July 8, 1969 R. G. MacKENDRICK 3,453,712

METHOD OF MAKING A POROUS ROLL

Filed Aug. 29, 1966 Sheet 1 of 2

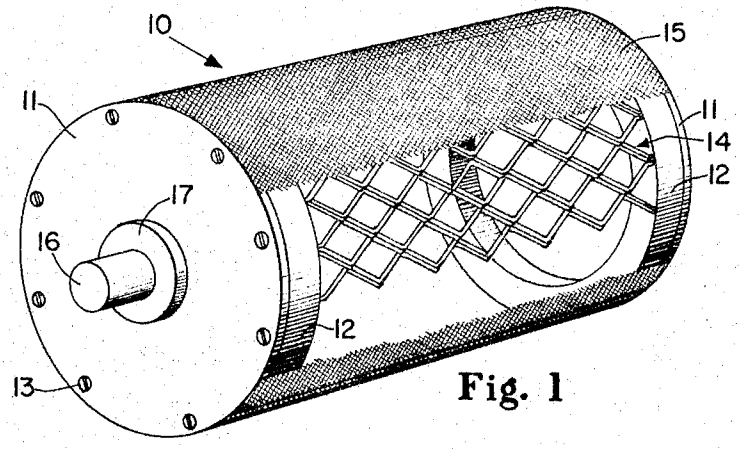


Fig. 1

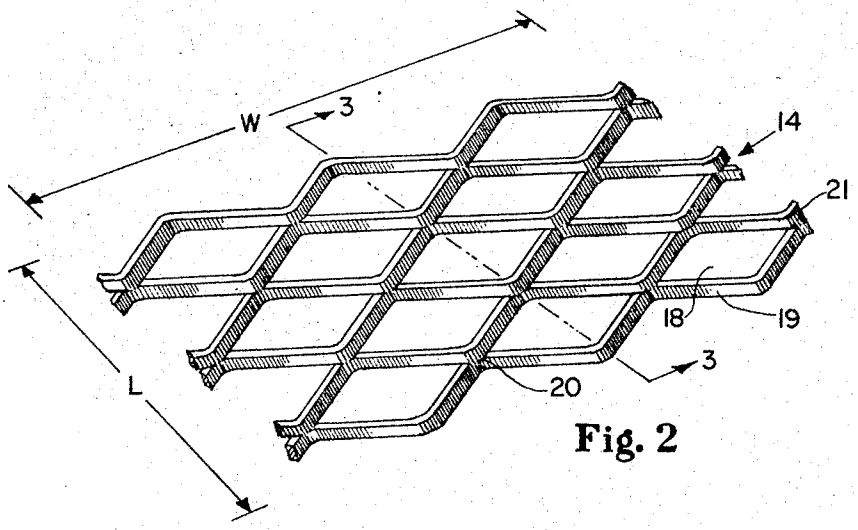


Fig. 2

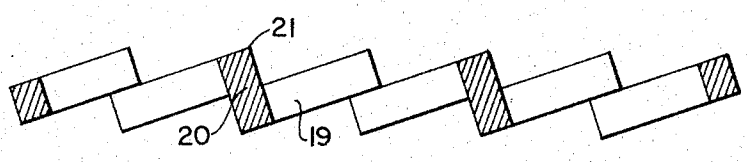


Fig. 3

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Fig. 6

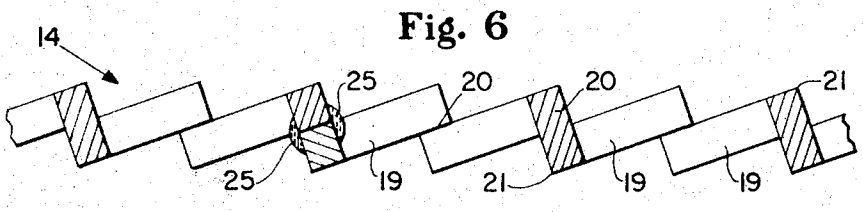


Fig. 5

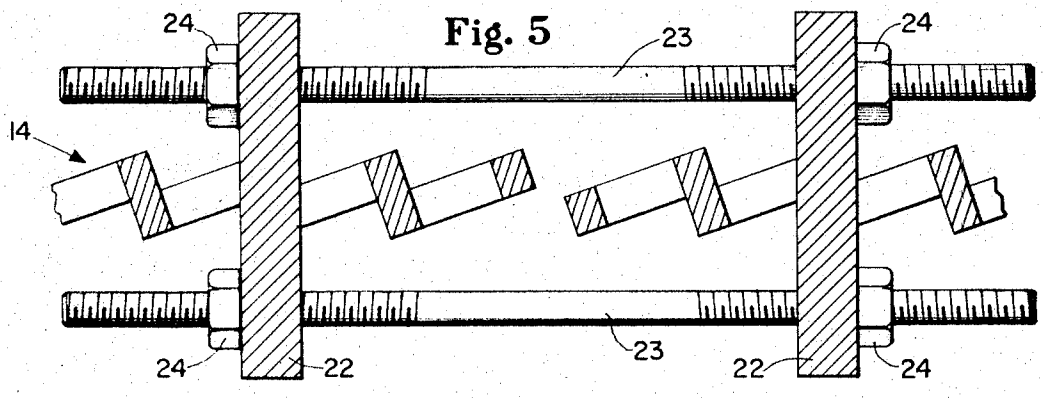
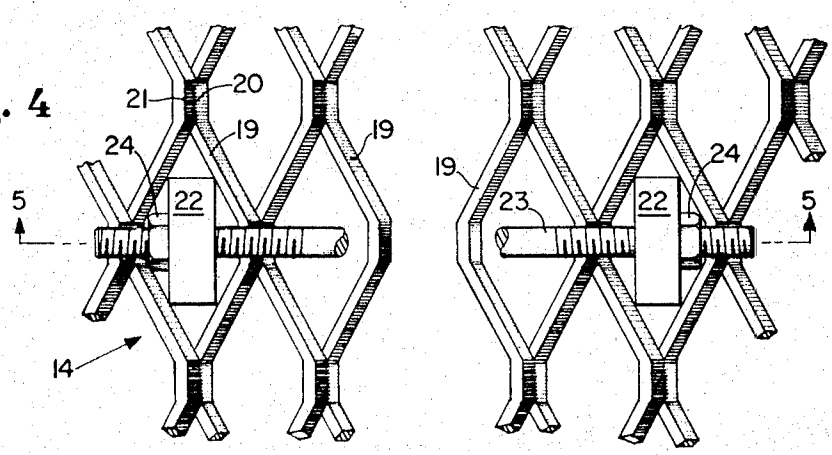


Fig. 4



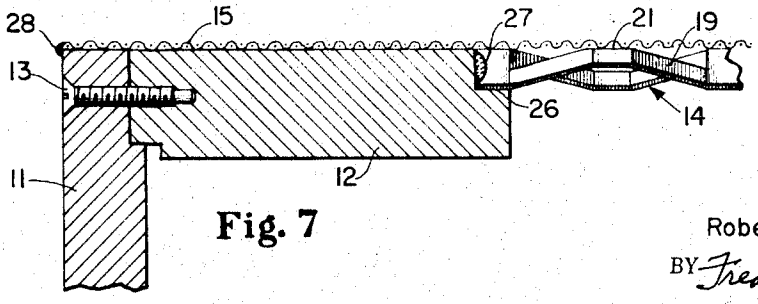


Fig. 7

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METHOD OF MAKING A POROUS ROLL

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U.S. Cl. 29—148.4 3 Claims

ABSTRACT OF THE DISCLOSURE

A method of making a porous roll from a sheet of extensible material having a plurality of apertures therein. The sheet is rolled over a pair of spaced circular discs which have a circumference greater than the length of the sheet and is circumferentially stretched to bring the opposed edges into abutting relationship. The abutting edges are permanently united and the ends of the rolled sheet are secured to the discs.

This invention relates to a method of making a porous roll and, more particularly, to a method of constructing a porous dryer roll which has a fine mesh screen outer covering applied over an extensible supporting member of unitary construction.

Previous porous dryer rolls have been constructed using a pair of spaced discs to which is attached a supporting structure made from individual pieces of heavy wire or a plurality of thin metal strips which have been cemented together to form an openwork structure. A fine, wire mesh screening is attached over the outer surface of the openwork structure to support the material which is to be dried. Rolls of this construction are used to remove water from a web of wet pulp by imposing a lower pressure or suction on the inner surface of the roll opposite the area in contact with a web of wet pulp. For example, in U.S. Patent 3,139,375, issued on June 30, 1964, to E. T. Bryand, a suction roll assembly is shown and described wherein the structure which supports the fine mesh screening is fabricated from a plurality of thin strips which are individually bent to form a spaced series of hemi-hexagonally shaped sections which are adhesively united to form a multiplicity of generally hexagonally-shaped openings therein. This openwork structure is affixed to the spaced discs to form a roll and the fine mesh screen is then applied over the hexagonal openwork. Other prior art dry roll structures have utilized a heavy supporting frame constructed from relatively large metal rods. Such a structure is shown in U.S. Patent 2,312,678, issued Mar. 2, 1943, to J. A. Spencer. A roll having a structure as taught in the latter patent results in an undesirable, large pressure drop across the outer surface of the roll thereby reducing the effectiveness of the drying operation. Additionally, rolls made according to the teachings of both the aforementioned patents are difficult and time-consuming to assemble, thus increasing the cost of the roll.

Accordingly, it is an object of this invention to provide a method of fabricating a porous roll from a unitary sheet of extensible material which forms the supporting structure for a fine, foraminous covering.

Another object of this invention is to provide a method for quickly and inexpensively making a porous roll suitable for carrying an outer screen material.

Briefly stated, in accordance with one aspect of the present invention, a method of making a porous roll is provided wherein an extensible sheet of metal which has been cut and stretched to form an openwork grid is cut to a width corresponding to the width of the porous roll. The sheet is cut so that the length is less than the circumference of the roll and contains a unit number of openings in the length-wise direction. The sheet so formed is rolled over at least two circular discs and is then stretched circumferentially until the edges abut each other to form a continuous grid having a unit number of fully formed openings therein. The stretched sheet is then permanently united at its edges and is then secured to the supporting discs to form a uniform openwork suitable for supporting a fine mesh screen.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view of a roll made according to the present invention showing the expanded metal and wire screening partially broken away;

FIGURE 2 is an enlarged fragmentary perspective view of a section of the expanded metal shown on the roll in FIGURE 1;

FIGURE 3 is a fragmentary cross section of the expanded metal of FIGURE 2 taken along the line 3—3 thereof;

FIGURE 4 is a fragmentary view of two edges of a sheet of expanded metal showing a pair of stretching clamps in place;

FIGURE 5 is a cross-sectional view taken along the line 5—5 of FIGURE 4;

FIGURE 6 is a fragmentary cross-sectional view of the expanded metal showing a welded joint therein; and

FIGURE 7 is a fragmentary cross-sectional view of the end of the roll showing the weld at the junction of the expanded metal in the end of the roll.

Referring now to the drawings and particularly to FIGURES 1 and 7, there is shown a roll **10** having circular end discs **11** to which are attached annular rings **12** by means of screws **13**. Welded to the annular rings **12** is a uniform openwork mesh of expanded metal **14** which supports a fine mesh wire screen **15**.

The discs **11** which define the end walls of roll **10** have a shaft boss **17** either integral therewith or attached thereto as by welding. The shaft boss **17** carries a trunnion or stub shaft **16** so that the roll can be rotatably mounted in a pair of journals. Although a stub shaft is shown in FIGURE 1, a shaft which passes completely through the roll can also be used.

The end walls of the roll **10** can be of any desired configuration and can be a unitary solid disc. However, the combination of a relatively thin end disc **11** with an attached annular ring **12** having the same outer diameter as the diameter of end disc **11** as shown in FIGURE 7 is preferred since it results in a lower weight and in less cost because less material is used. The end discs **11** form the principal supporting structure for the roll and together with the wire screen **15** define the outer diameter of the roll. The width of the roll is determined by the lateral spacing between the discs **11** shown in FIGURE 1.

The expanded metal sheet **14** which forms the structural base for the fine mesh wire screen **15** is formed from a solid sheet of metal by making a plurality of slits in the sheet and then uniformly stretching the sheet in a direction perpendicular to the slits so that it increases in length and the slits open to form a plurality of apertures which define a generally diamond-shaped openwork pattern. The slits pass completely through the sheet and are made by piercing the sheet with rectilinear cuts at uniform intervals both laterally and longitudinally.

After being pierced, the sheet has a series of spaced, parallel transverse rows of aligned, uniform, equally spaced rectilinear cuts or slits in the transverse or width dimension. The slits are spaced in order to preserve the integrity of the sheet. Alternate transverse rows of slits

have the slits and spaces therebetween similarly oriented in that the ends of the slits are parallel in a longitudinal direction. The transverse rows which are positioned intermediate the alternate transverse rows are offset therefrom so that there is equal overlap between adjacent rows of slits.

The expanded metal sheet is then formed by uniformly stretching the pierced sheet in a longitudinal direction perpendicular to the slits, thereby causing the metal to deform and to separate at the slits to form uniformly-shaped openings and provide an openwork sheet which has a length greater than the original solid sheet. Such a sheet is shown in FIGURE 2 and has diamond-shaped openings **18** which are defined by strands **19**. The thickness of the strands is determined by the thickness of the original, solid sheet and the width of the strands is determined by the longitudinal spacing between adjacent slits in the pierced sheet. In areas where the cuts are spaced laterally from one another, common areas **20** result to cooperate with the strands to close the diamond pattern **18**.

In the course of stretching the pierced sheet the strands **19** are deformed and the common areas **20** interconnecting adjacent strands are caused to rotate by the bending of the strands, assuming the general position shown in cross section in FIGURE 3. The degree of rotation of common areas **20** is a function of the deformation of strands **19**. The uppermost and lowermost portions of the rotated common areas **20** form a series of points which are referred to in the art as bridges and are indicated by numeral **21** on FIGURES 2 and 3. Although shown and described in terms of a diamond-shaped pattern, various other patterns are also possible depending upon the orientation of the cuts and the thickness of the metal used to form the expanded sheet. Expanded metal sheets of the character herein described can be obtained from the Penn Metal Company, Parkersburg, W.Va., and from the Exmet Corporation, Bridgeport, Conn.

After the expanded metal sheet has been formed it is cut to the required size by trimming a sheet to a width corresponding with the width of the roll to be formed, and to a length less than the circumference of the final roll. The relationship of the diamond pattern to the length and width is such that the major dimensions of the opening is transverse the sheet and the minor dimension is longitudinal as designated on FIGURE 2 by the letters L and W, respectively. The sheet is then wrapped around the discs which define the roll diameter and the ends thereof are unjoined as shown in FIGURE 4.

In order to provide a uniform openwork around the circumference of the roll, the transverse cuts in the expanded metal sheet must be made so that there is a unit number of openings in the circumferential direction which form complete openings when the ends are butted together. This permits the two ends to be butted together and form a continuous, uninterrupted pattern around the circumference of the roll. Longitudinal cuts can be made at any point on the sheet since the sides of the sheet are secured to the annular rings **12** and no matching of the pattern on the sides with another part of the sheet is required.

The porous roll is formed by rolling the expanded metal sheet over the end discs **11**. Since the length of the sheet of expanded metal is less than the circumference of the disc, the outer surface of the roll which results from wrapping the expanded metal around the discs presents a gap as shown in FIGURES 4 and 5. This gap can be about two pattern pitches but is preferably less than about one pattern pitch to permit sufficient stretching of the rolled, expanded metal sheet so that the cylinder so formed is under some stress in order to support the superposed fine wire screen and material which the latter carries. When the gap is more than about two pattern pitches, a large portion of the greater stretch thereby required is supplied by the deformation of the sheet in the area adjacent the gap, thus resulting in a substantially non-uniform circumferential pattern.

The rolled sheet is then uniformly stretched in the circumferential direction to close the gap and form a complete cylinder having a continuous, substantially uniform pattern by inserting clamps **22** between corresponding portions of the pattern on opposite sides of the gap between the edges of the sheet. It is necessary to provide a plurality of clamps **22** at spaced intervals along the gap in the sheet so that the sheet can be uniformly stretched to permit the opposed edges to come into contact so they can be fastened together. Studs **23** pass through clamps **22** and have nuts **24** threaded on each end thereof to contact the outer surfaces of clamps **22** and thereby provide a means for moving the clamps closer to each other. In the course of moving the clamps closer to each other by turning nuts **23** inwardly, the matching sections of the opposed edges are brought into contact and when this point is reached the edges are permanently united to each other by means of welds **25** shown on FIGURE 6. When welded, the sheet forms a continuous, substantially uniform circumferential pattern. After being so formed, the complete expanded metal cylinder is secured to annular ring **12** by means of weld **27**. Annular ring **12** has a rabbet **26** at an interior corner thereof which is cut to a depth to permit the bridges **21** of the expanded metal sheet **14** to be spaced the same radial distance from the centerline of the roll as the outer circumference of ring **12**. The outer covering of fine mesh **15** is then superposed over the outer surface of the expanded metal by tightly rolling the mesh thereover and is secured to the circumference of discs **11** by means of weld **28** as shown on FIGURE 7.

By stretching the expanded metal sheet **14** longitudinally in the process of wrapping it around the discs **11**, the resulting stresses in the strands **19** provide a taut sheet which resists inward deflection. Depending upon the size, pattern, and material of the expanded metal and the width of the roll, the stresses imposed by stretching can be sufficient to fully support the fine woven mesh screen **15** and a wet web of paper or the like. However, if the roll is very wide it is desirable to provide additional annular rings such as ring **12**, but of a diameter corresponding to that of rabbet **26** and of a width to present a minimum resistance to air flow, at various points along the axis of the roll. Any added rings are preferably welded to the expanded metal to form a rigid cylindrical structure.

It can be seen that the method of fabricating a porous roll as herein described provides a quicker means of assembling such a roll, thereby permitting the manufacture thereof at a much lower cost than rolls which have a supporting structure made from individual metal rods or an assembly of formed strips arranged edgewise.

In addition to providing an inexpensive porous roll, of suitable strength, the present method also provides a porous roll, having a cross section which presents a low resistance to air flow through the roll.

While particular embodiments of the invention have been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such changes and modifications.

What is claimed is:

1. A method of fabricating a porous dryer roll from a sheet of extensible material having a plurality of apertures therein, said roll having a foraminous periphery to permit the flow of air therethrough, said method comprising:

(a) rolling said sheet of extensible material over at least two spaced circular discs having a circumference greater than the length of said sheet;

(b) stretching said rolled sheet circumferentially to

bring the opposed edges thereof into abutting relationship;

(c) permanently uniting the abutting edges of said sheet;

(d) securing the ends of said rolled sheet to said discs whereby to form a porous, cylindrical roll.

2. The method of claim **1** including the following additional steps:

(a) forming a section of extensible material having a plurality of substantially congruent apertures therein disposed in equally spaced relationship to each other, said section being extensible in its lengthwise dimension; and

(b) cutting said section to form a sheet having a length less than the circumference of said roll along a line so disposed that the opposed ends of the sheet in the lengthwise direction form a continuous pattern comprising a unit number of complete apertures when said ends are butted together.

3. The method of claim **2** including the following additional steps:

(a) tightly rolling a sheet of fine mesh material having openings smaller than the apertures of said extensible material over the cylindrical surface of said roll to completely cover the same; and

(b) securing said sheet of fine mesh material to said discs.

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U.S. Cl. X.R.

29—121; 162—371