Oct. 31, 1967 P. J. MITCHELL, JR 3,349,693

ROLL COVER CONSTRUCTION

Filed Feb. 18, 1965

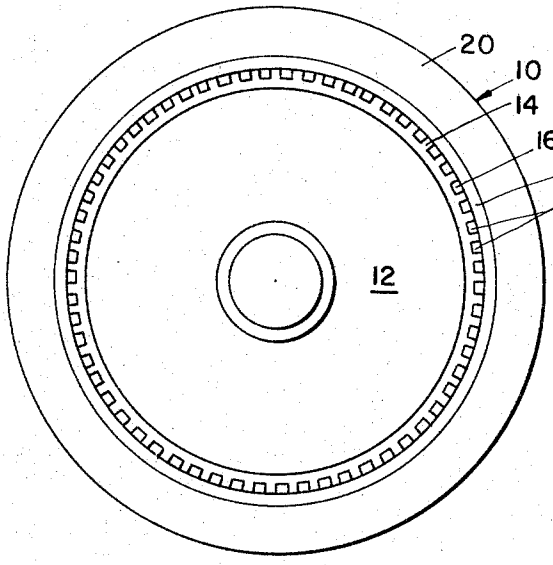


FIG. 1

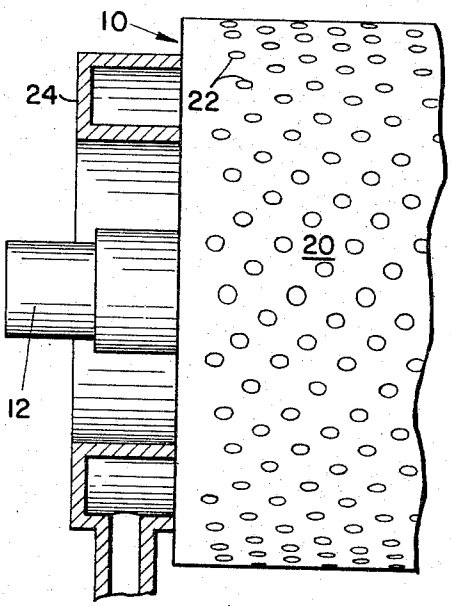


FIG. 2

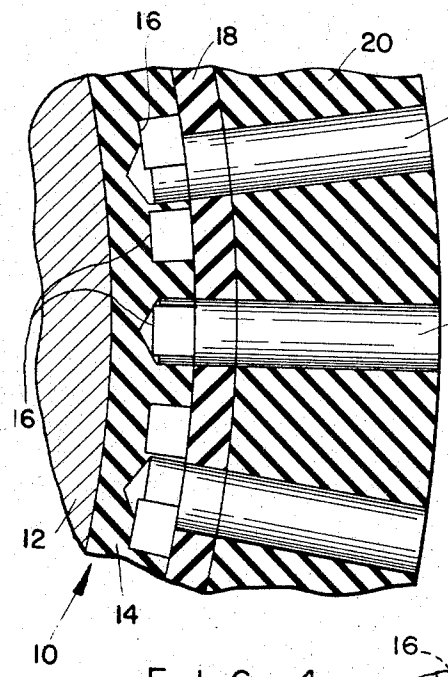


FIG. 4

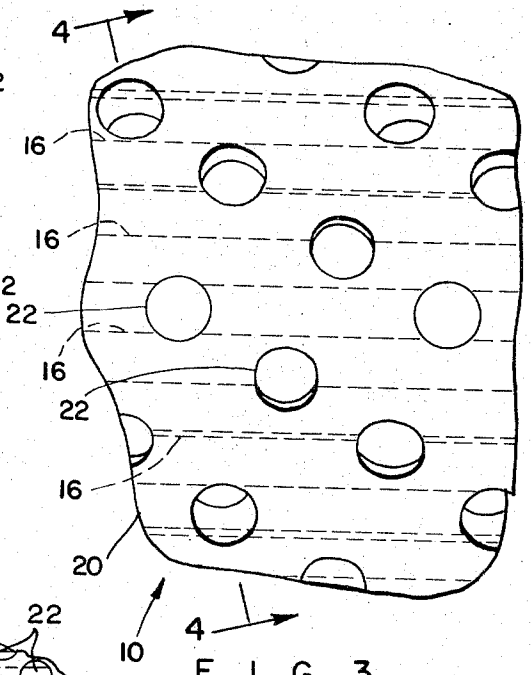


FIG. 3

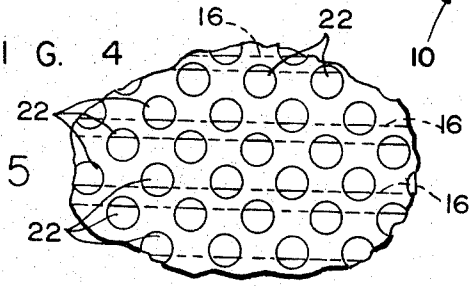


FIG. 5

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ROLL COVER CONSTRUCTION

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ABSTRACT OF THE DISCLOSURE

A roll construction, for the removal of water or the like from a paper, textile or other web, is characterized by a metallic core, an inner elastomeric sleeve having longitudinally extending grooves, and an outer elastomeric sleeve having a multiplicity of bores extending therethrough to the grooves. The diameter of the bores and the width of the grooves are particularly related. The arrangement is such that water or the like in a web contacting the outer surface of the roll may be directed through the bores and the grooves in a continuous stream from the roll.

Summary of the disclosure

The present invention relates to a novel and improved cover for removing fluids, including gases and liquids, from sheet materials such as textiles, paper and the like during manufacture or processing.

Objects of the invention are: to provide a press roll assembly incorporating novel and improved means for forcing a fluid through the roll for the purpose of removing fluid from sheet materials such as paper stock, textiles and the like and/or cooling the roll; and to provide a press roll assembly as described constructed to facilitate release of the compressed sheet material from the roll surface.

Other objects of the invention are: to provide a press roll assembly of the type described including passages providing for unrestricted fluid flow especially during extraction of liquid and/or gases from sheet materials such as paper stock, textiles, fabrics and the like, and to provide a press roll assembly that, from a relative standpoint is easy to manufacture and assemble, inexpensive and has improved strength and durability.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing wherein:

Brief description of the drawings

FIGURE 1 is an end elevational view of a press roll assembly embodying the invention;

FIG. 2 is a side elevation of the press roll;

FIG. 3 is an enlarged fragmentary view similar to FIG. 2; and

FIGS. 4 and 5 are fragmentary sectional views of alternative embodiments taken substantially along the line 4—4 of FIG. 3.

Detailed description

Press rolls of the type with which the present invention are concerned are particularly useful in the extraction of fluids, particularly water and entrapped gases, from sheet material such as paper stock and textiles including fabrics, felts and the like, during manufacture,

dyeing, bleaching, etc. For this purpose, as well as for cooling, provision is made for conducting fluids radially inwardly and/or outwardly with respect to the periphery of the roll. In this manner, for example, water in paper stock can be extracted by the application of compressive pressure to expel the water and/or by conducting expelled water away from the paper stock. The construction which provides for fluid circulation lends itself to the removal of fluids by suction thereby further facilitating their extraction; and permits a fluid, preferably a gas, to be expelled under pressure through the roll periphery in order to release the sheet from the roll.

Referring now to the drawing, the press roll assembly designated **10** is shown as comprising a solid cylindrical core or shaft **12** providing the basis or foundation of the press roll. Around the periphery of shaft **12** is provided an inner layer or sleeve **14** of a relatively hard, inflexible polymeric material, preferably an elastomer such as a synthetic rubber having high strength, resistance to water, oxidation and chemicals used in paper making and textile manufacture and processing, is unaffected by heat and has good bonding properties. Inner layer **14** may be cast around shaft **12** or formed as a sleeve into which the shaft is introduced, whereafter layer **14** is cured to bond it to the shaft. In an alternative construction, the periphery of shaft **12** may be grooved, serrated, roughened or otherwise formed in such a way as to promote adherence of sleeve **14** to the shaft. Sleeve **14** is provided in its outer surface with a multiplicity of axial grooves **16** extending from end to end thereof in generally parallel relation. Grooves **16** are easily formed either during the fabrication (e.g., by casting, extrusion, etc.), or after application to the shaft by conventional machining methods.

The completed press roll assembly includes a multiplicity of axial channels or conduits each formed by one of grooves **16**, and having four surfaces, three being the surfaces of the groove. The fourth surface or side of each conduit comprises the inner surface of an intermediate layer or sleeve **18** secured around and bonded to sleeve **14** intermediate grooves **16**. Sleeve **18** is preferably formed of an elastomeric material that is the same or similar to the material of sleeve **14** and is assembled, for example, by introducing the shaft and inner layer, with grooves **16** formed in its surface, into sleeve **18** which is pressed into contact with the inner sleeve and cured to adhere the sleeves to one another to form an integral layer having axial channels extending from end to end thereof. Alternatively, the inner sleeve may be cured and grooved and sleeve **18** can be secured to the inner sleeve by suitable adhesive material. In still another method of manufacture of the roll assembly, sleeves **14** and **18** may be formed in a partially cured condition, the inner sleeve is grooved and the two sleeves are then cured simultaneously to promote bonding therebetween. The press roll assembly includes a relatively thick outer layer or cover **20** formed of an elastomeric material having good wear and abrasion resistance, and preferably, although not necessarily, substantially more flexible than the inner and intermediate layers. Cover layer **20** may be formed by any of the conventional methods used to produce elastomeric roll coverings such as casting, is cured so as to form a bond with intermediate sleeve **18** and is finished to have a smooth, cylindrical outer peripheral surface. Alternatively, cover sleeve **20** may be formed of a relatively hard material similar to sleeve **14** and bonded directly to sleeve **14**, or sleeves **18** and **20** may be formed as a unit which is then secured around and bonded to inner sleeve **14** following grooving of the latter.

A multiplicity of uniformly distributed radial holes **22** are formed in the roll assembly extending from the outer surface of cover **20** and terminating in inner layer **16**.

Holes 22 can be formed easily and conveniently by drilling and each hole communicates with a channel 16. Drilling holes 16 so that each communicates with a channel can be facilitated, as shown in FIGS. 3 and 4, by spacing the channels apart from one another by a distance less than the diameter of the holes thus obviating the necessity for accurately locating the holes with respect to the channels. However, in an alternative construction shown in FIG. 5, the channels are spaced by distances at least equal to the diameter of the holes and have a width which may be less than the diameter of the holes. This construction permits fewer channels since it allows for adjacent axial rolls of holes to be connected with a single channel, and although greater care is required in drilling, more of the inner sleeve is retained and thus provides for a stronger and more durable construction. The area between channels in this construction may be of the order of two to three times the area of the channels. The number and size of holes should be as large as possible consistent with maintaining a strong structure and retaining the desired surface character of the roll.

Several mechanisms are available for withdrawing water expelled from the paper stock from holes through channels 16. In one form of press roll assembly, the inner and intermediate layers 14 and 18 constitute an essentially rigid structure while cover 20 is sufficiently flexible to allow the holes to close or collapse under pressure resulting in a pumping action as the roll is simultaneously pressed against another surface and rotated. As a hole is compressed or collapsed, water trapped therein is expelled into the channel with which it communicates and travels toward the ends of the channel. In an alternative embodiment, particularly when the cover sleeve is relatively rigid, vacuum chambers 24, shown as circular, are provided against the ends of the roll assembly for reducing the pressure within the channels and suctioning fluids including liquids such as water and gases therefrom.

As still another alternative, a fluid such as air or even a coolant liquid, e.g., water, can be passed through the channels from end to end for withdrawing fluids from the radial holes and/or cooling the roll and thereby increasing its useful life. Regardless of the mechanism (or combination thereof) employed to circulate liquid within and/or withdraw water from the roll, water or other fluid expelled from the paper stock or textile, is drawn radially inward through radial holes having very little tendency to clog or become restricted and thence through unobstructed axial channels; and should the channels or holes become obstructed, they may be cleared very simply by pumping a fluid under pressure in a reverse direction into the channels and outwardly through the holes.

The press roll construction provides still another advantage and this is a mechanism for releasing sheet material having a tendency to adhere to the press roll. This is accomplished by introducing a gas such as air into the channel or channels connected to holes located in contact with the sheet at the position, e.g., the nip of the rolls, at which release and separation is desired. It is possible by suitably arranged chambers at the ends of the roll to simultaneously release the pressure within certain of the channels and holes while increasing the pressure in others of the channels and holes.

Thus it will be seen that the invention provides a press roll construction having excellent strength and durability, adapted to the circulation of fluids therethrough, especially for the extraction of liquids such as water from sheet material such as paper stock and textiles, and adapted to simple and easy methods of manufacture.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A roll assembly for removing fluids from sheet material, said roll assembly comprising:
a cylindrical metal base;
an inner elastomeric sleeve surrounding said base, the inner periphery of said inner elastomeric sleeve being secured to the outer cylindrical periphery of said cylindrical base; said inner elastomeric sleeve having a plurality of grooves at said exterior periphery thereof and spaced from said exterior periphery of said metal base;
at least one outer elastomeric sleeve surrounding said inner sleeve, said outer elastomeric sleeve having an inner cylindrical periphery bonded to said outer cylindrical periphery of said inner sleeve;
said outer sleeve having therein a plurality of holes extending from said outer cylindrical periphery thereof substantially radially inwardly into communication with said grooves.

2. The roll assembly of claim 1 including means associated with at least one end of said roll in communication with said grooves for withdrawing fluid through said holes and said grooves.

3. The roll assembly of claim 1 wherein said holes have diameters exceeding the spacing between said grooves.

4. The roll assembly of claim 1 wherein said holes have diameters not exceeding the spacing between said grooves, said holes being arranged in axial rows, said groove having communication with the holes in two adjacent axial rows.

5. The roll assembly of claim 1 wherein said spacing between said conduits is of the order of two to three times the width of said grooves.

6. A roll assembly for removing fluids from sheet material, said roll assembly comprising:
a cylindrical metal base;
an inner elastomeric sleeve surrounding said base and secured thereto;
said inner elastomeric sleeve having a plurality of grooves at the exterior thereof and spaced from said metal base;
at least one outer elastomeric sleeve surrounding said inner sleeve and being bonded to said inner sleeve;
said outer sleeve having therein a plurality of holes extending therethrough radially inwardly into communication with said grooves,
said holes projecting into said inner elastomeric sleeve;
and means for withdrawing fluid through said holes and said grooves.

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