 is a cross sectional detail, the plane of which is indicated by the line 5—5 of FIGURE 2;

FIGURE 6 is a fragmentary view showing a few of the vanes in cross section, the plane of section being indicated by the line 6—6 of FIGURE 3; and

FIGURE 7 is a cross sectional view comparable to FIGURE 3 but showing a modified form of device.

While the field of application of the air curtain device is very wide, it is especially described herein as it is installed in connection with a doorway between an outer area at normal atmospheric conditions and an inner room at a low temperature so that the atmospheric air in enter-

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ing the low temperature room cools and leaves condensate within the cold room.

The cold room 6 is separated from the outside 8 by a building wall 9 having an opening therein defined by the floor 11, a pair of side walls 12 and 13 and a top wall 14. This is the customary opening provided in the building. Pursuant to the invention, a housing 16 is installed on the wall 9. The housing includes a rearward side 17 at least some of which can be considered as a mounting wall. This is preferably a rectangular plate or sheet of light metal having sufficient strength and stiffness to receive removable fastenings 18 passing through the rearward side 17 into the building wall 9. If desired, spacers 19 provide an appropriate setting of the housing to clear any irregularities there may be in the surface of the building wall.

The housing 16, in addition, has a pair of vertically extending planar side walls 21 and 22 and also has a planar, vertically extending front wall 23 to afford an enclosure rectangular in plan. Customarily, all of the housing parts are fabricated of similar material. The enclosure is defined at the top by a removable screen 26 of the usual configuration and appropriately seated in a horizontal plane.

The housing is further enclosed by a bottom wall 27. This conveniently is a continuation of the sheet that constitutes the front side 23 and extends in a horizontal plane from a curved merger with the front side 23 toward the rearward side 17. The bottom wall 27 as it approaches the rearward side is curved downwardly through an arcuate portion 28 and provides a vertically extending wall 29 parallel to the lower portion of the rearward side 17. The wall 29 extends for substantially the full dimension of the housing to define a relatively narrow, elongated discharge opening 31 or nozzle.

Disposed within the housing is a diaphragm wall 36 having an edge flange 37 abutting and secured to the four sides of the housing. This establishes a transverse, planar barrier between the upper screen 26 and the bottom wall 27 and divides the housing interior into an upper chamber 38 and a lower chamber 39. The diaphragm wall is continuous and forms a complete closure except for a plurality of fan openings 41 and 42. These are circular, are nearly tangent to the front side 23 and the rear side 17 and are reinforced and further defined by shroud bands 43. The fan openings 41 and 42 are for the most part out of vertical registry with the elongated discharge opening 31, as seen in the left-hand side of FIGURE 2.

Extending for almost the entire length of the housing is a pair of supporting beams 46 and 47. These conveniently are inverted channels as shown in FIGURE 4 and at their ends and intermediate their ends are supported on the diaphragm wall 36. The support of the beams is indirect in order to reduce the transmission of vibration between the beams and the housing.

As especially shown in FIGURE 4, the diaphragm 36 at appropriate points is provided with openings 48 through which rubber grommets 49 are installed. When unstressed, the grommets are T-shaped in cross section and have a central tube. Disposed between the grommet head and spanning the flanges of one of the beams 46 and 47 is a washer 51. Extending through the pierced beam and through the washer and grommet is a threaded bolt 52 having a suitable washer 53 and nut 54 thereon. After initial installation with the tubular portion of the grommet extending through the diaphragm wall 36, the nut 54 is tightened on the bolt. This not only moves the washer 53 upwardly, but also deforms and partially extrudes the grommet into the shape shown in FIGURE 4. There is then grommet material on both sides of the diaphragm 36 and no metal-to-metal contact. The beam, such as 47, is thus firmly supported and positioned, yet

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the transmission of vibration between the beam and the diaphragm is greatly reduced.

The beams 46 and 47 are designed to support a pair of driving motors 61 arranged with their rotational axes vertical and parallel. Each of the motors 61, as shown particularly in FIGURE 5, rests on the two subjacent beams 46 and 47 through an insulating support. Depending from the motor 61 is a plurality of threaded studs 62 having nuts 63 at their ends gripping rubber sleeves 64. Washers 65 and 66 and a spacer 67 are interposed so that the sleeve 64 is well confined and the motor is well mounted. The transmission of vibration between the motor and the beams is reduced. Because vibration from the motor to the beams and from the beams to the housing must pass through two separate insulating devices, the vibration of the motor is not deleteriously imposed upon the housing.

Each of the motors 61 carries a radial blade axial flow fan 68, sometimes called a propeller fan, of a diameter substantially to fill the fan opening 41. The tips of the fan blades run close to the shroud band 43 near the lower edge thereof. The motors and fans are arranged so that the adjacent tips of the fans operate in the same direction; that is, if the left-hand fan in FIGURE 2 operates clockwise in the direction of the arrow 71, the other fan operates counterclockwise in the direction of the arrow 72.

When the motors are supplied with electricity and rotated, air is drawn in from the top screen 26, passes downwardly over the motors 61 and then passes under the urgency of the fans through the fan openings 41 and 42 to be discharged into the lower chamber 39. The air therein is deflected by the bottom wall 27 toward the discharge opening 31 and is discharged with a strong vertically downward component from the opening 31 substantially as shown by the broken arrows 73 in FIGURE 1. There is thus established a relatively narrow, well-defined curtain of relatively high velocity air descending from the housing 16.

It is usually preferred to provide a means for changing the direction of the downward flow of discharging air. This is accomplished by providing in the elongated discharge opening 31 a plurality of vanes 76. These are conveniently sheet metal elements channel-shaped in cross section and are rotatably secured by aligned rivets 77 and 78 to the rearward side 17 and to the front side 29. The flanges of the channel vanes engage the adjacent walls with sufficient friction so that unless manually pivoted they stay in any set position, as illustrated in FIGURE 6. Some or all of the vanes can be inclined to deflect the air to one side or the other of the opening and to afford a somewhat wider curtain than otherwise would be the case.

In some instances it is also desirable to have the down-flowing air curtain 73 deflected outwardly. There is then less tendency for the air curtain to flow into the interior of the building 9 after striking the floor 11. For this purpose, the housing is supplemented by a lower strip 79 inclined downwardly and outwardly. The downwardly discharging air is given an outward component. When the outwardly deflected air curtain strikes the floor 11, it tends to flow outwardly away from the enclosure. This is of particular use in preventing the incursion of moist air into a relatively cold room.

In the cold room environment sometimes a good deal

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of frost from condensing and frozen atmospheric moisture deposits on the blades of the fans 68. This reduces the effectiveness of the fans and so the effectiveness of the whole device. Under these special circumstances I provide an arrangement as shown in FIGURE 7 in which the bottom wall 81 of the housing is not generally horizontal but inclines downwardly and forwardly to a low point 82 at which a drain opening 83 is provided for discharge. Water deposited on the interior walls of the housing drains down by gravity and under the influence of the flowing air and is largely trapped, drained and discharged through the opening 83.

Under some severe conditions, this arrangement is augmented by an electric heater 84 mounted on brackets 86 extending upwardly from the lower wall 81 and in a position beneath the fans. The fan blades are so heated to a temperature such that while water may be condensed thereon and may be centrifugally or axially discharged, the water is at too high a temperature to form frost or ice.

What is claimed is:

1. An air curtain device comprising a housing, said housing having an open top and closed sides, said housing having a substantially planar bottom curved downwardly near the rear side of said housing to define a narrow elongated discharge opening having vertical walls, a plurality of transverse vanes extending between said vertical walls, a substantially horizontal solid diaphragm joined to said sides and spanning the interior of said housing, said diaphragm having fan openings therein, beams spanning the interior of said housing, means for supporting said beams on said diaphragm, a plurality of driving motors having shafts, means for supporting said motors on said beams with said shafts in axial alignment with said fan openings, and propeller fans on said shafts of said motors and disposed in said openings.

2. An air curtain device as in claim 1 in which said vanes are rotatable on horizontal axes relative to said housing.

3. An air curtain device as in claim 1 which said beam supporting means and said motor supporting means include vibration absorbers.

4. An air curtain device as in claim 1 in which the rotational axes of said motors and fans are substantially vertical.

5. An air curtain device as in claim 1 in which said discharge opening and said fan openings are substantially out of vertical registration.

6. An air curtain device as in claim 1 in which there are two driving motors and propeller fans rotatable in opposite directions.

7. An air curtain device as in claim 1 in which said diaphragm is substantially planar and in which said propeller fans are disposed in said openings approximately coplanar with said diaphragm.

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