July 25, 1967 H. MELZER 3,332,334

AIR CURTAIN APPARATUS

Filed Aug. 9, 1965 2 Sheets-Sheet 1

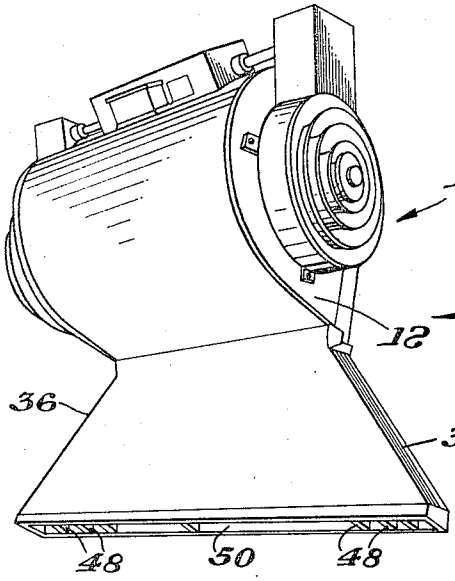

Fig. 1.

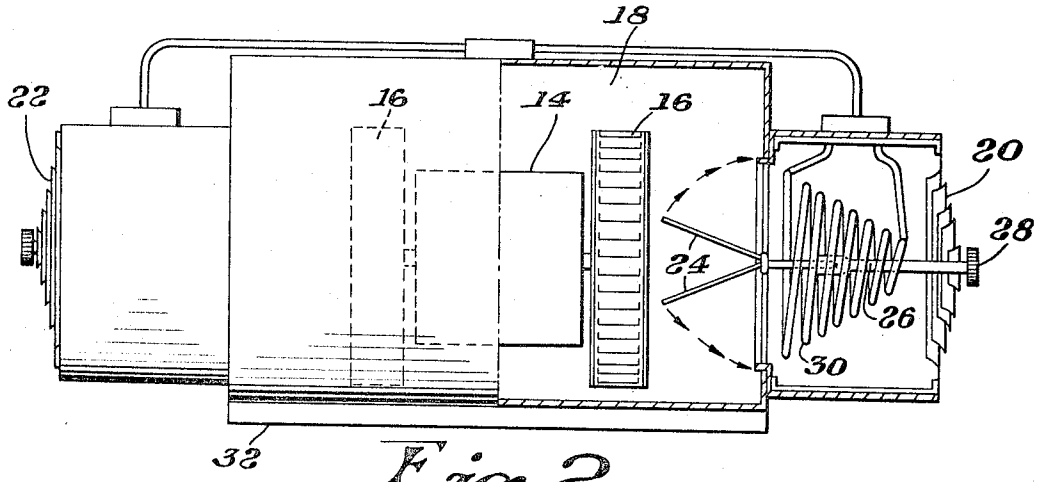

Fig. 2.

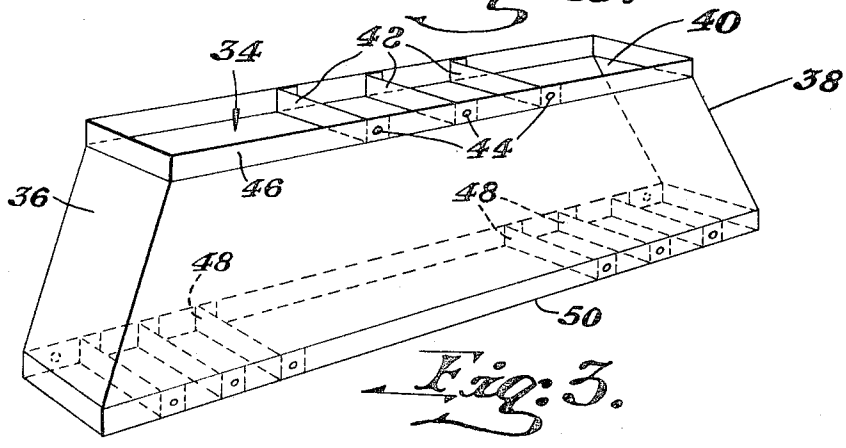

Fig. 3.

July 25, 1967 H. MELZER 3,332,334

AIR CURTAIN APPARATUS

Filed Aug. 9, 1965 2 Sheets-Sheet 2

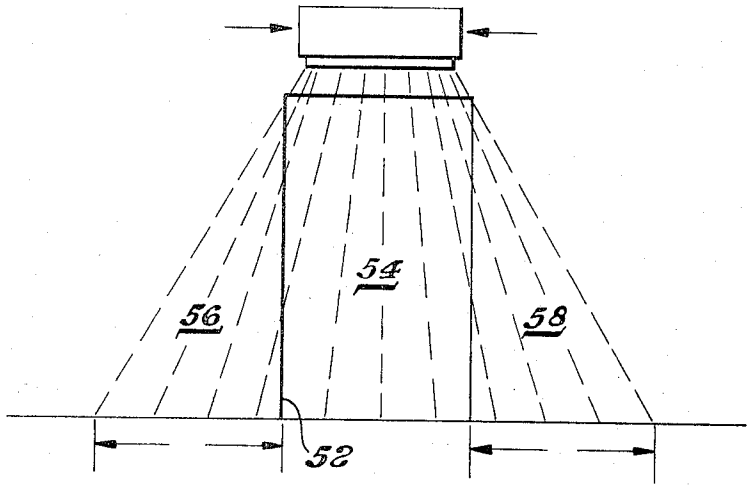

Fig. 4.

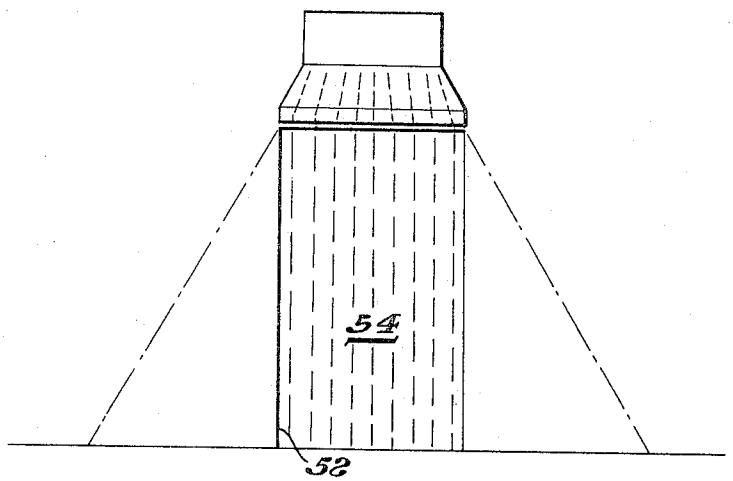

Fig. 5.

United States Patent Office 3,332,334 Patented July 25, 1967

3,332,334

AIR CURTAIN APPARATUS

Herman Melzer, 2109 Gordon Ave., McKeesport, Pa. 15132

Filed Aug. 9, 1965, Ser. No. 478,075
2 Claims. (Cl. 98—36)

This invention relates to an improved air curtain apparatus, and more particularly, to an improved air curtain apparatus in which the air curtain can be easily and effectively adapted for a variety of sizes and access openings.

The principle of generating an air flow which is directed across a doorway to serve as a barrier against the passage of heat, insects, pollen, etc., has now been quite well established. However, many access openings are not constructed with the view in mind of eventually having an air door and therefore many such access openings, doors, and the like cannot readily be fitted with an air barrier-generating device because the air barrier-producing device tends to be of a standard size and shape, intended to fit a majority but not all of doorway openings, etc. In the event of an irregular or nonstandard opening, it is difficult to use such standard air curtain devices.

The principle of an air door is that the entire outline of doorway or other access opening must be traversed along one side with a stream of air which is flowing at the appropriate rate and of the appropriate thickness. Should there occur any discontinuities in the stream along the uncovered outline portion, there will be a flow of heated or cooled air through the doorway or access will be permitted for entry of pollen, dirt, insects, etc., and the entire purpose of the air barrier will be defeated or compromised. Consequently, the entire cross sectional area of the doorway, along one side thereof, must be covered with an air flow.

Accordingly, one of the principal objects of the present invention is to provide means whereby a standard construction of air curtain can be readily adapted for various size doorways and other access openings so that all portions of such openings can be covered with a flow of air which is moving at the desired speed and direction as well as having the appropriate shape and dimension including depth and outline.

It is a still further object of the present invention to provide a device which is capable of shaping an air flow to the desired dimension and location in relation to a given size doorway opening and in this way increase the utility of the air barrier-generating apparatus.

A still further object of the present invention is to provide an inexpensive, readily mountable and demountable accessory which can be installed on an air curtain device to shape and direct its flow in relation to a given doorway opening and which is inexpensive to produce and install. It is an important feature of the invention that such accessory effects its shaping and directing of the flow of air without substantially impeding the flow and thereby requiring increased power output from the device.

It is an overall object of the present invention to provide an economical but highly effective means for shaping and directing air curtain flow requirements and necessitating only a small space so that it can be fitted within the area available between the upper part of the doorway and the overhead ceiling.

It is also an important feature of the present invention that an accessory can be provided in conjunction with an air curtain which is readily adjustable so as to shape and direct the flow in accordance with the doorway or access opening.

Other objects and features of the present invention will become apparent from a consideration of the following

description, which proceeds with reference to the accompanying drawings, wherein:

FIGURE 1 is an isometric view of an air curtain device incorporating the present invention therein;

FIGURE 2 is a partial fragmentary view illustrating a part of the interior components of the device illustrated in FIGURE 1;

FIGURE 3 is an isometric view of the device for shaping the air flow to fit the access opening, this structure being shown detached from the air curtain device in FIGURES 1 and 2; and,

FIGURES 4 and 5 are schematic views illustrating the air pattern flow; in the prior art in FIGURE 4, and in its improved form in FIGURE 5.

Referring now to the drawings, air curtain device, designated generally by reference numeral **10**, includes a volute casing **12**, wherein is mounted a motor **14** which drives pumping elements **16**, one on each side thereof, to inflate the interior of the volute chamber **18**. The chamber **18** serves as a plenum for maintaining superatmospheric pressure and a supply of air is provided from inlets **20**, **22**, one at each side of the apparatus. The effective size of the openings for the inlets can be regulated by adjustable barriers **24**, positioned by means of a threaded stem **26** and operated by a knob **28**.

As the air flows into the plenum chamber **18**, it moves past heating coils **30**. For details of heating the air flow as well as adjustment of the rate of air flow, reference may be made to my copending application, No. 385,729, filed July 28, 1964, now Patent No. 3,294,005, entitled, "Apparatus for Providing an Air Barrier."

When the air flow discharges through rectangular opening **32**, it enters a guide channel **34** having outwardly diverging sides **36**, **38**, the rectangular opening **40** matching in general outline and dimension with the opening **32**. Where the air discharges from opening **32** and enters channel **34**, there are a plurality of transverse adjustable vanes **42** which are pivotally secured at their opposite ends on pin connections **44** with flanges **46** permitting the angularity of the vanes to be adjusted and thereby direct the flow of air and distribute such flow substantially evenly throughout the cross section of the opening **34**. As the air continues to move downwardly in channel **34**, its cross section is elongated until it exits from the guide channel **34**. There are a second series of adjustable vanes **48**, one group at each of the opposite ends of discharge nozzle or slot **50** of the channel **34**.

The described reshaping of the flow of air is something that can be accomplished as to cross section and width, but its uniformity of cross sectional density of flow or distribution is retained substantially constant. That is, the rate and quantity of flow, per cross sectional unit area, is substantially constant at the point of discharge from slot **50**. The flow is directed across the doorway, and is, at the point of discharge, not less than the width of the doorway, so that as it flows across the opening, there are no uncovered portions of the doorway through which air, foreign matter, pollen, insects, etc., can penetrate.

From FIGURE 3, it will be seen that the entirety of the flow of air is subjected to shaping by the vanes **42**, **48**, one series of vanes **42** being at the upper end, and the lower series of vanes **48** being displaced laterally in order to provide guiding and shaping to the entire air flow. The adjustments are effected by angularly setting the various vanes **42**, **48**, so that as the air moves through channel **34**, it will flow in the prescribed directions such, that at the time of leaving discharge nozzle **50**, it will have increased in dimension but will be of uniform flow rate throughout its cross section and its dimension is matched with that of a doorway or other access opening to competely traverse the outline of the doorway. There

is consequently no opportunity for penetration by foreign material, pollen, dirt, insects, or movement of air through the doorway at any uncovered portions.

It is, of course, possible to provide a number of different size channel structures 34 which can be selectively coupled to opening 32 and in this way, the range and versatility of the air curtain-producing apparatus can be increased.

It is an important feature of the structure described, that the channel structure 34 can effect a reshaping of the flow of air without substantially impeding its direction or rate of movement. That is, the reshaping is a gradual process unaccompanied by sudden or violent directional changes whereby the flow of air is relatively smooth and is essentially a laminar type flow and is characterized in that the reshaping of the air flow is accomplished without consuming substantial power; and, therefore, with the same size motor 14 and pump element 16, a satisfactory rate of flow can be provided to serve as an effective air barrier; even the cross sectional thickness of the air barrier flow has been reduced in the process of its elongation.

Adjustment of the vanes 42 can either be accomplished previous to coupling to the outlet nozzle 32 or the adjustment can take place after installation as well as adjustment of the vanes 48.

Referring to FIGURE 4, if the outlet flow of air is not controlled, a substantial portion of the air flow is ineffective. Referring to the apparatus designated by reference numeral 10, the air-flow is divergent and the triangular areas covering the wall on either side of the jamb 52 of doorway opening 54 are ineffective. The area constituted by triangular portions 56, 58, is approximately the same as the area of doorway 54 and, therefore, only one-half of the total flow is effective for sealing the doorway 54.

Referring now to FIGURE 5, the same air flow is confined essentially to the area of the doorway, the areas 56, 58, are eliminated so that the density of flow is approximately doubled and in this way, the depth of air flow is increased, thus increasing the efficiency of the air curtain seal. By more closely confining the air flow, I improve the overall efficiency of the device 10, since generally speaking, the greater the depth of the air curtain flow, the more effective is its function of sealing the doorway against penetration of insects, pollen, dirt, etc., or by passage of air through the doorway. The greater confinement of air flow at the prescribed outline of the doorway is a direct consequence of the present invention utilizing as it does the channel 34.

Although the present invention has been illustrated and described in connection with a single example embodiment, it will be understood that this is illustrative of the invention and is by no means restrictive thereof. It is reasonably to be expected that those skilled in the art can

make numerous revisions and adaptations of the invention, and it is intended that such revisions and adaptations will be included within the scope of the following claims as equivalents of the invention.

What is claimed is:

1. An apparatus for producing an air curtain of substantially uniform density and air flow rate which is directed across a doorway in substantially the same outline as said doorway, comprising: a rotatable pump having an inlet for generating a substantially continuous superatmospheric pressure outflow of air, a volute cross section plenum chamber which is pressurized to above atmospheric pressure by said pump, means for mounting said pump internally of said plenum chamber, said mounting means being disposed at a location which is in non-interferring position with the flow of said air, an air outlet of a rectangular configuration forming a discharge opening of said plenum chamber, means forming a downwardly extending, diverging chamber connecting said discharge opening with the interior of said plenum chamber, means extending transversely of the cross section of said diverging chamber for directing the outflow of air from within said last mentioned means whereby the flow of air is substantially evenly distributed through the cross section thereof, a plurality of adjustable means at the outlet of said tapering channel whereby the direction and intensity of air flow is shaped and directed across an access opening to form the air barrier and an adjustable means controlling the inlet flow of air which is continuously drawn into said plenum chamber for compression by said pumping means to effect above atmospheric pressure interiorly of said chamber which is balanced at an equilibrium pressure by the outflow of air forming said barrier.

2. The apparatus in accordance with claim 1 including a plurality of adjustable means disposed within said diverging means adapted to shape the flow of air therein to an outwardly and then vertically downwardly directed flow of air forming a barrier to the passage of heat or foreign material through said opening.

References Cited

UNITED STATES PATENTS

3,023,688	3/1962	Kramer	98—36
3,157,105	11/1964	Tamm et al.	98—36
3,215,058	11/1965	Anderson	98—36
3,256,798	6/1966	Melzer	98—36

FOREIGN PATENTS

910,942	11/1962	Great Britain.
560,893	4/1957	Italy.

ROBERT A. O'LEARY, *Primary Examiner.*

W. E. WAYNER, *Assistant Examiner.*