July 23, 1940. F. HONERKAMP 2,209,121

FLUID DISTRIBUTING DEVICE

Filed Dec. 31, 1938 2 Sheets-Sheet 1

Fig. 1.

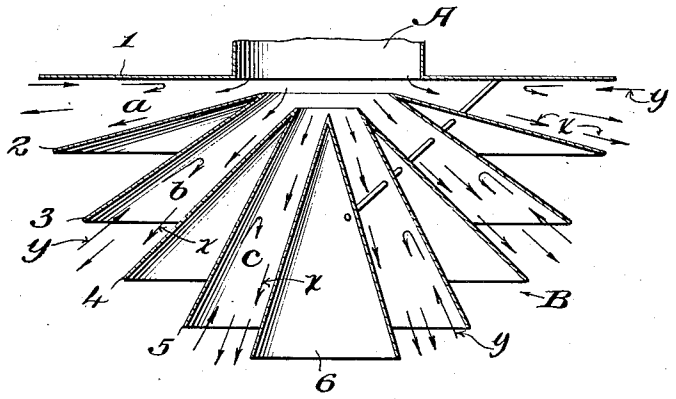

Fig. 2.

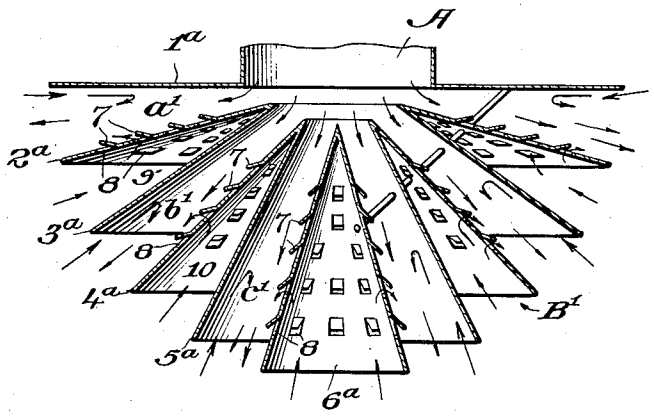

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Fig. 3.

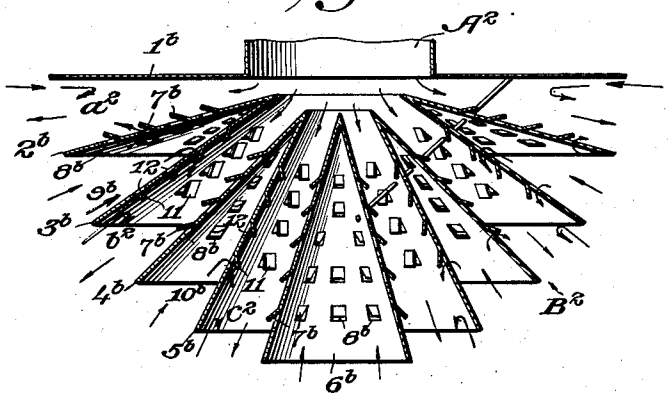


Fig. 4.

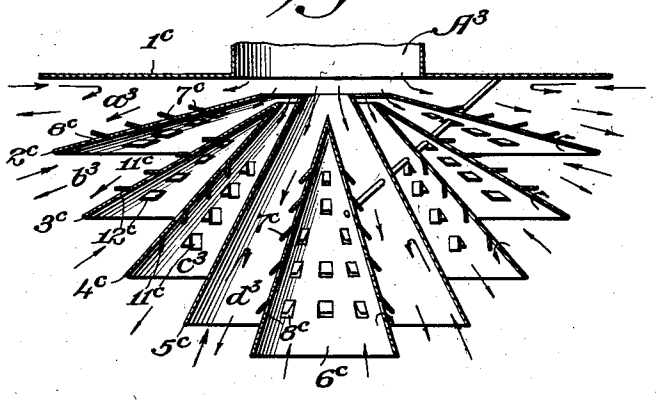
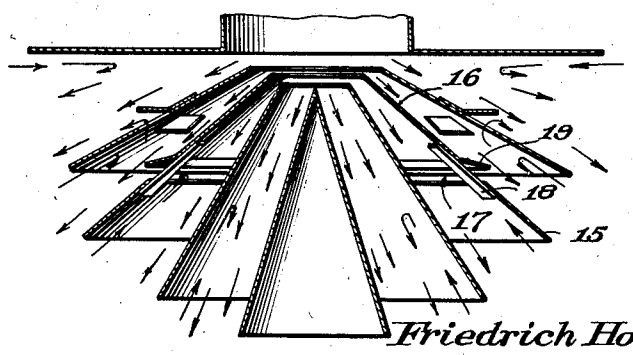


Fig. 5.



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2,209,121

FLUID DISTRIBUTING DEVICE

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Application December 31, 1938, Serial No. 248,815

10 Claims. (Cl. 98—38)

This invention relates to air distributing devices of the general type comprising a series of successively smaller, forwardly flaring, truncated, hollow members, disposed in spaced apart relationship to provide a series of air passageways therebetween, as disclosed, for example, in Kurth and Honerkamp application, Serial No. 104,955, filed October 10, 1936, (now Franz J. Kurth Patent No. 2,142,134 dated January 3, 1939), and the present application is, in part, a division of said prior application and, in other part, represents a carrying forward of the invention disclosed in said application and patent.

According to each of the air distributing devices illustrated in Patent No. 2,142,134, the walls of the flaring members are thin from end to end and all of the passageways between said members are open at both their forward and their rear ends. Consequently, there is a pronounced flow of air through each passageway, either primarily forwardly in the case of some given passageway, or primarily rearwardly in the case of another given passageway, or both forwardly and rearwardly in the case of some other given passageway, depending upon the relationship of the rear ends of the flaring members to each other.

In any passageway where there is a forward flow of air, due to its inherent tendency to flow in a straight line directly forwardly through the device, the forwardly flowing air travels primarily along the inner side portion of the passageway and creates a reduced pressure zone in the outer side portion of the passageway, thereby causing a rearward flow of air in the said outer side portion of the passageway with the result that air enters the said outer side portion of the passageway from the space in advance of the forward end thereof. There is thus effected within the passageway and in the area in advance of the forward or outlet end of the passageway, a desirable mixing of the supplied air with the air of the room or other enclosure into which the supplied air is delivered.

Where the flaring members are of thin-walled form and air flows forwardly through the inner side portions of any two adjacent passageways, there is, in advance of the device between the two forwardly flowing streams of air, only a relatively narrow zone in which there occurs a rearward flow of air. In some instances it may be desirable to widen this zone thereby to obtain a more pronounced rearward flow of air into the outer side portion of the innermost of said two passageways. Accordingly, one special object of the present invention is to provide a device of the type mentioned embodying one or more flaring members so constructed that this desired result may be obtained. In this connection certain of the flaring members, if they are of thin-walled construction, may be joined together at their rear ends, to provide, in effect, a single member of forwardly flaring cross section; or, alternatively, any one or more of the flaring members may be of solid, forwardly flaring cross section.

It may be desirable to have a more pronounced rearward flow of air in some one or more of the passageways of a device of the present type, and a mixing with the supplied air, within and adjacent to the device, of a larger volume of the room or other enclosure air into which the supplied air is delivered, than is obtainable by means as illustrated by the aforementioned patent. Accordingly, another special object of the present invention is to provide a device of the type mentioned embodying a flaring member construction whereby this desired result may be obtained. In this connection, the invention resides in providing an opening, or openings, in at least one of the flaring members and in associating with said opening, or openings, an air deflecting member, or members, so that air flowing forwardly through at least one of the passageways produces a pronounced flow of air into such passageway from that portion of an adjacent passageway wherein, ordinarily, there is either no flow of air or only a rearward flow of air.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in an air distributing device of the type mentioned embodying the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings:

Figure 1 is a central, longitudinal section through an air distributing device constructed in accordance with one practical embodiment of the invention; and

Figures 2, 3, 4 and 5 are views similar to Fig. 1 illustrating alternative embodiments of the invention.

Referring first to Fig. 1 of the drawings, A designates a supply conduit for outside or treated air, and B designates, generally, an air distributing device constructed in accordance with one practical embodiment of the invention and lo-

cated at the outlet or delivery end of said conduit.

The device B comprises a member 1 extending laterally outward from the outlet or delivery end of the conduit A, a series of successively smaller, hollow, forwardly flaring, truncated members 2, 3, 4 and 5 disposed in spaced apart relationship successively inwardly of one another with the outermost or larger member of said series spaced forwardly or inwardly from the member 1, and a smaller or innermost flaring member 6, which may be either truncated or non-truncated and either hollow or solid, spaced inwardly from the innermost member 5 of said series of truncated members.

The walls of the members 2 to 5 are, in the present instance, thin from end to end and, in accordance with the invention, the rear end of the member 2 is joined to the rear end of the member 3 and the rear end of the member 4 is joined to the rear end of the member 5. Accordingly, each of the two pairs of members 2, 3 and 4, 5 provides, in effect, a single member of forwardly flaring cross section insofar as concerns distribution of air by the device, since, obviously, air supplied through the conduit A cannot enter the space between the pair of members 2, 3 nor the space between the pair of members 4, 5. Manifestly, therefore, instead of providing pairs of thin walled members 2, 3 and 4, 5 and joining them together at their rear ends, each pair of said members may, equivalently, be comprised by a single member of flaring cross section. However, pairs of thin-walled members joined together at their rear ends are preferred, not only to maintain a uniform appearance of the members comprising the device, but because they are lighter in weight and more susceptible to economical production than solid members.

Since the members 2, 3 and 4, 5 are joined together at their rear ends, there are three passageways through which air delivered by the conduit A may flow forwardly and laterally through the device B; viz., an outermost passageway *a* between the member 1 and the larger or rearmost flaring member 2, a medial passageway *b* between the flaring members 3 and 4, and an innermost passageway *c* between the flaring members 5 and 6. In this connection it will be observed that the connected rear ends of the members 2, 3 may be disposed laterally inward with respect to the duct A and that the connected rear ends of the members 4, 5 may be disposed laterally inward with respect to the connected rear ends of the members 2, 3. Consequently, a portion of the air delivered through the conduit A is intercepted by the rear end portion of the member 2 and is deflected by said member through the passageway *a*; another portion of the supplied air is intercepted by the rear end portion of the member 4 and is deflected by said member through the passageway *b*, and the remaining or core portion of the supplied stream of air is delivered through the passageway *c*. The air flowing forwardly through the passageways *a*, *b* and *c*, due to its inherent tendency to flow in a straight line directly forwardly from the duct A and to being deflected laterally outward by the members 2, 4 and 6, travels primarily along the inner side portions of said passageways, as indicated by the arrows *x*, and creates reduced pressure zones in the forward, outer side portions of said passageways, thereby causing a rearward flow of air in the forward, outer side portions of said passageways, as indicated by the arrows *y*, with the result that air is drawn from the area in advance of the device into the forward, outer side portions of said passageways and desirably becomes mixed with the forwardly flowing air. Moreover, because of the air being divided into separate streams flowing laterally and forwardly through forwardly flaring passageways, that is, passageways which flare forwardly with reference to the longitudinal axis of the device and which preferably, but not necessarily, are themselves of forwardly flaring cross sectional form, the velocity of the air is reduced to such an extent that, for any normal velocity of the air in the conduit A, there is not produced any sensation of draft forwardly and laterally of the device B. Furthermore, since the members 2, 3 and 4, 5 are joined together at their rear ends and are forwardly flaring relative to each other, they serve to separate the streams or layers of air flowing forwardly through the forward portions of the passageways *a*, *b* and *c*, so that forwardly and laterally of the device there are, between the supplied streams of air, relatively wide zones from which relatively large volumes of the room or other enclosure air flow toward and into the forward, outer side portions of said passageways to thereby become mixed with the supplied air.

Figure 2 of the drawings illustrates a device which embodies an arrangement of members and passageways duplicating the arrangement of members and passageways shown in Fig. 1. Accordingly, the same numerals and the same letters of reference as are used in Fig. 1 are used with the exponents *a* and 1, respectively, to designate the parts of the Fig. 2 device.

As distinguished from the Fig. 1 construction, the members 2^a, 4^a and 6^a have tongues 7 struck therefrom to provide in said members numerous openings 8. Thus, communication is afforded between the passageway *a'* and the space 9 between the members 2^a, 3^a; between the passageway *b'* and the space 10 between the members 4^a, 5^a, and between the passageway c' and the interior of the member 6^a. In this connection it will be observed that the tongues 7 are joined to the members 2^a, 4^a and 6^a at the rear ends of the openings 8 and are struck from said members into the passageways *a'*, *b'* and *c'*, respectively, being forwardly directed relative to said members and forming therewith acute angles. Because of this construction, supplied air flowing through the passageways *a'*, *b'* and *c'* and being deflected over the openings 8 by the tongues 7, causes air to be sucked through said openings 8 from the spaces 9 and 10 and from the interior of the member 6^a, into the passageways *a'*, *b'* and *c'*, respectively. Since the spaces between the members 2^a, 3^a and 4^a, 5^a and the interior of the member 6^a are open at their forward ends, sucking of air from said spaces 9 and 10 and from the interior of the member 6^a through the openings 8 results in a replacement rearward flow of the room or other enclosure air into said spaces 9 and 10 and into the interior of the member 6^a. Thus, there is produced within and in the vicinity of the device B' an effective and pronounced intermixing of the supplied air with the air of the room or other enclosure into which the supplied air is delivered, with the extremely advantageous result that there may be a decided temperature differential between the supplied air and the air of the room or other enclosure without producing a sensation of draft. As in the case of the Fig. 1 construction, the supplied air flowing forwardly through the passageways *a'*, *b'*, *c'* produces an aspirating effect or rearward flow of

air in the forward, outer side portions of said passageways, as indicated by the arrows.

Figure 3 illustrates a device which also embodies an arrangement of members and passageways duplicating the arrangement of members and passageways shown in Figs. 1 and 2. Accordingly, the same numerals and letters of reference as are used in Figs. 1 and 2 are used with the exponents *b* and 2, respectively, to designate the parts of the Fig. 3 device.

According to the Figure 3 form of the device the flaring members 2^b, 4^b and 6^b are provided with tongues and openings 7^b and 8^b, respectively, as in the Fig. 2 form of the device, but as distinguished from the Fig. 2 form of the device the members 3^b and 5^b of the Fig. 3 form of the device also have tongues, designated as 11, struck therefrom to provide in said members openings designated as 12.

The tongues 11 are joined to the members 3^b and 5^b at the rear ends of the openings 12 and are struck from said members into the passageways b^2 and c^2, respectively, being forwardly directed relative to said members 3^b and 5^b and forming therewith acute angles. Thus, air flowing forwardly through the passageway b^2 sucks air from the space 9^b between the members 2^b, 3^b as well as from the space 10^b between the members 4^b, 5^b, and air flowing through the passageway c^2 sucks air from the space 10^b as well as from the interior of the member 6^b. Consequently, there is obtained by the Fig. 3 construction a still more pronounced mixing within and in the vicinity of the device B^2 of the room or other enclosure air with the supplied air than is obtained by the Fig. 2 construction.

Figure 4 illustrates a variation of the forms of the invention shown in Figs. 1 to 3. In Fig. 4 the air supply conduit is designated as A_3; the member extending laterally outward therefrom is designated as 1^c; the successively inwardly spaced, truncated flaring members are designated as 2^c, 3^c, 4^c and 5^c, respectively, and the smaller, non-truncated flaring member is designated as 6^c. According to this form of the invention only the members 3^c, 4^c are joined together at their rear ends. Consequently, there is an open-ended air passageway a^3 between the members 1^c and 2^c; an open-ended air passageway b^3 between the members 2^c and 3^c; an open-ended air passageway c^3 between the members 4^c and 5^c, and an open-ended air passageway d^3 between the members 5^c and 6^c. The member 5^c is not apertured, but the members 2^c and 6^c are provided with tongues and apertures 7^c and 8^c, respectively, as in the Figs. 2 and 3 constructions, and the members 3^c, 4^c likewise are provided with tongues and apertures 11^c, 12^c, having the same disposition relative to said members 3^c, 4^c as the tongues 11 and 12 have to the members 2^b, 3^b and 4^b, 5^b of the Fig. 3 construction. Consequently, air flowing forwardly through the passageways b_3, c_3 produces a pronounced rearward flow of air through the space between the members 3^c, 4^c. According to the Fig. 4 form of the invention there is a greater diffusion of the supplied air and a lesser mixing within the device of the supplied air with the room or other enclosure air, as compared with the Figs. 2 and 3 forms of the invention, because there is one more open-ended passageway and one less space between adjacent members closed at its rear end, than in the Figs. 2 and 3 forms of the invention.

Obviously, according to any of the forms of the invention the number of flaring members employed may be varied; likewise, the flaring members may be alined axially or may be axially offset relative to the air supply conduit and relative to each other, and the rear ends of the flaring members may be disposed relative to each other in accordance with the teachings of Patent No. 2,142,134. Moreover, the tongues of the flaring members may be struck from said members or may be formed separately from said members and may be attached thereto in any suitable manner. Furthermore, instead of aperturing one-piece flaring members, any of said members may be formed of two or more sections suitably joined together in spaced apart relationship to provide substantially continuous, annular openings therein of any desired width. This latter construction is illustrated in Fig. 5 wherein the second larger flaring member is comprised by separate front and rear, alined sections 15 and 16, respectively, spaced apart at their rear and front edges, respectively, to provide in said member an opening 17 which is continuously annular except where it is interrupted by suitable elements 18 employed to join the sections together. Fig. 5 also illustrates an annularly continuous tongue 19 formed by deflecting the front marginal portion of the rear section 16 laterally outward to deflect air across the opening 17, thus to assist in effecting suction of air through said opening. Furthermore, Fig. 5 indicates that openings in the flaring members, and associated tongues or equivalent air deflecting elements, may advantageously be provided in devices of the present type in which none of the flaring members are joined together at their rear ends. Even in the absence of openings, air supplied through the passageways streams along the inner side portions of the passageways and produces a rearward flow of air along the outer side portions of said passageways, thereby producing a certain amount of mixing within said passageways of the supplied air with the room or enclosure air. By providing openings in the flaring members and, preferably, but not necessarily, by providing associated air deflector elements extending into the passageways outwardly of the respective members, the supplied streams of air intensify rearward flow of air in the outer side portions of the passageways.

While devices constructed in accordance with the invention are particularly intended for distributing air, they also are well adapted for distributing other gases and even liquids.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. A fluid distributing device comprising a fluid supply conduit and means dividing the space in advance of the fluid delivery end of said conduit into a plurality of successively smaller, successively inwardly disposed, fluid passageways forwardly flaring with reference to the longitudinal axis of the device and open at their front and rear ends and in fluid receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, the dividing means between at least two adjacent of said passageways being of forwardly flaring cross sectional form so that between the streams of fluid

flowing from said passageways there is a zone which is substantially undisturbed by the supplied streams of fluid.

2. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, spaced successively inwardly of one another, the spaces between certain of said members being open at their front and rear or smaller diameter ends and, at their rear ends, being in fluid receiving relationship to said conduit, at least two of said members being joined together at their rear ends to provide, in effect, a single member of forwardly flaring cross section.

3. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, spaced successively inwardly of one another and providing a plurality of fluid passageways open at their front and rear ends and in fluid receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, at least one of said members having an opening therein, and means extending from said member into a passageway adjacent thereto and disposed to deflect supplied fluid over said opening to produce a fluid suction action therethrough.

4. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, disposed in spaced apart relationship successively inwardly of one another to provide therebetween a series of passageways forwardly flaring with reference to the longitudinal axis of the device and having their rear or smaller diameter ends facing said conduit, at least two of said members being joined together at their rear or smaller diameter ends to close the rear end of the passageway therebetween, the innermost of the members defining said closed-end passageway having an opening therein, whereby fluid flowing forwardly through an adjacent passageway produces a rearward flow of fluid through said opening from the passageway having the closed rear end.

5. A fluid distributing device as set forth in claim 4 including a fluid deflector element extending from the member having the opening into the adjacent fluid supply passageway, said deflector element extending from said member adjacent to the rear end of the opening.

6. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, spaced successively inwardly of one another and providing a plurality of fluid passageways open at their front and rear ends and in fluid receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, and a plurality of tongues struck from certain of said members into certain of said passageways, thereby providing openings in said members for flow of fluid therethrough between adjacent of said passageways, said tongues extending from the rear ends of said openings.

7. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring truncated members, spaced successively inwardly of one another and providing a plurality of fluid passageways open at their front and rear ends and in fluid receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, an innermost hollow, flaring member open at its forward end and closed at its rear end, said innermost member having an opening therein, and a fluid deflecting element extending from said innermost member into the passageway laterally outward of said innermost member and disposed to deflect supplied fluid over said opening, thereby to cause fluid to be drawn through said opening from the interior of the innermost member.

8. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, spaced successively inwardly of one another, to provide fluid passageways therebetween, the passageways between certain of said members being open at their front and rear or smaller diameter ends and, at their rear ends, being in fluid receiving relationship to said conduit, at least two of said members being joined together at their rear or smaller diameter ends to provide, in effect, a single member of forwardly flaring cross section, the space between said joined together members being open at its forward end, said joined together members each having openings therein and the outer of said joined together members having means to deflect air, supplied through the passageway outwardly thereof, across the openings therein so that fluid flowing forwardly through the passageways adjacent to said joined together members produces flow of fluid through said openings from said space.

9. A fluid distributing device comprising a fluid supply conduit and, in advance of the fluid delivery end of said conduit, a plurality of successively smaller, hollow, forwardly flaring, truncated members, spaced successively inwardly of one another and providing therebetween a plurality of fluid passageways open at their front and rear ends and in fluid receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, at least one of said members having an opening therein affording communication between the inner side portion of one of said passageways and the outer side portion of the next adjacent inwardly disposed passageway, and means extending from said member into said first mentioned passageway to deflect air supplied through said first mentioned passageway over said opening.

10. A fluid distributing device comprising a fluid supply conduit and means dividing the space in front of the fluid delivery end of said conduit into a plurality of successively smaller, successively inwardly disposed fluid passageways forwardly flaring with reference to the longitudinal axis of the device and open at their front and rear ends and in fluid-receiving relationship at their rear or smaller diameter ends to the delivery end of said conduit, the dividing means between at least two adjacent of said passageways having inner and outer faces that flare or diverge forwardly relative to each other.

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