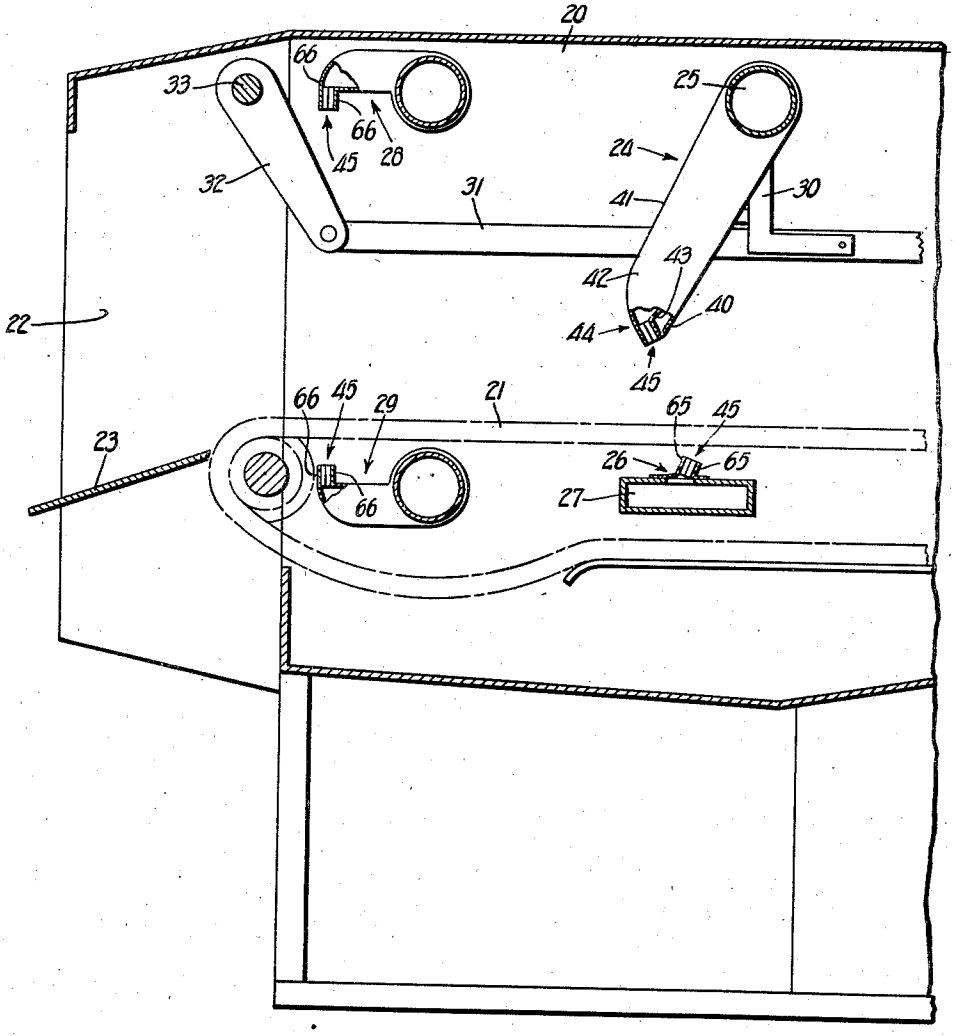
Jan. 7, 1947. E. R. ZADEMACH ET AL 2,413,937

SECTIONAL NOZZLE STRUCTURE FOR DRIERS

Filed Aug. 19, 1941 3 Sheets-Sheet 1

Fig. 1.



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Fig.2.

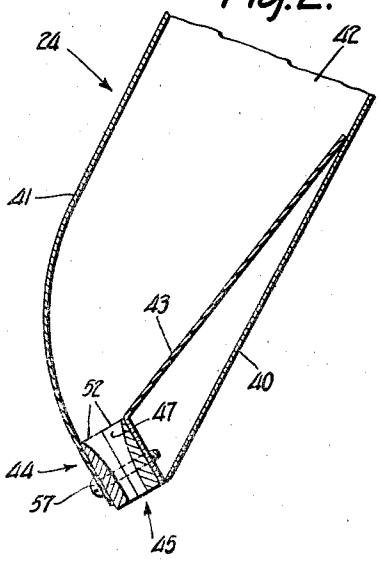


Fig.3.

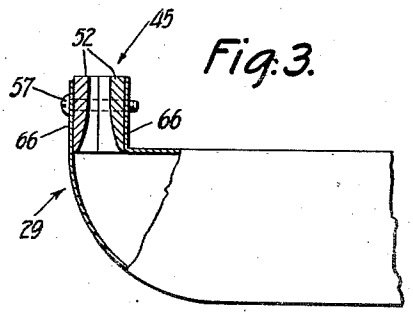


Fig.4

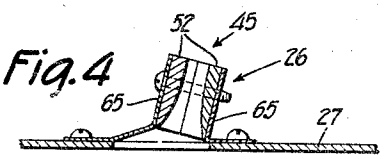
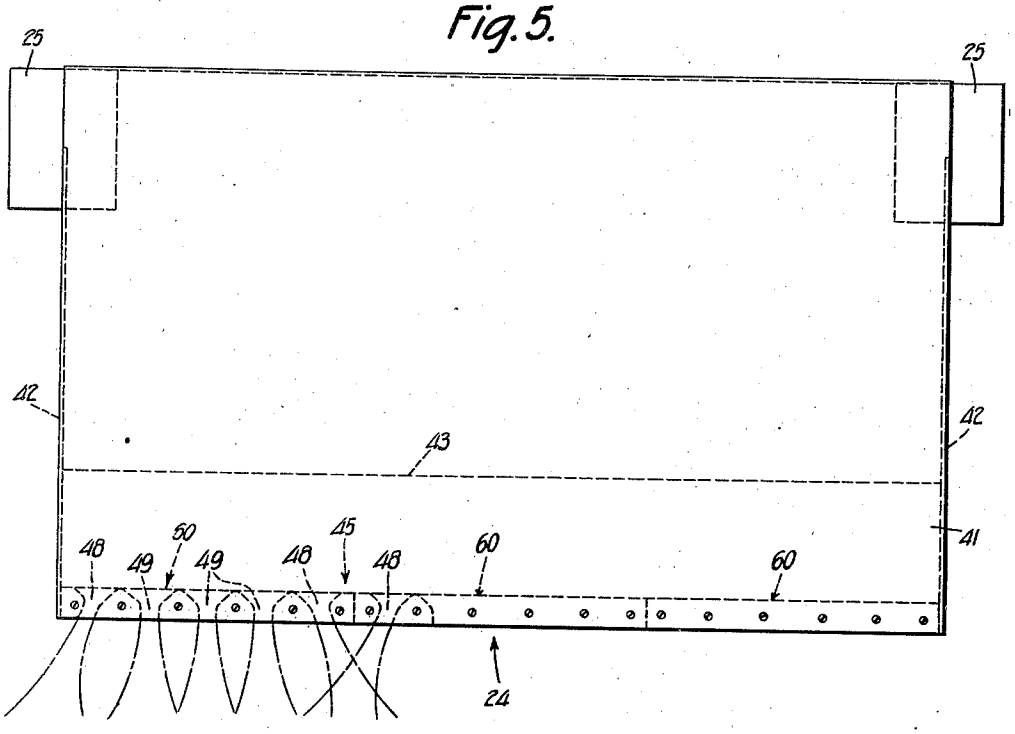


Fig.5.



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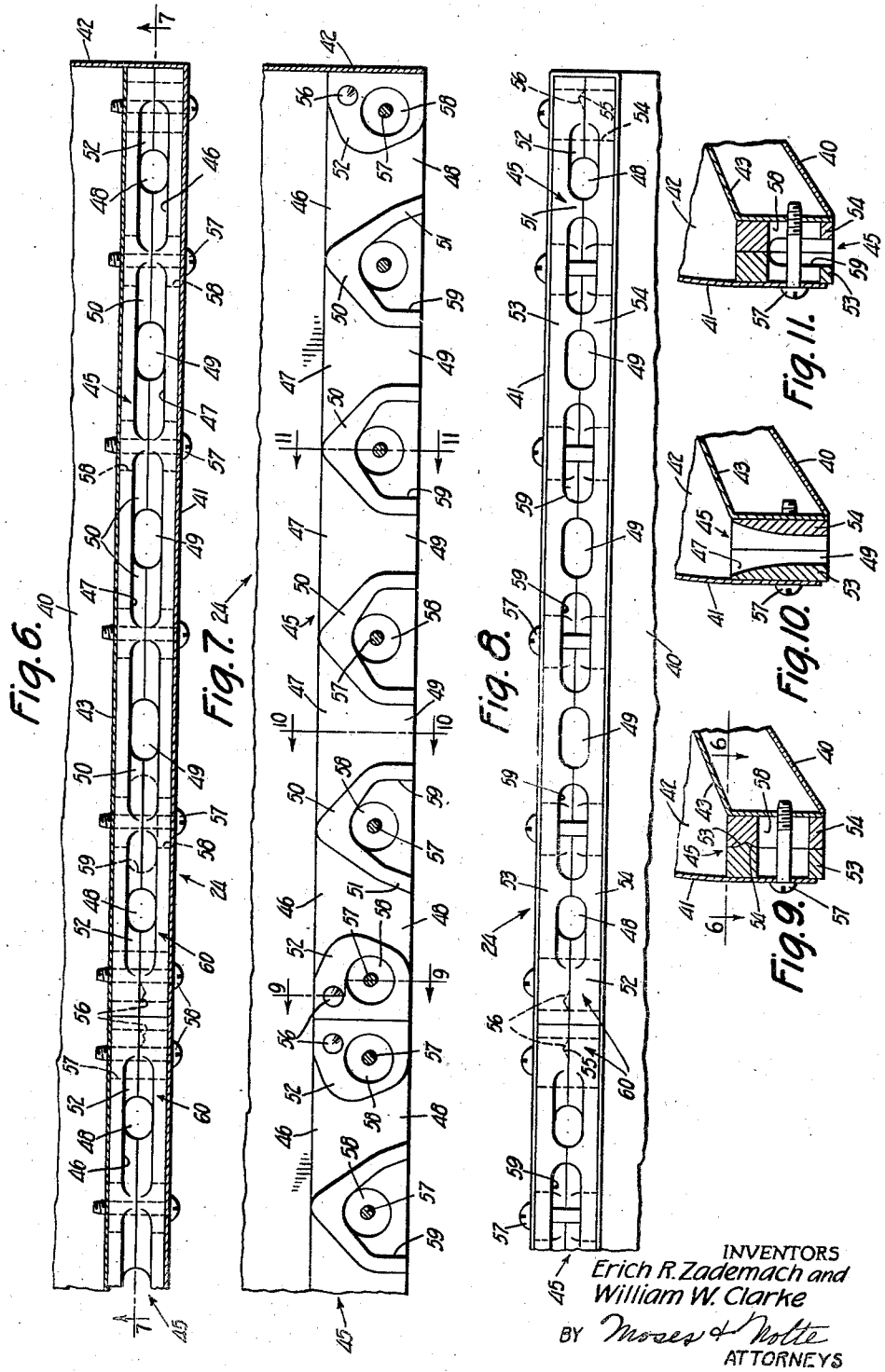


Fig. 6.

Fig. 7.

Fig. 8.

Fig. 11.

Fig. 10.

Fig. 9.

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SECTIONAL NOZZLE STRUCTURE FOR DRIERS

Erich R. Zademach, Elizabeth, and William W. Clarke, Summit, N. J., assignors, by mesne assignments, to Metalwash Machinery Company, Newark, N. J., a copartnership

Application August 19, 1941, Serial No. 407,404

6 Claims. (Cl. 299—141)

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This invention relates to driers of the type in which a restricted blast of air is directed against articles to be dried, and especially to improvements in the construction and arrangement of the structure for discharging and controlling the air blast.

The invention is illustrated in its application to driers in which articles on a traveling conveyor are exposed to a restricted stream of air discharged from relatively narrow elongated nozzles extending transversely adjacent to the path to the articles. In driers of this type it is important to concentrate the stream in the zone of impingement on the articles, since the impact of the air is useful in mechanically removing or dispersing drops or other accumulations of water. It is also important to provide an air stream that is substantially continuous and uniform across the entire width of the conveyor. Consequently the air stream should be in the form of a relatively thin uniform sheet or curtain in the zone of effective action. It has also been found that since such driers are used to treat articles having certain contours and arranged in certain relationships on the conveyor, it is desirable to provide a flat stream of the indicated type which impinges on the articles at a predetermined angle.

In prior constructions for producing a wide, flat stream of air it has been the practice to discharge the air from a narrow elongated opening or short passage; but this arrangement is relatively inefficient, since there is excessive friction and disturbance of the air stream. The provision of a series of holes in an air pipe is likewise inefficient and presents difficulties in obtaining the desired volume without excessive pressures and resistance.

Air discharge nozzle designs have been developed for general use which are relatively efficient, and include a round discharge opening with a specially contoured passage flaring inwardly from the opening, the walls of which have an appropriate curvature in accordance with established principles of design. However, these principles are not directly applicable to air discharge constructions of the type above indicated because of the extreme length and narrowness of the discharge opening.

An important purpose of the invention is to provide an air discharge structure suitable for providing a thin, substantially continuous air stream in any desired width with improved efficiency and uniformity. This is in general accomplished by devising a nozzle construction in which a series of properly contoured and related discharge openings are arranged in alignment to produce the desired air stream. Specifically, each discharge opening is advantageously somewhat elongated to cooperate in producing the desired type of air current, but is at the same time sufficiently close to the ideal circular contour to retain a substantial part of the efficiency of the latter.

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The invention also includes an improved nozzle structure particularly adapted for convenient manufacture of the type of nozzle above indicated. In particular, the nozzle structure is advantageously made in units which may be arranged end to end to provide a nozzle of any desired overall width.

Another feature is the provision of an arrangement in which the air from the end openings of the elongated nozzle unit is directed outwardly at an angle, thereby producing an air stream of maximum width for a given width of nozzle. This arrangement, however, introduces an additional factor when nozzle units are positioned end to end; and a specific purpose of the invention is to construct the outwardly deflected end nozzle openings so that when they are located adjacent each other at abutting ends of the nozzle units, the streams of air from such openings will balance each other and be deflected downwardly to form a uniform continuous portion of the air stream.

An additional purpose is to provide an efficient streamlined nozzle construction which may be readily introduced into an air discharge opening or short passage, and may be readily fastened in place therein. Specifically, such construction may be arranged to fit readily into short sheet metal air discharge nozzles of the type employed in prior constructions.

The invention likewise includes specific improvements in the structure and arrangement of each unit which facilitate the construction and assembly of units having properly contoured nozzles. For this purpose each unit is made in two sections, which may conveniently be cast, avoiding any special processing for providing the proper curvature to the discharge passage walls, and which are readily connected to form the unit. Such connection may be accomplished by the same means that is used to mount the unit in the discharge passage of the air supply construction.

Other objects and advantages will appear from the following description considered in conjunction with the accompanying drawings in which

Fig. 1 is a diagrammatic longitudinal vertical section through the discharge end of a drier pro-

vided with air discharge nozzles embodying the invention;

Fig. 2 is a detail fragmentary vertical section through one of the upper swinging nozzles;

Fig. 3 is a fragmentary side elevation of a lower nozzle construction with parts broken away;

Fig. 4 is a fragmentary transverse vertical section through the discharge portion of another type of lower nozzle construction;

Fig. 5 is a rear elevation of a depending upper nozzle indicating the paths of the air streams from the nozzle openings;

Fig. 6 is a fragmentary top view, in section, of an end portion of a multiple unit nozzle construction with parts broken away, taken from the supply side of the nozzle, on the line 6—6 of Fig. 9;

Fig. 7 is a vertical section on line 7—7 of Fig. 6;

Fig. 8 is a bottom view of the construction shown in Fig. 6 from the outlet side; and

Figs. 9, 10 and 11 are fragmentary transverse vertical sectional views on lines 9—9, 10—10 and 11—11 of Fig. 7.

The invention is illustrated in its application to a drier of the type disclosed in the pending application of Erich R. Zademach, Serial No. 325,845, filed March 25, 1940, for Drier, which employs the same general construction as that set forth in the patent to Zademach No. 2,137,104 issued November 15, 1938. The drier includes a casing 20 enclosing an endless conveyor 21 of openwork metal construction through which air passes freely, arranged to discharge articles through the discharge opening 22 onto apron 23. The articles on conveyor 21 are subjected to a series of air streams directed downwardly from the outlets of a series of flat transverse depending air spouts or nozzles 24 each pivotally connected at its upper end to air supply ducts 25 and to a series of air streams directed upwardly from lower nozzles 26 in air supply ducts 27 extending transversely below the conveyor 21. Only the nozzles 24 and 26 nearest the outlet 22 are illustrated.

The drier also includes a pair of air curtain nozzles 28 and 29 arranged to direct air streams downwardly and upwardly, respectively, in the same plane to provide a joint air curtain arrangement which will tend to minimize the flow of air into or out of the drier without interfering with the passage of the articles through the outlet 22.

A suitable arrangement for adjusting the angular position of nozzle 24 is provided including an adjusting arm 30 connected to each nozzle and pivoted at its lower end to an adjusting rod 31 connected to adjusting lever 32 on shaft 33 extending outside of casing 20 and appropriately rotated to adjust the swinging nozzle 24 by suitable means (not shown), one arrangement being illustrated in the patent above mentioned.

Nozzles 24, 26, 28 and 29 are all adapted and intended to discharge air in the form of a relatively thin sheet or stream in a predetermined plane, which in the case of nozzle 24 can be adjusted by swinging such nozzle about its axis. Each of said nozzles is shown as constructed at its outlet in accordance with the invention to provide a stream of the desired type with increased accuracy and efficiency, requiring less pressure and power for the same results, and including a simple and strong construction. Specifically, each nozzle 24 is made of sheet metal and includes a front wall 40 and rear wall 41, the latter being curved forwardly toward the lower

margin of wall 40 to provide an elongated opening extending substantially across the entire width of conveyor 21 to end walls 42 of nozzle 24.

A throat plate 43 extends inwardly from the lower edge of the front wall 40 for a short distance and then is deflected upwardly and toward said wall to provide a short air discharge passage 44, plate 43 extending across nozzle 24 to end walls 42 and being suitably attached at its upper and lower edges to front wall 40 as by welding.

It was found that the efficiency of air discharge through passage 44 is substantially increased by providing a suitable air outlet structure in said passage which will provide a plurality of outlet passages properly contoured and arranged for increased efficiency and reduced resistance in producing the desired air stream below the passage. This is accomplished by inserting in passage 44 an outlet strip 45 provided with aligned end passages 46 and intermediate passages 47 which are substantially continuous at their inlet ends and which taper toward outlets 48 and 49, respectively. The latter are substantially shorter than inlets 46 and 47, and advantageously are not more than three times as long as they are wide, the form illustrated having a length substantially twice its diameter.

Passages 46 and 47 may be suitably contoured in accordance with present engineering practice, as in the form illustrated, in which the end walls are concave as indicated in Figs. 6 and 7, and the side walls converge toward the outlets 48 and 49 as illustrated in Fig. 10. It has been found advantageous to form each intermediate passage 47 with side walls 50 which converge sharply from the inlet for about half the distance to the outlet, and then are substantially parallel for the remainder of the distance.

Each end passage 46 is similarly contiguous except that the lower portion 51 of wall 50 and the registering lower part of outer end wall 52 are parallel and inclined toward the end of the strip 45, diverging from the direction of the side walls 50 of the adjacent intermediate passage 47. This arrangement provides somewhat flattened air streams discharge from openings 49 in a direction parallel to the sides and ends of passage 46, while the stream from openings 48 are parallel to the sides of said passage but are directed outwardly toward the ends thereof.

It has been found that when the passages 46 and 47 are arranged and contoured in the indicated manner, a smooth, compact stream of air will be discharged from each outlet 48 and 49 and will retain its direction and identity, the streams merging into a smooth, compact curtain of air with a minimum of loss through turbulence or marginal diversion into the adjacent air.

In order to manufacture the outlet strip 45 with the rather complicated contours desirable for passages 46 and 47, strip 45 is constructed in two complementary sections 53 and 54, each formed with one-half of walls 51 and 52, which are substantially continuous when sections 53 and 54 are held together in assembled relation. A suitable construction may be provided to assure convenient and accurate registry of the sections such as low conical protuberances 55 in the portions of outside walls 52 carried by section 53, fitting into registering conical depressions 56 in the portion of said walls carried by section 54.

Suitable means is provided for holding sections 53 and 54 in assembled relation, as well as for mounting outlet strip 45 in passage 44; and a feature of the disclosed construction is the pro-

vision of an arrangement in which the same retaining elements serve both purposes. This arrangement includes a plurality of retaining members **57** engaging wall **41** and throat plate **43**, which lie flat against opposite faces of the strip **45**, said members passing through suitable openings **58** in the strip located in the space between adjacent passages **46** or **47**. It is convenient to have openings **58** substantially larger than members **57** for convenience in rapid insertion of the members, eliminating the necessity for extreme care in registering the members with apertures **58** and permitting ready alignment of strip **45** with the margins of passage **44**.

For economy and lightness the portions of strip **45** intermediate the air passages may be cut away so that walls **50** have only the thickness necessary for structural strength, leaving a substantial clearance space **59** between said walls extending downwardly and outwardly from openings **58**. Retaining members **57** may conveniently be bolts or screws, and are illustrated as screws which may be conveniently and rapidly screwed into apertures in the wall of throat plate **43** in known manner.

The outlet strip **45** may conveniently be provided in the form of a series of outlet units **60** in endwise abutment with each other and with end walls **42** of nozzle **24**. In this arrangement it will be evident that the passages **46** adjacent abutting ends of unit **60** will be arranged to direct air streams through outlets **48** in directions which will intersect a short distance below strip **45** as indicated in Fig. 5. At the same time the air streams from the intermediate outlets **49** will expand laterally and intersect at a predetermined distance between the lower edge of nozzle **24**, the various air streams forming at that distance a continuous relatively concentrated air stream adapted to impinge upon the effectively dry articles traveling along the conveyor through said stream.

A similar passage outlet construction is provided for lower nozzles **26**, which are provided with walls **65** forming a narrow passage directed upwardly and forwardly through conveyor **21**. A suitable outlet strip **45** is mounted in the nozzle **26** and is constructed and arranged in the same manner as that already described.

Air curtain nozzles **28** and **29** are each provided at the discharge end with walls **66** defining a narrow outlet passage into which an outlet strip **45** is fitted in the same manner. Passages formed by walls **66** are located and arranged so that the flat air streams discharged from strips **45** in said passages will be in substantially the same vertical plane and will intersect adjacent the vertical center of the drier to form a curtain of air as already set forth. It has been found that the substantially improved regulation of the air discharge curtain by the provision of scientifically contoured air discharge passages in outlet strips **45** is of substantial value in increasing the uniformity of such air curtain and is effective in obstructing the flow of air into or out of the drier.

We have described what we believe to be the best embodiments of our invention. We do not wish, however, to be confined to the embodiments shown, but what we desire to cover by Letters Patent is set forth in the appended claims.

We claim:

1. An air nozzle drier construction comprising a manifold chamber having an elongated continuous discharge passage, and a plurality of elongated nozzle units in said passage extending in

abutting end to end relationship, each of said units including a series of walls extending across said passage and spaced lengthwise thereof, said walls being of substantial length in the direction of air flow through said passage to form between each pair of adjoining walls a nozzle passage of predetermined cross-section and of substantial length, each of said nozzle passages being peripherally closed on all sides and communicating at its inlet end with said manifold chamber, said nozzle passages being aligned along the length of said manifold discharge passage and being separated by said walls, the lengths of said walls between the discharge ends of adjoining nozzle passages being substantial, whereby the air from said manifold chamber is discharged through said nozzle passages at high velocity in separate narrow widely spaced streams and said streams are gradually merged into a single thin stream at a region spaced from the discharge ends of said nozzle passages, the end nozzle passages of each nozzle unit having their axes diverging outwardly in the longitudinal plane of said discharge passage, the intermediate nozzle passages between said end nozzle passages having their axes extending substantially parallel in the plane of said first-mentioned axes and diverging outwardly with respect to said latter axes.

2. An air nozzle construction for drier and the like comprising a manifold chamber having parallel sides defining an elongated discharge passage, a nozzle unit in said passage split longitudinally into two sections and comprising a series of walls extending across said passage and spaced lengthwise thereof to form between each pair of adjoining walls a nozzle passage, said nozzle passages being aligned along the length of said manifold discharge passage and being separated by said walls, the lengths of said walls between the discharge ends of adjoining nozzle passages being substantial, whereby the air from said manifold chamber is discharged through said nozzle passages at high velocity in separate narrow widely spaced streams and said streams are gradually merged into a single thin stream at a region spaced from the discharge ends of said nozzle passages, and mounting members passing through said walls between adjoining nozzle passages and secured to said chamber sides for fastening said nozzle unit in place in said discharge passage and for holding the two sections of the nozzle unit together.

3. An air nozzle construction for driers and the like comprising a manifold chamber having substantially parallel sides forming an elongated discharge passage, a plurality of elongated nozzle units in said passage extending in abutting end to end relationship, each of said units including a series of walls extending across said passage and spaced lengthwise thereof to define a series of spaced nozzle passages aligned along said chamber passage, and mounting members for holding said units in place in said passage, the end nozzle passages of each nozzle unit having their axes diverging outwardly in the longitudinal plane of said discharge passage, the intermediate nozzle passages between said end nozzle passages having their axes extending substantially parallel in the plane of said first-mentioned axes and diverging outwardly with respect to said latter axes, whereby air jets projected from said nozzle passages merge at a region spaced from the discharge ends of said nozzle passages into a single relatively thin stream.

4. An air nozzle construction for driers and

the like comprising an elongated nozzle unit having a series of transverse walls defining a series of spaced nozzle passages aligned along said unit, said unit being longitudinally split into two sections, each section having a series of recesses spaced along its inner face, the recesses of the two sections being arranged in opposed pairs, each pair of opposed recesses on the two sections conjointly forming a corresponding unitary nozzle passage and having a common outlet separated from the outlet of an adjoining nozzle passage by a corresponding transverse wall.

5. An air nozzle construction for driers and the like comprising a manifold chamber having parallel sides defining an elongated discharge passage, a nozzle unit in said passage comprising a series of walls extending across said passage and spaced lengthwise thereof to form between each pair of adjoining walls a nozzle passage, said walls between adjoining nozzle passages defining recesses closed from communication with said manifold chamber, said nozzle passages being aligned along the length of said manifold discharge passage and being separated by said walls, the lengths of said walls between the discharge

ends of adjoining nozzle passages being substantial, whereby the air from said manifold chamber is discharged through said nozzle passages at high velocity in separate narrow widely spaced streams and said streams are gradually merged into a single thin stream at a region spaced from the discharge ends of said nozzle passages, and mounting members passing through said walls and said recesses between adjoining nozzle passages and secured to said chamber sides for holding said nozzle unit in place in said discharge passage.

6. An air nozzle construction for driers and the like comprising an elongated nozzle unit having a series of transverse walls defining a series of spaced nozzle passages aligned along said unit, said unit being longitudinally split into two sections, each recessed to include a portion of the periphery of each nozzle passage, and mounting members passing through said walls between said nozzle passages to hold said sections in face to face registry.

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