Sept. 16, 1958 A. V. ALEXEFF 2,852,311

GAS DISTRIBUTOR HEAD

Filed April 22, 1955

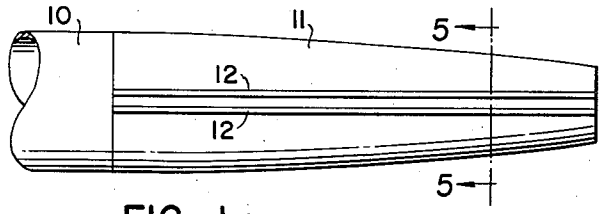


FIG. 1 (PRIOR ART)

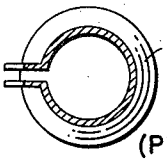


FIG. 5
(PRIOR ART)

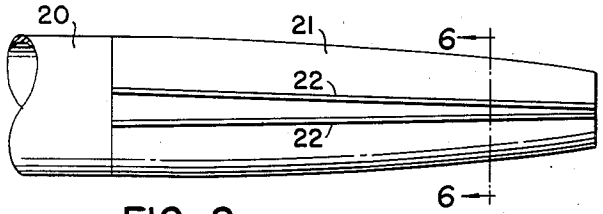


FIG. 2 (PRIOR ART)

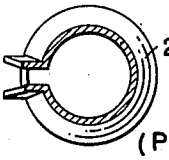


FIG. 6
(PRIOR ART)

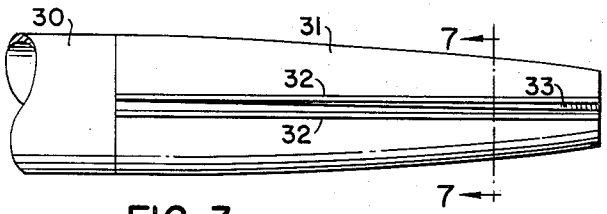


FIG. 3

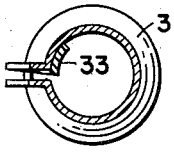


FIG. 7

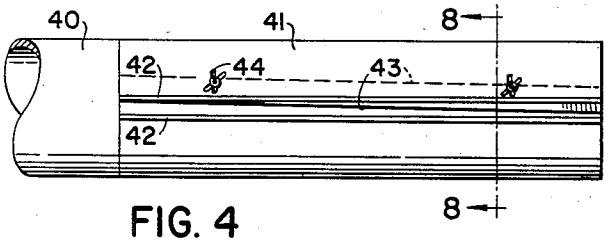


FIG. 4

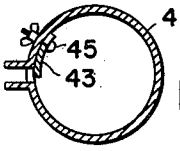


FIG. 8

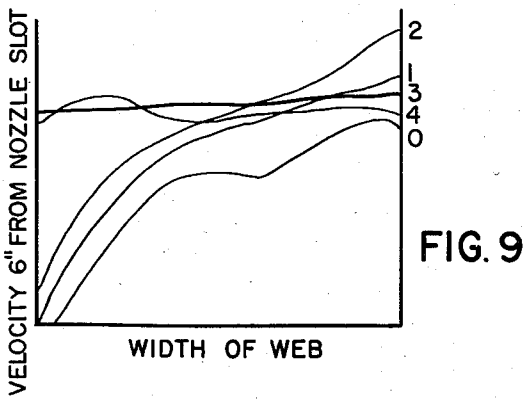


FIG. 9

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GAS DISTRIBUTOR HEAD

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Application April 22, 1955, Serial No. 503,176

2 Claims. (Cl. 299—132)

The present invention relates to apparatus for treating the width of a passing web with a gas, such as air, and more particularly to a gas-distributing head for evenly distributing the gas over the surface of the web.

It has been a common practice in manufacturing many types of web material to heat, cool, dry or otherwise process the web by passing it through one or successive blasts of air or other gas projected at the web by one or more distributing heads extending across the width of the web, one end of each distributing head being connected to a gas supply. In some applications, as many as forty or fifty such heads may be employed. The heads should ideally cause the gas to impinge at a uniform velocity across the entire width of the web. With such even impingement, the web receives uniform treatment, and minimum equipment cost is involved in assuring that the necessary degree of treatment is achieved on all portions of the web surface. However, to date, the art has been unable to provide a distributor structure which is at once effective in accomplishing even distribution and practical from the standpoint of cost and elaborateness of the equalizing means. It may be attempted to accomplish this object by progressively narrowing the nozzle or slot through which the gas, such as air, is expressed from the distributor. While this tends to even mass flow along the length of the distributor, it does not avoid, and in fact may tend to exaggerate, the condition of varying gas velocities along the length of the distributor, so that the passing web is subjected to widely variant treatment across its width.

The general object of the present invention is to provide a distributor which is both extremely simple in structure and highly effective in creating a uniform curtain of moving air or other gas.

Another object of the invention is to provide a simple means for passing progressively smaller volumes of gas across the width of the distributor structure as the velocity tends to increase across this width, and providing an additional extremely simple means extending across the width of the distributor to allow a degree of gas expansion which increases as the velocity tends to increase across the width, such expansion lowering the velocity and increasing the volume (decreasing the density) of the passed gas to a progressively increasing extent across the width of the distributor head to provide output gas of uniform velocity and density across the distributor head.

The above objects are attained through the provision of a nozzle slot which may not vary in dimensions along its length but which along its length is increasingly dampered at its input side, the nozzle thus serving at advanced points along its length as an expansion chamber, the degree of expansion varying inversely to the degree of damping.

The objects and advantages of the invention will be more clearly understood from the following description of a specific example of the invention.

In the drawings,

Figure 1 is a side view of one typical form of conventional distributor.

Figure 2 is a side view of another distributor which does not embody the invention.

Figure 3 is a side view of a distributor embodying the invention.

Figure 4 is a side view of another distributor embodying the invention.

Figures 5–8 are, respectively, views taken in cross-section on line **5**—**5** in Figure 1, **6**—**6** in Figure 2, **7**—**7** in Figure 3 and **8**—**8** in Figure 4.

Figure 9 is a graphic indication of velocity distribution across a web located a short distance from the nozzle slots of the several distributor structures discussed below.

In Figures 1–8, the diameters of the distributors are exaggerated for purposes of clarity, that is, the distributors are foreshortened. In an actual installation, the length of a distributor typically would be in the vicinity of eight or ten times its large diameter.

Shown in Figure 1 is a distributor of a type known to the art. A gas, commonly air, is supplied through a line **10**. The air is received within the distributor body **11** and is expressed out the nozzle slot or path-of-flow defined by the flanges or guide members **12**, the end of the body **11** opposite to the line **10** being closed. The air is directed toward a passing web, and the parts are arranged so that the nozzle slot extends across the width of the web and usually a small distance past both edges of the web. In a typical installation, the web might be 62 inches wide and the nozzle slot might be 70 inches wide, with the web spaced less than 12 inches from the nozzle slot.

With the above arrangement, output velocities are considerably higher toward the outer end of the distributor and toward the outer edge of the web, as indicated by curve 1 in Figure 9. The progressively reduced cross-section of the distributor body **10**, however, does represent some improvement over a cylindrical distributor of conventional type (not shown) which is similar in all respects to the distributor shown in Figure 1, except that the distributor body is cylindrical rather than tapered. The velocity distribution provided by such a cylindrical distributor is indicated by curve 0 in Figure 9.

Shown in Figure 2 is a distributor having a supply line **20**, distributor body **21** and tapered nozzle slot or path-of-flow defined by the flanges or guide members **22**. As indicated by curve 2 in Figure 9, this arrangement does not eliminate the wide disparity in discharge velocity across the width of the web.

Shown in Figure 3 is a distributor embodying the invention. The supply line **30** supplies air to the distributor body **31** from which the air is expressed through the nozzle slot or path-of-flow defined by the flanges or guide members **32**. Extending along the input side of the nozzle slot is a damper **33** which is positioned for progressively greater damping along the length of the distributor. Through such progressively greater damping at the input side of the nozzle slot, a remarkable degree of uniformity of velocity distribution may be obtained across the width of the web being treated, as indicated by curve 4 in Figure 9. Further, the mass of distributed air is constant or very nearly constant across the width of the web. The mass flow of air or gas entering the nozzle slot from points toward the outer end of the distributor is reduced by the damper, and the normally higher velocity of this air or gas is then reduced by expansion within the nozzle slot which is wide compared to the damper opening. This effect is progressively more pronounced with the greater damping along the length of the nozzle slot, and the net effect is a balancing out of flow

conditions so that air or gas at uniform velocity (and density) is directed toward the web.

These highly advantageous effects are disturbed very little by the substitution of a cylindrical distributor body for the tapered distributor body **31** of Figure 3. Thus, in Figure 4, a supply line **40** supplies air to a distributor body **41** from which the air is expressed through the nozzle slot or path-of-flow defined by the flanges or guide members **42** along which slot extends the input damper **43**. The velocity distribution attained by such a structure is indicated by curve 4 in Figure 9. Such results are quite comparable to those indicated by curve 3 in Figure 9.

Obviously, distributors embodying the invention may be varied in many respects from the somewhat schematic showings of Figures 3 and 4. For example, the distributor body may have a cross-section which is polygonal rather than circular. A plurality of nozzle slots may be provided. The outlet aperture from the distributor body may comprise a series of holes rather than a continuous slot. It is particularly desirable that the damper be adjustable. To this end, the distributor shown in Figure 4 may be provided with slots **44** in which are adjustably received damper bolts **45** in a manner which will be apparent from the drawings.

From the point of view of fabrication, it is highly desirable that the nozzle slot be of constant width along its length, but it is to be noted that variations in this width can be compensated for in significant measure by corresponding variations in damper aperture.

The immediately preceding observations should make it apparent that the invention is not limited to any precise form of distributor or to other details which are merely incidental to the above disclosure. The scope of the invention is defined in the following claims.

What is claimed is:

1. A distributor for producing a curtain of gas comprising a relatively long and narrow hollow body adapted to be connected to a gas supply line at one end and closed at the other end, exhaust aperture means extending along the length of said body on at least one side thereof, said aperture means communicating with the interior of said body, said aperture means also communicating with the exterior atmosphere through a path-of-flow defined by guide members extending along the length of said body and enclosing the outflow side of said aperture means, damper means at least partly defining said aperture means, said damper means and guide members being so proportioned and positioned that said aperture means presents a smaller cross-section to exhaust flow than does the extent of said path-of-flow at a majority of locations along the length of said body, and the ratio of cross-section presented to exhaust flow by said aperture means on the one hand to minimum cross-section presented to exhaust flow by said path-of-flow on the other hand is smaller toward said other end of said hollow body than it is near said one end of said hollow body.

2. A distributor for producing a curtain of gas comprising a relatively long and narrow hollow body adapted to be connected to a gas supply line at one end and closed at the other end, exhaust aperture means extending along the length of said body on at least one side thereof, said aperture means communicating with the interior of said body, said aperture means also communicating with the exterior atmosphere through a path-of-flow defined by guide members extending along the length of said body and enclosing the outflow side of said aperture means, damper means at least partly defining said aperture means, said damper means and guide members being so proportioned and positioned that said aperture means presents a smaller cross-section to exhaust flow than does the extent of said path-of-flow at a majority of locations along the length of said body, and the ratio of cross-section presented to exhaust flow by said aperture means on the one hand to minimum cross-section presented to exhaust flow by said path-of-flow on the other hand becomes progressively smaller from said one end to said other end along the length of said hollow body.

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