United States Patent [19]

Amidon, Jr. et al.

[11] **3,736,669**

[45] **June 5, 1973**

[54] **NOZZLE DESIGN FOR A FABRIC WEB TREATING FACILITY**

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[22] Filed: **Sept. 20, 1971**

[21] Appl. No.: **181,793**

[52] **U.S. Cl.**.....**34/229**, 34/222

[51] **Int. Cl.**.....**F26b 19/00**

[58] **Field of Search**.....34/110, 114, 122, 34/229, 222; 239/550, 590.5, 601

[56] **References Cited**

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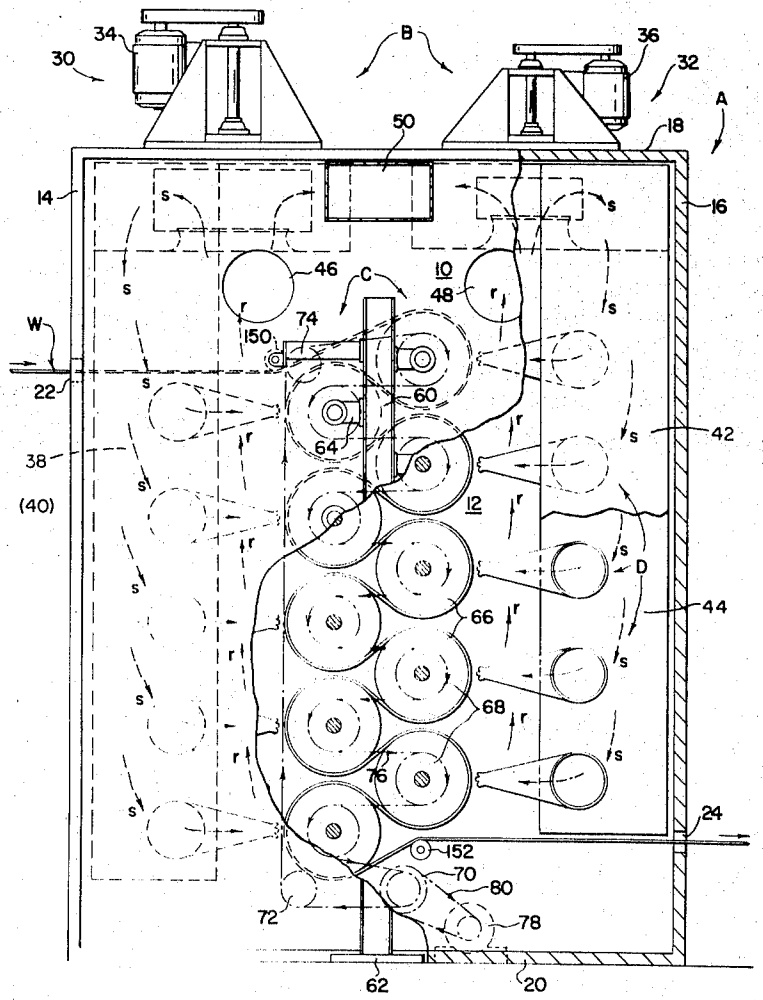
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Assistant Examiner—James C. Yeung
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[57] **ABSTRACT**

A nozzle design for particular use with a fabric web treatment facility in which heated air is periodically impinged against the web through nozzles as it is processed through the facility around a plurality of elongated rolls. The design provides for ease of access into the facility for cleaning and threading the web onto the rolls by providing a pivotal mounting for the nozzles in order that they may be arcuately moved between a first operative position closely spaced to the web and a second position spaced remote therefrom. Each nozzle includes three air outlet passages extending transversely thereacross in order that the heated air flow therethrough will impinge the web at varied angles and eliminate return air velocities.

8 Claims, 6 Drawing Figures



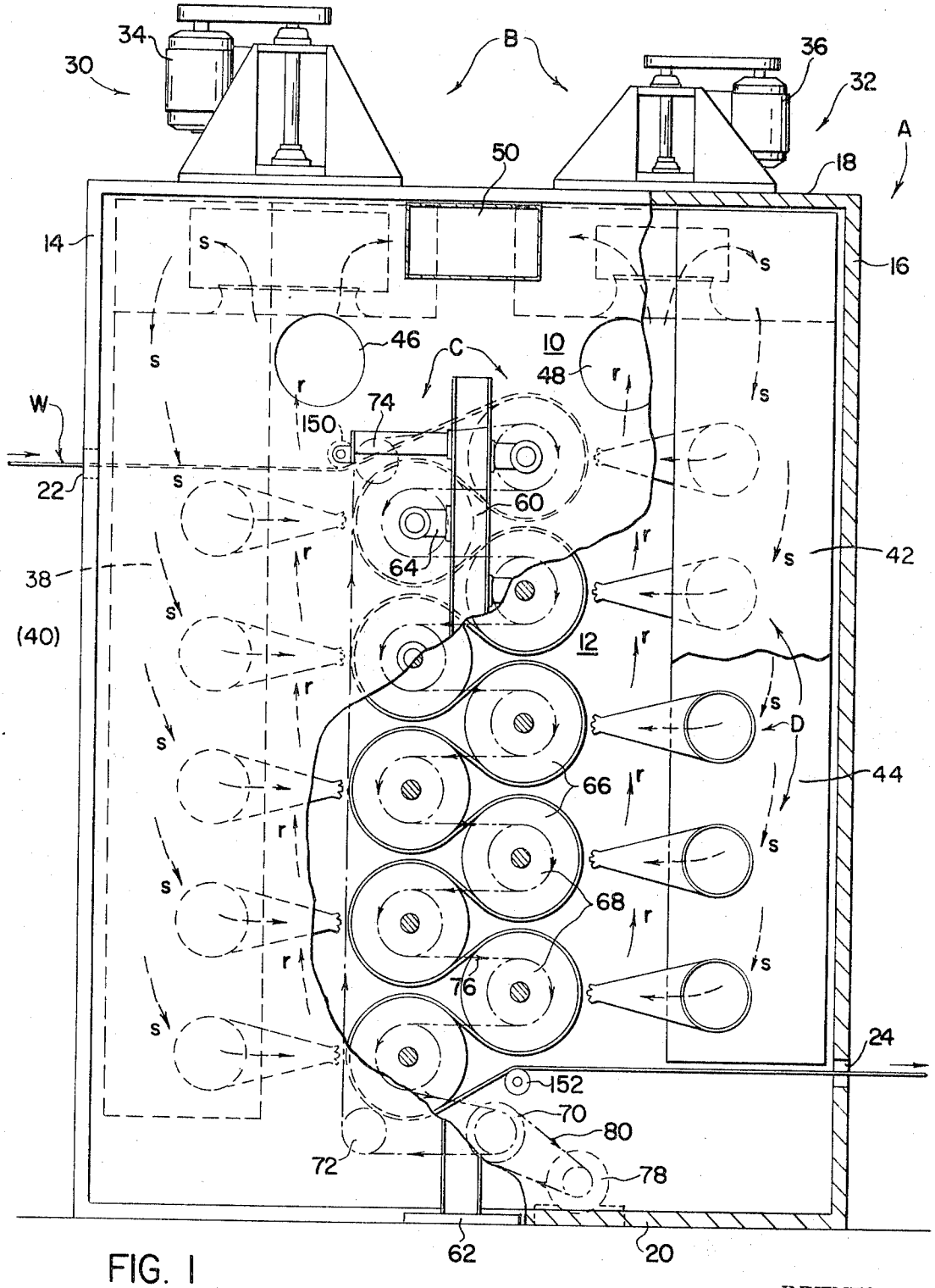


FIG. 1

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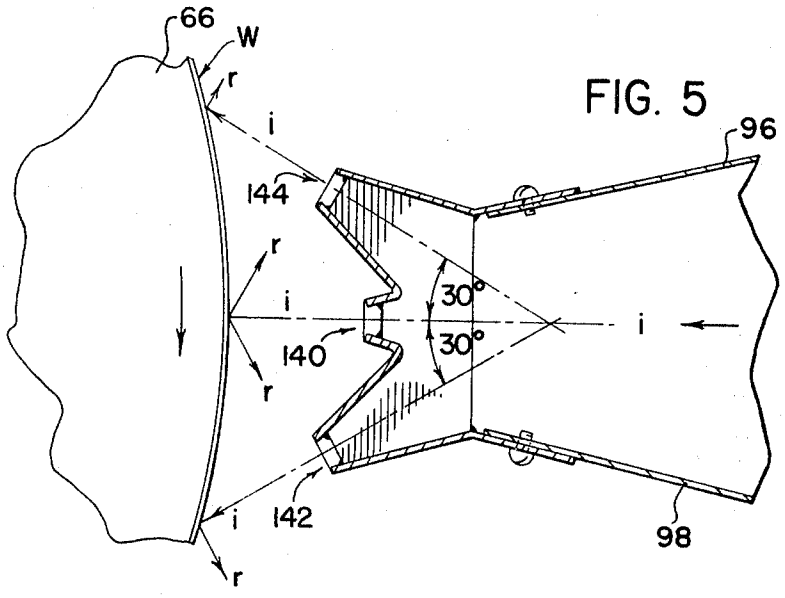


FIG. 5

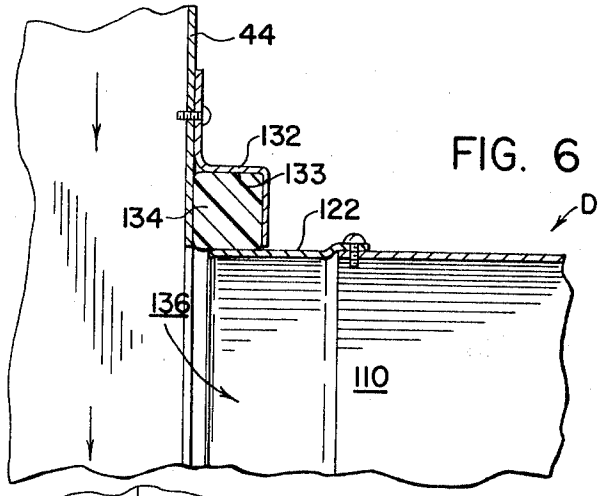


FIG. 6

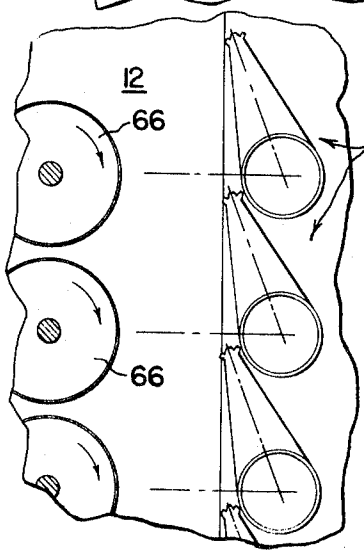
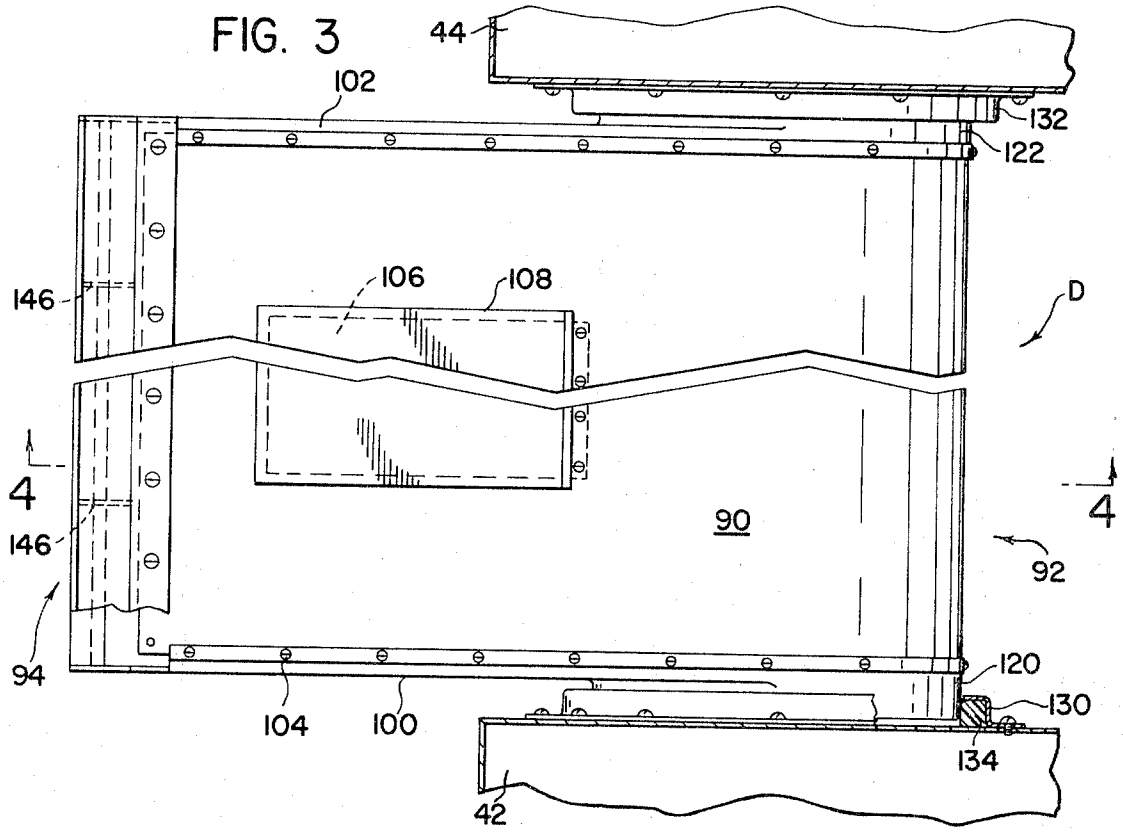


FIG. 2

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FIG. 3



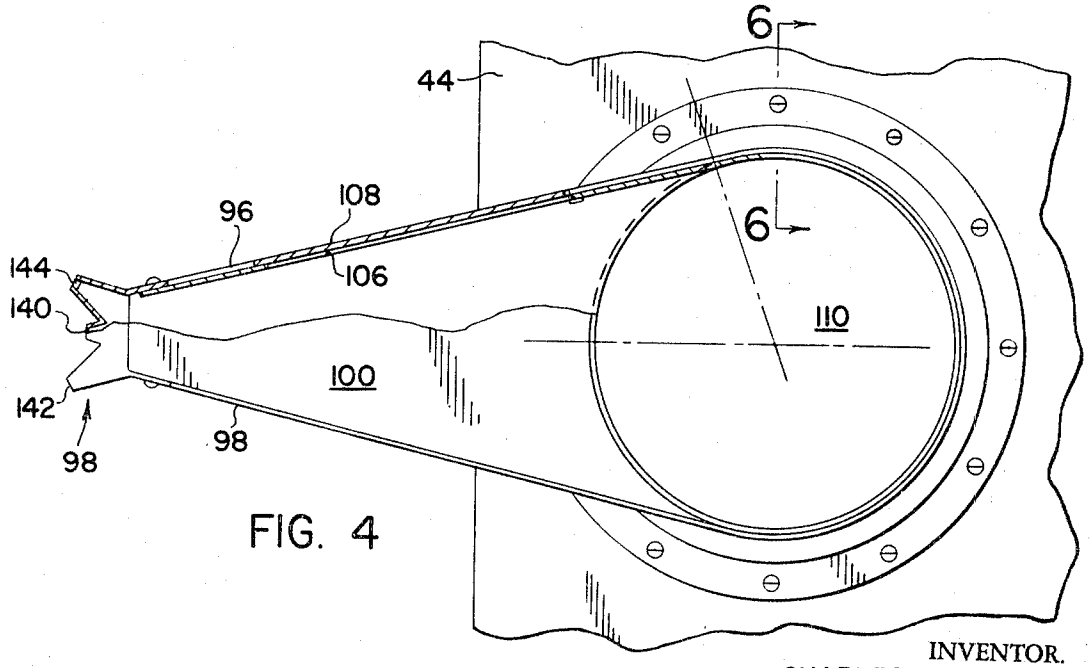


FIG. 4

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NOZZLE DESIGN FOR A FABRIC WEB TREATING FACILITY

This application pertains to the art of fabric treatment and more particularly to a nozzle design for use with a fabric web treatment facility.

The invention is particularly applicable to a fabric web treatment facility wherein a heated air flow is directed by a plurality of nozzles to impinge a fabric web as it is processed through the facility around a plurality of elongated rolls and will be described with particular reference thereto; however, it will be appreciated that the invention has broader applications and may be used in any environments where it is desired to direct a gaseous flow to impinge a fabric web or other workpieces.

In fabric web treatment, it is often desired to pass the web through a facility wherein a heated air flow is periodically directed against the web. Such treatment may be alternately desired to dry and/or condition the web. A facility of this type generally employs a plurality of elongated rolls spaced adjacent to and parallel with each other so as to form at least one column or row of rolls which may be enclosed in a housing. The web is threaded between adjacent rolls in a serpentine fashion and a heated air flow directed to impinge the web by nozzles spaced adjacent each roll.

Heretofore, these fabric web treatment facilities utilized a plurality of fixed nozzles placed in closely spaced relationships relative to the web. Because of this arrangement, the nozzles were necessarily located approximately 6 to 10 inches away from the web to enable maintenance work to be performed on the facility, to provide a clearance area for cleaning the rolls, and to permit threading of the web around the rolls. Because of this necessary distance, the effective velocity of the heated air flow issuing from the nozzles was substantially reduced so that the receipt of an efficient heat transfer from the air to the web was greatly impaired. Further, these prior nozzles only utilized a single air outlet passage disposed adjacent the web so that the air was directed to impinge the web only in a direction generally normal thereto. This single outlet passage did not provide a particularly efficient impinging air supply against the fabric web so that many rolls and associated single outlet passage nozzles were required to dry and/or work the web as desired. Further, in prior facilities of this type, each nozzle formed a part of a plenum chamber which confined the air after it had impinged the web and caused transverse velocities of air resulting in uneven heating of the web selvedges.

The present invention contemplates a new and improved apparatus which overcomes all of the above referred problems and others and provides a nozzle design for a fabric web treatment facility which provides ease of access for cleaning the facility components and which provides more efficient air impingement on the fabric web.

In accordance with the present invention, there is provided a gas flow supply nozzle for particular use with a fabric web treatment facility. The nozzle is comprised of an elongated housing including a gas inlet area disposed adjacent one end thereof and a plurality of gas outlet passages disposed across the other end in a generally side by side relationship. The nozzle is mounted relative to the facility in order that it may be selectively moved between a first position in closely spaced operative relationship relative to the web and a second position spaced remote therefrom.

In accordance with a more limited aspect of the present invention, the plurality of outlet passages comprises three passages. The middle or central passage is disposed so as to direct a portion of the gas flow in a direction normal to the web when the nozzle is in the first position. The other two passages are disposed so as to direct portions of the gas flow against the web at angles to the normal direction.

In accordance with another limited aspect of the present invention, the angled outlet passages are each disposed to direct gas outwardly at an angle of approximately 30° from the normal.

The principal object of the present invention is the provision of a new and improved gas flow nozzle for use in a fabric web treatment facility.

Another object of the present invention is the provision of a new and improved gas flow nozzle for use in a fabric web treatment facility wherein the nozzle is movable between a first operative position relative to the web to a second position spaced remote therefrom.

Another object of the present invention is the provision of a new and improved gas flow nozzle for use in a fabric web treatment facility which improves gas flow impingement onto the fabric web.

Still another object of the present invention is the provision of a new and improved gas flow nozzle for use in a fabric web treatment facility which permits the nozzle to be closely spaced to the fabric web when in the operative position.

Yet another object of the present invention is the provision of a new and improved gas flow nozzle for use in a fabric web treatment facility which eliminates return air velocities.

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and wherein:

FIG. **1** is a side view of a fabric web treatment facility using the concepts of the subject invention and having a portion of the side wall removed for ease of illustration;

FIG. **2** is a view of three warm air nozzle assemblies constructed in accordance with the subject invention and which have been arcuately moved from the operative position for cleaning or threading of the facility;

FIG. **3** is a plan view of one of the warm air nozzle assemblies of the subject invention;

FIG. **4** is a cross sectional view taken along lines **4—4** of FIG. **3**;

FIG. **5** is an enlarged view of the air outlet passages in one of the warm air nozzle assemblies; and,

FIG. **6** is a cross sectional view taken along lines **6—6** of FIG. **4**.

Referring now to the drawings, wherein the showings are for the purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting same, the FIGURES show a fabric web treatment facility A including therein warm air circulating units B, fabric web roll assemblies C and warm air nozzle assemblies D.

More specifically, the treatment facility includes a pair of spaced apart side walls **10,12** a front wall **14**, a rear wall **16**, a top wall **18**, and a bottom wall **20**. These walls may be constructed from any convenient material such as sheet metal or the like and include extending therebetween and therealong any necessary and appro-

priate rigid frame members. The facility is not shown in more detail as it, in and of itself, does not form a part of the present invention and as it may comprise any design necessary to fulfill a particular fabric treatment function. Front wall **14** includes a fabric web inlet slot **22** and rear wall **16** includes a fabric web outlet slot **24.** Further, side walls **10,12** may include a plurality of access doors (not shown) which readily permit access to the inside of the treatment facility itself.

Disposed on top wall **18** are a pair of warm air circulating units B comprised of conventional circulating ducts and components generally designated **30,32** which, in the preferred embodiment, are driven by electric motors **34,36** to generate air flow through the facility. It should be noted that unit **30** includes an air supply duct **38** extending generally vertically along the inside of a portion of side wall **10** and an air supply duct **40** in an identical relationship with side wall **12.** Likewise, a second pair of air supply ducts **42,44** are disposed in association with heating and circulating unit **32** and side walls **10,12** respectively. The air flow through these ducts will be more fully described hereinbelow relative to operation of the apparatus. A heater **46** is disposed in an operative relationship with circulating unit **30** and a heater **48** is disposed in operative relationship with circulating unit **32** in order to heat the air being circulated inside of the facility. In the preferred embodiment, heaters **46,48** are mounted to and extend through side wall **10.** Heaters **46,48** are only shown in a general manner and may comprise any of several types of heaters adaptable for such use. An exhaust duct **50** is provided between units **30,32** to connect the inside of the facility with ambient air in order to assist in providing a continuous flow of air within the facility.

An I-beam like channel member **60** extends vertically upward along each side wall **10,12** at generally the midpoints thereof. Each channel member includes a base portion **62** and a plurality of pillow block mountings **64** spaced longitudinally therealong on each side thereof. These pillow block mountings are for mounting elongated rolls in position relative to the facility and the number of pillow blocks employed depends entirely upon the number of rolls to be used. In the preferred embodiment, ten elongated cylindrical rolls **66** are used and are journaled in a known fashion between the associated of the pillow block mountings **64** of the two channel members so as to form two vertical columns or rolls. It is, of course, possible to have other spacial relationships between the rolls and still use the concepts of the subject invention. It will be appreciated that the opposed channel members must be rigidly mounted to support these rolls, which rigid mounting may take the form of any of several structural reinforcements which do not form a part of the present invention and are therefore not shown. It should be noted that rolls **66** may be comprised of any material consistent with use for fabric web treatment such as, for example, stainless steel or steel rolls covered by a synthetic material. Disposed at one end of each roll is a sprocket-like element **68** for use in rotatably driving each of the rolls as will hereinafter be more fully described. Spaced adjacent from channel member **60** or mounted therefrom in any convenient manner are idler sprocket elements **70,72** and **74.** In the preferred embodiment, these elements are adapted to receive a drive chain **76** which extends in a continuous fashion therearound and also around each sprocket-like element **68** associated with rolls **66.** A drive motor generally designated **78** and of the type generally associated with rotatably driving a plurality of rolls is mounted relative to bottom wall **20** in a known fashion and a second continuous drive chain **80** extends between the drive motor and sprocket-like element **70.** The drive motor effects resultant rotational movement between each of rolls **66,** the speed of which may be varied by altering the sizes of the sprocket-like elements and/or the drive motor speed in a known fashion. As far as the present invention is concerned, it is merely necessary to appreciate that rolls **66** are driven at identical speeds.

The overall arrangement for warm air nozzle assemblies D is best shown in FIG. **1.** In that FIGURE, it will be noted that for each roll **66,** an associated nozzle assembly is mounted in a cooperating relationship therewith adjacent thereto. Referring more specifically to FIGS. **3, 4, 5** and **6,** description of one of these assemblies will hereinafter be made, it being understood that the remainder of the assemblies are identical thereto unless otherwise specifically noted. Assembly D is comprised of a nozzle housing **90** having an air supply area generally designated **92** and an air outlet area generally designated **94.** Housing **90** is comprised of a top wall **96,** bottom wall **98** and a pair of spaced apart side walls **100,102.** It should be noted that in the preferred embodiment, these walls are made from a relatively thin walled rigid material such as, for example, sheet metal, although other materials could be employed. Further, it should be noted that the top and bottom walls are formed from a single piece of sheet metal and that the housing is so designed that the top and bottom walls converge toward each other from air supply area **92** to air outlet area **94.** As shown, the housing is assembled by using a plurality of mechanical fasteners designated **104,** although other means such as welding or adhesives could be utilized. Disposed along the top wall is an access area **106** which includes an access area cover **108** thereover which is retained in position by mechanical fastening means or other convenient means. Disposed in each of side walls **100,102** is a generally circular air supply inlet **110.** Corresponding, generally circular and outwardly extending, mounting flanges **120,122** are mounted around air supply inlets **110** in walls **100,102** respectively. Corresponding receiving flanges **130,132** extend inwardly from ducts **42,44** respectively to receive mounting flanges **120,122.** Each of these receiving flanges is identical and, as best shown in FIG. **6,** flange **132** is designed to provide a circular gasket receiving channel **133** extending therearound. A gasket-like member **134** which may be comprised of rubber or similar material is received in channel **133** in order to provide a relatively air-tight sealing relationship between mounting flanges **120,122** and receiving flanges **130,132.** As may also be best seen in FIG. **6,** duct **44** includes an air outlet passage area **136** therein inside the confines defined by receiving flange **132.** It should be here noted that each of air supply ducts **38, 40, 42** and **44** include similar air supply outlets as required to facilitate operative mounting for the desired number of nozzle assemblies D.

With mounting flanges **120,122** received inside of receiving flanges **130,132** respectively and with the receiving flanges mounted to their respective air supply ducts, it will be appreciated that nozzle housing **90** may be pivoted about that mounting so that air outlet area

94 may be moved from, and with reference to FIG. 1, a closely disposed relationship with the associated roll 66 to a second position, and with reference to FIG. 2, arcuately spaced therefrom so that a clearance area is developed between each of the rolls and its associated nozzle assembly. In the preferred embodiment of the subject invention and with the nozzle assemblies in the first position, air outlet areas 94 are disposed approximately two inches away from their associated rolls. In the second position, however, the nozzles are disposed approximately 18 inches away from their associated rolls. This eighteen inch clearance is more than sufficient to provide access to the rolls and/or nozzles for cleaning or maintenance purposes as will hereinafter be more fully apparent. If tight-fitting relationships exist between receiving flanges 130,132, gaskets 134, and mounting flanges 120,122, the nozzle assemblies will remain focused as positioned without the need for locking means. However, simple locking means for positively locking each of the nozzles in desired location may be easily provided. Further, it is also possible to interconnect all the nozzle assemblies so that they may be simultaneously automatically moved between their first and second positions.

FIGS. 3, 4 and 5 best show outlet area 94 which is comprised of air outlet passages 140,142 and 144. These passage areas may be fabricated from any relatively thin rigid material such as sheet metal and affixed to the end of housing 90 by any convenient means such as, for example, mechanical fasteners. As seen in FIG. 4, these passages extend transversely across housing 90 in a side by side relationship between side walls 100,102 and have reinforcements 146 extending laterally therebetween to provide rigidity for the structure. As can be appreciated, it is most desirous that the transverse width of housing 90 and the resultant width of each air outlet passage is at least as wide as the fabric web to be treated. Therefore, it is advantageous to have this width substantially the same dimension as the length of rolls 66. As best seen in FIGS. 4 and 5, air outlet passage 140 is situated so as to direct a portion of the air flow from the nozzle housing longitudinally coextensive with the housing itself. When the housing is in the first position, this causes an air flow to be directed against the surface of the associated roll 66 in a direction generally normal thereto. Passages 142,144 are disposed so as to direct the remainder of the air flow angularly outward from the nozzle housing at an angle to the normal flow. In the preferred embodiment, and most advantageously, this angle is 30° as it has been found that this angle provides the most efficient air impingement onto the surface of roll 66 and the fabric web. Obviously, other angles could be used or even additional passage areas could be used if desired.

In using the subject invention, all the warm air nozzle assemblies D are first moved to a position similar to that shown in FIG. 2. A fabric web generally designated W which may have previously been treated in a liquid cleaning or dying substance such that it is desired to dry it by impinging warm air thereagainst as it travels through treatment facility A is supplied for processing therethrough. The lead end is inserted through fabric web inlet 22 in front wall 14 and threaded in a serpentine fashion back and forth between the two vertical columns or rolls 66 and then out through fabric web outlet 24 in rear wall 16. The web may be supplied from a reel (not shown) generally associated with fabric web handling and rerolled adjacent the outlet area by a takeup reel (not shown) also of a type used in fabric web handling. As shown in FIG. 1, appropriate lead-in roll 150 and exit roll 152 are also provided to support the web. Once the fabric web has been threaded into the facility, nozzle assemblies D may be moved to their first positions as shown in FIG. 1.

The warm air circulating units B may next be energized to provide a continuous flow of warm air through air supply ducts 38, 40, 42 and 44 and out through outlets 136 into the associated of the nozzle assemblies. At the same time, heaters 46,48 are activated to heat this air flow in order that warm air will be impinged against the fabric web. The air flow path is shown best in FIG. 1 by arrows designated *s* for the supply air passed through ducts 38, 40, 42 and 44 and *r* for the return air flow which will be reheated and recirculated. The web may then be pulled through the apparatus by the effect of drive motor 78 rotatingly driving in unison all the rolls 66 and the takeup roll. As the web passes between the rolls in the serpentine pattern, one column of the air nozzle assemblies will impinge warm air against one side of the web and the other column of air nozzle assemblies will impinge warm air against the other side of the web. Thus, both sides of the web receive a flow of warm air thereagainst to dry or otherwise treat the web. As can best be seen in FIG. 5, air passing out of each nozzle assembly has the effect of directing a warm air flow to impinge the web at different angles and is designated *i* therein. Once this air has impinged the web, it is in effect converted into a portion of return air flow *r*. Therefore, once the impinging air has expended its energy to the web, it bounces back and returns away from the web so that it is free to return to the recirculating system for reheating and reimpinging.

Once the roll of fabric web has been processed, it is merely necessary to again return the nozzle assemblies to the second positions in order that another roll of fabric web may be threaded and processed through the facility. As can be appreciated, it will oftentimes be desirous of having access to the inside of the facility, and in particular, the surface of the rolls in order to perform maintenance periodic cleaning. With the nozzle assemblies in the positions shown in FIG. 2, and with the access doors in side walls 10,12 this is easily accomplished as, in the preferred embodiment, a distance between the assemblies and rolls of 18 inches is provided. This distance is such that maintenance personnel will have free access thereto to perform whatever maintenance for cleaning is deemed necessary. Similarly, access area covers 108 may be removed from the associated access areas 106 in order to provide access into the inside of each nozzle assembly.

The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon the reading and understanding of this specification. It is our intention to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalence thereto.

Having thus described our invention, we now claim:

1. A gas flow supply nozzle for particular use in treating a fabric web as it is continuously passed through a web treatment facility, said nozzle comprising:

an elongated housing;

means for mounting said housing relative to said facility and means for selectively moving said hous-

ing between a first position in an operative relationship with said web and a second position spaced remote from said web; and,

at least one gas inlet area disposed adjacent one end of said housing and means for forming a plurality of gas outlet passages disposed adjacent the other end of said housing, said plurality of gas outlet passages comprising at least three of said gas outlet passages extending in a generally side by side relationship laterally across said other end wherein said first position one of said at least three passages is disposed so as to direct a portion of said gas flow generally longitudinally outward from said housing substantially transversely across said web and the other of said at least three passages are disposed so as to direct portions of said gas flow outwardly from said housing at angles to the gas flow issuing from said one passage.

2. The nozzle as defined in claim **1** wherein said mounting means comprises means for pivotally mounting said housing adjacent said one end for permitting said other end to be arcuately moved between said first and second positions.

3. The nozzle as defined in claim **1** wherein said at least three outlet passages comprise three of said passages, said one passage comprising the middle one of said three passages and said angles comprising diverging angles of approximately 30° from each side of the gas flow issuing from said one passage.

4. The nozzle as defined in claim **3** wherein said housing has a generally rectangular cross section defined by a pair of opposed side walls, a top wall and a bottom wall, said top and bottom walls converging toward each other from said one toward said other end, said three outlet passages extending transversely across said other end between said side walls.

5. The nozzle as defined in claim **4** wherein said mounting means are disposed in said side walls, said at least one gas inlet area being disposed inside at least one of said mounting means.

6. In a fabric treatment facility wherein a fabric web is passed continuously over a plurality of rolls while a gas flow is directed against said web from at least one nozzle assembly, the improvement comprising:

said nozzle assembly including means for forming a plurality of adjacent outlet passages, each of said plurality extending generally transversely across said assembly in a generally side by side relationship for separating said gas flow into separate gas streams which each impinge said web generally transversely thereacross at varied angles relative to each other from said nozzle assembly, said nozzle assembly including means for mounting said assembly for permitting selective movement of said plurality of outlet passages between a first operative position adjacent said web and a second position spaced remote therefrom, said passages extending generally transverse to said web when said outlet passages are in said first position.

7. The improvement as defined in claim **6** wherein said plurality comprises three of said outlet passages in a coextensive side by side relationship, one of said outlet passages being disposed so as to direct a portion of said gas flow against said web in a direction generally normal thereto when said outlet passages are in said first position and the other of said outlet passages being disposed so as to simultaneously direct portions of said gas flow against said web at angles to said normal direction.

8. The improvement as defined in claim **7** wherein said one outlet passage comprises the center one of said three outlet passages and said other outlet passages are disposed so as to direct said portions against said web at a diverging angle of approximately 30° from each side of said normal direction.

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