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R. WALSER ETAL

3,276,140

DRYER CYLINDER

Filed May 19, 1964

FIG. 1

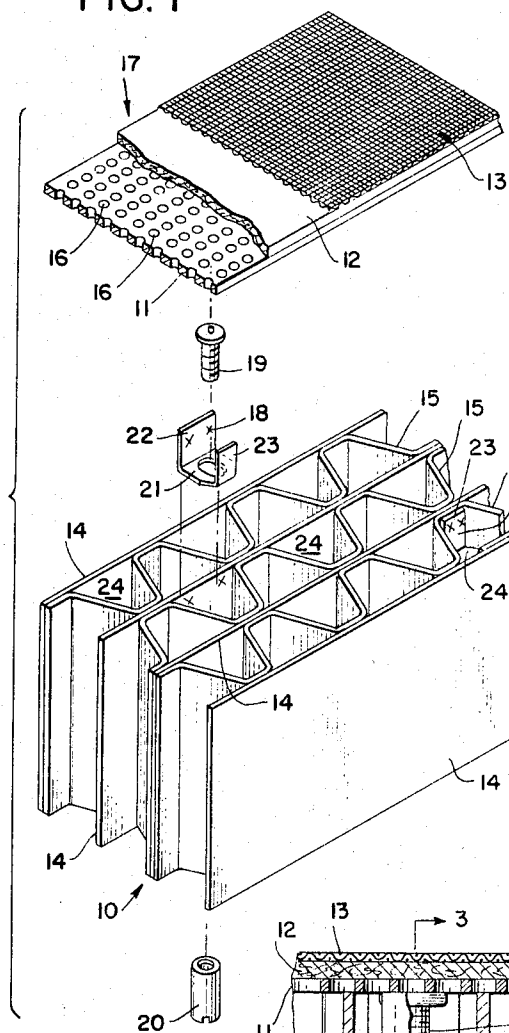


FIG. 4

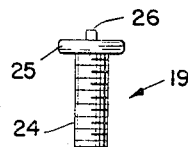
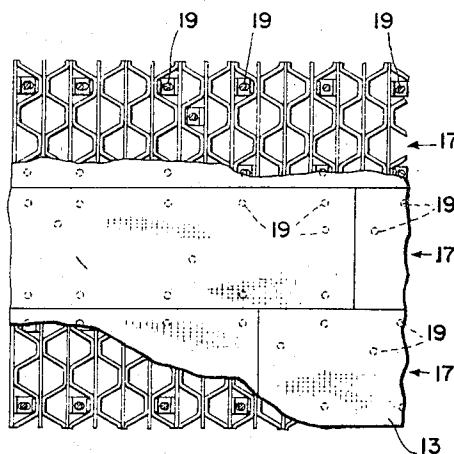


FIG. 6

FIG. 5

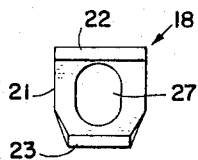


FIG. 2 

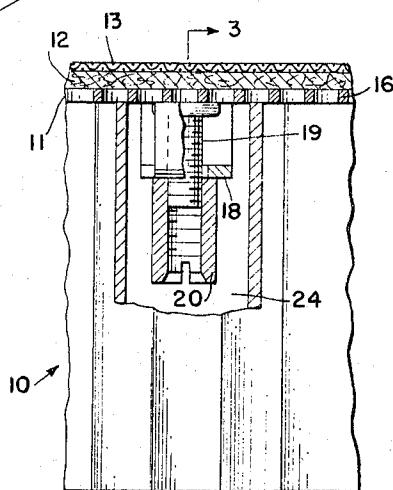
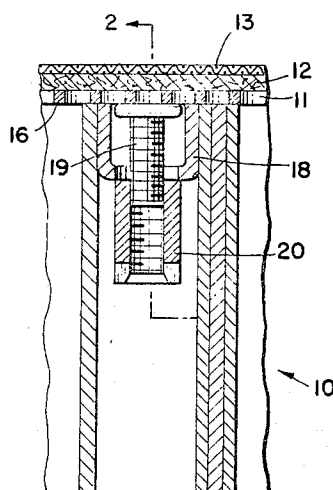


FIG. 3 2 ←



1

3,276,140

DRYER CYLINDER

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4 Claims. (Cl. 34-110)

The present invention relates to the drying of porous materials and more particularly to dehydrating newly formed paper.

The newly formed paper web withdrawn from a Fourdrinier or other paper-making machine contains a high percentage of moisture, which must be removed. Typically, the moisture may represent 80% of the newly formed paper web. It has been customary to reduce the moisture content of a newly formed paper web, for example, to 60%, by passing the web between a series of press rolls. The partially dehydrated web is then passed over a series of heated dryer rolls or cans. Typically, as many as 20 to 140 dryer rolls may be used before the paper stock is dried sufficiently to be subjected to its final calendering.

A particularly efficient and desirable dryer construction which can be used in place of a number of conventional steam heated dryer rolls is described and claimed in the copending United States patent application of Rudolph Walser, William O. Davis and Steve L. Kaczeus, Serial No. 329,431, filed December 10, 1963.

The dryer described in said application employs a hollow honeycomb cylinder having a multiplicity of relatively large, closely spaced openings, a thin perforated metal cylinder overlying and covering the outer surface of the honeycomb cylinder, and a thin sintered fiber metal cylinder overlying and covering the outer surface of the perforated metal cylinder. An endless length of dryer fabric is directed into a path about the fiber metal cylinder and presses a web of wet paper stock into tight contact with a selected portion of the fiber metal cylinder. Heated air from inside the dryer honeycomb cylinder passes through the cylinders, through the paper web, and through the dryer fabric, and effects the desired drying action.

The present invention is concerned primarily with providing an efficient and improved dryer cylinder construction for use with a dryer of the type shown in said copending application, and the principal object of the invention has been the provision of such a novel and improved dryer cylinder construction.

A feature of the invention has been the provision of a novel and improved means for attaching the outer cylinder layers to the honeycomb cylinder.

Other and further objects, features and advantages of the invention will appear more fully from the following description of the invention taken in connection with the appended drawing, in which:

FIG. 1 is an exploded perspective view of a portion of a dryer cylinder unit embodying the invention;

FIG. 2 is a cross-sectional view of a portion of the assembled dryer cylinder unit of FIG. 1, taken along the line 2-2 of FIG. 3;

FIG. 3 is a cross-sectional view taken along the line 3-3 of FIG. 2;

FIG. 4 is a side elevational view of an attaching stud shown in FIGS. 1-3;

FIG. 5 is a plan view of a bracket shown in FIGS. 1-3; and

FIG. 6 is a fragmentary plan view of a portion of the surface of the dryer cylinder unit of FIG. 1 with portions broken away to show the attachment structure.

Referring now to the drawings, the dryer cylinder unit of the invention comprises a hollow metal open-faced or honeycomb cylinder 10, a perforated metal cylinder 11, and a porous cylinder 12 having a screen mesh 13 sintered thereto.

2

The cylinder 10 is preferably made from stainless steel in the form of a grating structure having radially disposed plates 14 separated by corrugated strips 15 having lands which are welded to the plates 14 along the areas of juncture. The strips 14 extend parallel to the axis of the cylinder. Typically, the cylinder 10 might be 92" long and have an outside diameter of 48" and a wall thickness (height of plates 14) of 2". The cylinder 10 is supported for rotational motion by a suitable supporting structure (not shown) such as the one illustrated and described in the aforementioned copending application. The dimension set forth above and other numerical values herein set forth are intended only by way of example and should not be taken as limiting the invention. Thus, as another example, the cylinder 10 might be 300" long and 15' in diameter.

The perforated metal cylinder 11 typically might be 0.0625" thick stainless steel and have a multiplicity of $\frac{1}{8}$ " diameter circular holes 16 having their centers spaced about $\frac{3}{16}$ " apart to afford free passage of air. The cylinder 11 is wrapped closely around and is rigidly attached to cylinder 10 and is coextensive with the latter.

The cylinder 12 is preferably made of a sintered fiber metal structure. Such a structure is a porous, bonded mat of randomly oriented, uniformly distributed metal fibers in which the individual fibers are joined and bonded to adjacent fibers at spaced points along the fiber where such fiber contacts adjacent fibers. The fiber metal structure might be made, for example, by the process described in the United States patent of Walter C. Troy, No. 3,127,668, issued April 7, 1964. Other processes for the production of the fiber metal structure may also be used. Typically, the cylinder 12 might be 0.125" thick and be formed of stainless steel fiber metal having an apparent density of 52%. By apparent density is meant the ratio of volume of solid material to total volume expressed in terms of percent. An apparent density of 52% corresponds to a porosity of 48%. The material of cylinder 12 should have an apparent density lying in the range of about 40 to 60% for the purposes of the invention. An apparent density greater than about 60% will generally give too high a pressure drop for satisfactory results, while an apparent density of less than about 40% will result in too soft a fiber metal and which likely will be distorted in service. It is preferable that the fibers be relatively coarse, i.e., $\frac{1}{2}$ to 1" long.

The cylinder 12 is coextensive with cylinder 11 and is sintered thereto to form a unitary structure.

The cylinder 13 is a wire screen which is sintered to the outer surface of the fiber metal cylinder 12. The cylinder 13 adds strength to the fiber metal surface and prevents fuzzing of the latter in service. A typical screen for this purpose would be an 18-mesh screen made from 0.009" diameter 304 stainless steel wire. Cylinder 13 might also be made from a fine perforated metal or a tightly woven wire screen. The cylinder 13 is coextensive with the cylinder 12.

The cylinders 11, 12 and 13 form a unitary structure (in the thickness direction) by reason of being sintered together. This unitary structure, designated 17 in FIG. 1, may be termed a covering blanket. The covering blanket 17 is rigidly attached to honeycomb cylinder 10 by means of brackets 18, studs 19 and nuts 20.

Brackets 18 are generally U shaped and each comprise a flat base 21 and upwardly extending side flanges 22 and 23. The brackets fit into respective honeycomb spaces 24. The brackets 18 are shaped and sized so that the flange 22, which is wider than flange 23, is in surface contact with the plate 14 portion of the wall of a honeycomb space and the flange 23 is in surface contact with the opposite land portion of a corrugated strip 15. The

3

flanges 22 and 23 of the brackets 18 are welded or brazed to the plates 14 and strips 15 to provide rigid attachment of the brackets to the honeycomb cylinder. It is desirable that the axial extent of the flanges 23 be substantially equal to the axial extent of the corrugation land so as to provide substantial surface contact area between the flange 22 and the corrugation strip. Similarly, it is desirable that the flange 22 have an axial length substantially greater than that of the flange 23. This construction affords substantial rigidity.

The studs 19 have a threaded shank 24, a flat head 25 and a narrow projecting end 26 extending beyond head 25. The studs 19 are welded to the perforated plate cylinder 11. For this purpose, the studs are held against the cylinder surface with the end 26 contacting a land area of the cylinder 11, and a high electrical current is passed through the stud and cylinder 11. The current melts the narrow end 26, effectively welding the stud to the cylinder surface. It is preferable that the studs 19 be welded to the cylinder 11 of blanket 17 after the latter has been roll formed to the correct curvature. The blanket 17 is then wrapped around the honeycomb cylinder and forced to assume its cylindrical shape.

In assembly, the shanks 24 of studs 19 extend through slots 27 in bases 21 of respective brackets 18. Nuts 20 are threaded onto shanks 24 and are forced up tightly against the surfaces of bases 21 of brackets 18 to hold covering blanket 17 tightly against honeycomb cylinder 10, as shown in FIGS. 2 and 3. For convenience, the nuts 20 preferably have screwdriver slots in their bottoms. The nuts should be drawn up tightly against the bracket bases to put the studs in tension.

The cylinder 10 will usually be a fully unitary structure in the sense that all parts thereof are welded together to form a single large cylinder. However, the cylinders 11, 12 and 13 will generally be formed from a series of relatively narrow strips extending around the cylinder and located side by side so as to form a cylindrical covering blanket, as shown in FIG. 6. It is desirable that the lines of juncture of the ends of the adjacent strips be staggered and welded.

The numbers and locations of the brackets 18 and studs 19 may be varied widely. However, in general, it will be desirable to provide a cooperating stud and bracket every few inches along the sides of the individual strips, as shown in FIG. 6, with a few additional cooperating studs and brackets staggered in the intervening area between the strip edges.

While the invention has been described in connection with a specific embodiment thereof and in a specific use, various modifications thereof will occur to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. In a dryer for the wet paper web output of a paper-making machine and the like, the combination comprising:

- (a) a hollow honeycomb cylinder having a multiplicity of closely spaced, relatively large, radially extending openings in the honeycomb cylinder surface affording a free passage of air therethrough;
- (b) a thin perforated metal cylinder overlying and covering the outer surface of said honeycomb cylinder, the perforation in said thin metal cylinder having sufficient cross-sectional area and being sufficiently numerous to afford free passage of air through all parts of the surface of said honeycomb cylinder;
- (c) a thin, porous, sintered, fiber metal cylinder overlying and covering the outer surface of said perforated metal cylinder and being sintered thereto; and
- (d) means for rigidly attaching said thin perforated metal cylinder and said fiber metal cylinder as a unit to said honeycomb cylinder, comprising a multiplicity of generally U-shaped brackets each having a base and a pair of side walls and each being in-

4

serted in a respective one of said radially extending openings in said honeycomb cylinder, the side walls of said brackets being permanently attached to opposite walls of said respective openings and each bracket base having a hole, a like multiplicity of threaded studs each having a head welded to the inner surface of said perforated metal cylinder, said studs extending through said holes in respective ones of said brackets, and a like multiplicity of threaded nuts threadedly engaging respective ones of said studs and contacting said bases of said brackets to exert tension on said studs thereby to retain said thin perforated metal cylinder in tight contact with the outer surface of said honeycomb cylinder.

2. In a dryer for the wet paper web output of a paper-making machine and the like, the combination comprising:

- (a) a hollow honeycomb cylinder having a series of spaced, elongated axially and radially extending metal strips separated by corrugated metal strips providing a multiplicity of closely spaced, relatively large, radially extending openings in the honeycomb cylinder surface affording a free passage of air therethrough;
- (b) a thin perforated metal cylinder overlying and covering the outer surface of said honeycomb cylinder, the perforations in said thin metal cylinder having sufficient cross-sectional area and being sufficiently numerous to afford free passage of air through all parts of the surface of said honeycomb cylinder;
- (c) a thin, porous, sintered, fiber metal cylinder overlying and covering the outer surface of said perforated metal cylinder and being sintered thereto, said fiber metal cylinder having an apparent density lying in the range of about 40 to 60%;
- (d) a metallic screen overlying and covering said fiber metal cylinder and being sintered thereto; and
- (e) means for rigidly attaching said thin perforated metal cylinder, said fiber metal cylinder and said screen as a unit to said honeycomb cylinder, comprising a multiplicity of generally U-shaped brackets each having a base and a pair of side walls and each being inserted in a respective one of said radially extending openings in said honeycomb cylinder, the side walls of said brackets being welded to opposite walls of said respective openings and each bracket base having a slotted hole, a like multiplicity of threaded studs each having a flat head welded to the inner surface of said perforated metal cylinder, said studs extending through said slotted holes in respective ones of said brackets, and a like multiplicity of threaded nuts threadedly engaging respective ones of said studs and contacting said bases of said brackets to exert tension on said studs thereby to retain said thin perforated metal cylinder in tight contact with the outer surface of said honeycomb cylinder.

3. A dryer as set forth in claim 2 in which said thin perforated metal cylinder, said fiber metal cylinder and said screen are formed as narrow side-by-side strips wrapped around said honeycomb cylinder.

4. A dryer as set forth in claim 2 in which cooperating ones of said brackets and studs are closely spaced along each edge of said side-by-side strips.

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