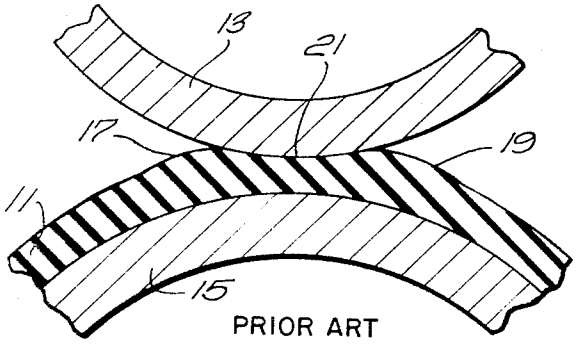
June 3, 1969 W. E. GREENE 3,447,600

CONSTRUCTION OF ROLL FOR MACHINERY AND THE MANUFACTURE THEREOF

Filed Sept. 23, 1966 Sheet 1 of 2



PRIOR ART

FIG. 1

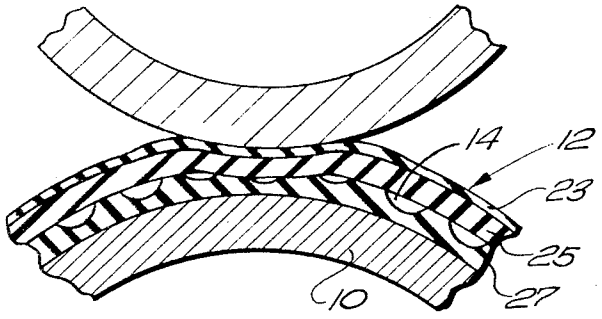


FIG. 2

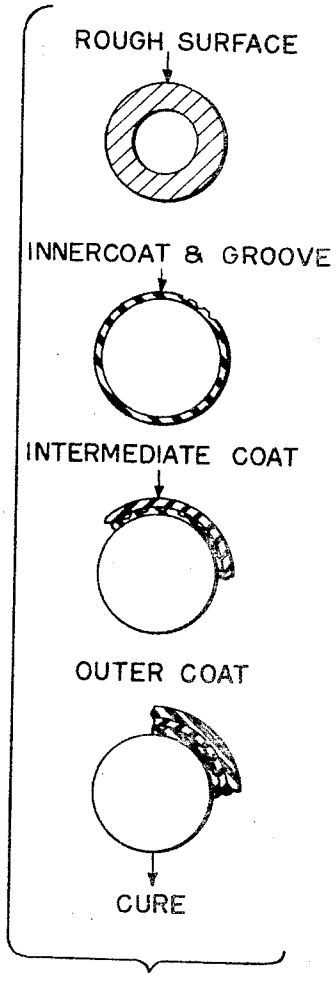


FIG. 5

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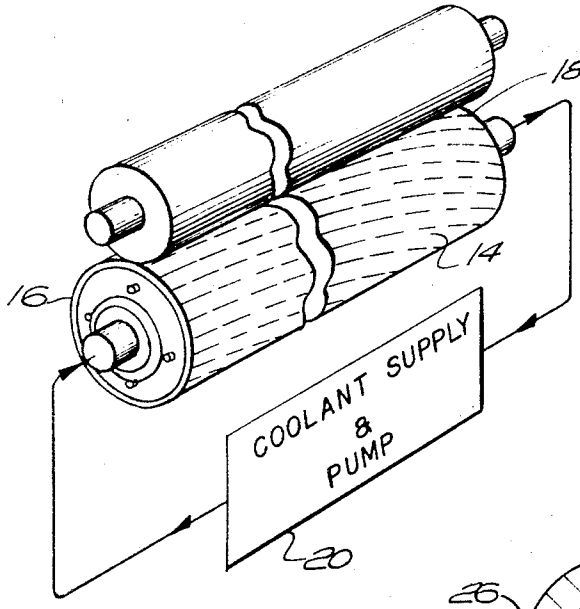


FIG. 3

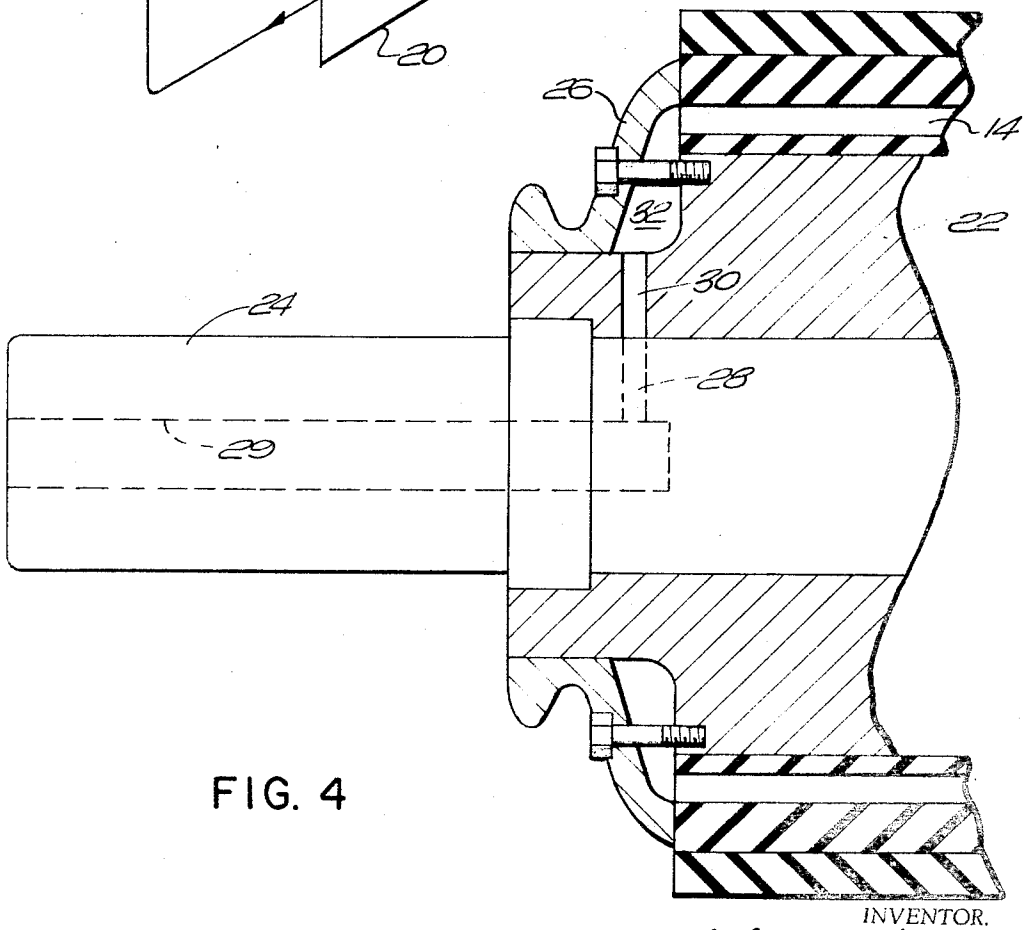


FIG. 4

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CONSTRUCTION OF ROLL FOR MACHINERY AND THE MANUFACTURE THEREOF

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U.S. Cl. 165—90 2 Claims

ABSTRACT OF THE DISCLOSURE

A roll has a specially designed elastomeric cover having an inner working region and an outer non-working region. The inner working region is perforated by generally longitudinal spiral channels in order to counteract the inability of its elastomeric mass to compress and in order to flow a cooling liquid for temperature control. The outer non-working region has a higher modulus of elasticity than the inner working region. It has been found that these relationships sufficiently isolate the outer operation of the external surface of the roll from the inner operation of the conduits.

The present invention relates to a novel roll construction of the type useful in a variety of machines, particularly paper making and processing machines, etc. The present invention relates more particularly to a roll construction of the type having a metallic core, the extremities of which are journaled, and an elastomeric cover or veneer, the physical and mechanical properties of which are particularly selected. The roll construction of the present invention, for example, is adapted for use in the press, size and breaker-stack positions of a paper making machine of the type incorporating flow means for making available a slurry of fibers in water, slice means for distributing the slurry throughout an area in a thin layer, suction means for removing the water from the slurry in the layer and roll means for advancing, squeegeeing and conditioning the layer to form paper. The present invention, from a broad standpoint, is intended for a variety of applications involving high speed and high pressure.

The primary object of the present invention is to provide a novel roll construction having a specially designed elastomeric, inner cover that is perforated by generally longitudinal channels or conduits in order to counteract the inability of its elastomeric mass to compress and in order to provide temperature control for its elastomeric mass when in operation. The elastomeric cover has an inner "working" region or relatively low modulus of elasticity and an outer "non-working" region of relatively high modulus of elasticity, the inner working region providing the channels and the outer non-working region providing a durable surface. In a conventional roll, of the type presently in use, the elastomer, for example, either natural or synthetic rubber, is as a practical matter incompressible. When under pressure at the nip between a pair of rolls, the elastomer is squeezed laterally away from the nip. In other words, any increment of an elastomeric veneer that is squeezed, between its own core and the surface of another roll, in accordance with its visco-elastic properties, is displaced on both sides of the nip rather than compressed within the nip. This inability of the elastomeric mass to compress interferes with desired conditions at the nip and, therefore, with the desired function of the

roll cover. As the rolls turn, the complex movement and counter-movement of the elastomeric mass in the nip area results in large hysteresis heat generation. The present invention serves in a practical manner to limit both undesired displacement and undesired heat generation at the nip and to permit the utilization of harder outer surfaces having greater wear resistance.

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

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

FIG. 1 illustrates the displacement of elastomeric material at both sides of the nip between a pair of rolls of ordinary construction;

FIG. 2 illustrates the compression at the nip of one of a pair of rolls constructed in accordance with the present invention;

FIG. 3 is a perspective view, partly broken away, of a roll system embodying the present invention;

FIG. 4 is an exaggerated cross-sectional view of one of the rolls of FIG. 3; and

FIG. 5 is a flow diagram of a process for fabricating rolls embodying the present invention.

As shown in FIG. 1, the ordinary roll construction is such that the elastomeric roll covering **11** when compressed between a pair of metal roll cores **13**, **15**, is displaced on both sides **17**, **19** of the nip **21**. Generally, a roll construction embodying the present invention, as shown in FIG. 2, comprises as components: a cylindrical metallic core **10**, preferably composed of cast iron, bronze or steel; and a tubular cover **12**, preferably composed of an elastomer, such as natural or synthetic rubber. Extending longitudinally or helically throughout the length of the roll are a series of spaced conduits **14**. As shown, cover **12** includes a wear resistant outer layer **23** and a pair of inner layers **25**, **27** to be described in detail below, that provide conduits **14**. Circulating through conduits **14**, in order to conduct away hysteresis heat is a cooling medium, for example, a liquid such as water or a gas such as air. When compressed between core **10** and another roll **15**, displacement of the type shown in FIG. 1 is avoided.

As shown in FIG. 3, an inlet reservoir is provided at one end **16** of the roll and an outlet reservoir is provided at the other end **18** of the roll. Thus a continuous flow of liquid or gas may be directed through inlet reservoir **16**, through various conduits **14** and through outlet reservoir **18** continuously via a supply and pump **20**. As shown in FIG. 4, the cooling medium is introduced through the roll axle in the following manner. The roll core, shown at **22**, is keyed to a shaft **24**, which extends therethrough and is journalled at its opposite extremities. Covering the extremities of the roll are a pair of dishes, one shown at **26**. Since, the structures at ends **16** and **18** are the same, only the structure at end **16** need be described. An axial bore **29** and a cross bore **28** in shaft **24** connect through a communicating bore **30** to a reservoir **32** that is defined by dish **26**. The extremities of conduits **14** open into reservoir **32**.

As shown in FIG. 3, preferably conduits **14** are disposed in directions which are helical with respect to the axis of rotation of the roll. When viewed from the end of the roll into which the coolant is introduced, the helical direction of the conduits is opposite that of the rotational

direction of the roll. By virtue of this arrangement, one extremity of any particular conduit enters the nip between the rolls before succeeding increments of the conduits so that a liquid or gas, i.e. a fluid such as water, within that conduit is forced by pressure at the nip in a single direction through the conduit. Best results are achieved under the following conditions:

Diameter of aperture **14**	⅛ to ¾ inch.
Pressure of water	5 to 250 pounds per sq. inch.
Hardness of outer layer	0 to 20 plastometer.
Thickness of outer layer	3/16 to ⅝ inch.
Hardness of two inner layers	Less than that of outer layer.
Total thickness of two inner layers	½ to one inch.
Spacing between apertures	½ to one inch.

Generally the size of the aperture must be large enough so that pressure losses due to skin friction do not exceed the pressure on the conduit as it passes under the nip. The plastometer hardness designation is well known in the art, as defined in A.S.T.M. designation D–531–56.

EXAMPLE

A preferred method of coating a steel core with an apertured elastomeric coating in accordance with the present invention is as follows, as shown, in FIG. 5. After roughtening the surface of the steel core and coating it with a metal to plastic bonding medium, an inner coat of elastomer is applied. After partial curing, longitudinal or helical grooves of semi-circular or like cross-section are ground into the surface of this inner coat. Next a medial coat of elastomer is applied, air being forced into the openings defined by the grooves in such a way as to prevent the medial coat from contacting the inner surfaces of the grooves. Then an outer coat of elastomer is applied. And finally, the entire assemblage is cured. All of the foregoing steps are effected with compositions and under conditions that are well known to persons skilled in the art.

In operation, water from supply and pump **20** is flowed in sequence through inlet **16**, through apertures **14**, through outlet **18** and back to supply and pump **20**. The water pressure and the speed of the roll are established in such a way as to ensure that heat generated in the veneer is carried away by the water, the entire process being aided by pressure in the nip in consequence of the skew relation between the conduits and the axis of the roll.

The foregoing disclosure places emphasis on two concepts. First, the utilization of the conduits to accommodate the elastomer displaced in the nip and, second, the utilization of the conduits to conduct a cooling medium. These concepts can be utilized separately. The first concept alone improves roll performance and the second concept alone enables adjusting the size of the conduits and the pressure on them so as to allow the creation nip waves as shown in FIG. 1 while gaining the benefit of cooling. Although a pump is shown in FIG. 3, in certain systems, without a pump, the roll conduits can be left open and fluid circulation is effected simply by flexing the conduits. Since certain changes may be made in the foregoing disclosure without departing from the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. A roll comprising a metallic core and an elastomeric veneer, said veneer having an inner region adjacent to said core and an outer region spaced from said core, said inner region having a series of conduits therethrough extending from one extremity of said roll to the opposite extermity thereof along a series of spiral lines, the overall hardness of said inner region of said veneer in the vicinity of said conduits being less than the overall hardness of said outer region of said veneer at the surface thereof, the diameter of each of said conduits ranging from ⅛ to ¾ inch, the hardness of said outer region ranging from 0 to 20 plastometer, the thickness of said outer region ranging from 3/16 to ⅝ inch, so that when cover is under pressure and a nip is formed the rubber under compression may be displaced into the holes and reduces substantially the build up of the elastomeric material before and after the nip.

2. A roll comprising a metallic core and an elastomeric veneer, said veneer having an inner region adjacent to said core and an outer region spaced from said core, said inner region having a series of conduits therethrough extending from one extremity of said roll to the opposite extremity thereof along a series of spiral lines, the overall hardness of said inner region of said veneer in the vicinity of said conduits being less than the overall hardness of said outer region of said veneer at the surface thereof, an inlet reservoir at one end of said roll communicating with the ends of said conduits at said one of said roll, and an outlet reservoir at the other end of said roll communicating with the ends of said conduits at said other end of said roll, so that a fluid cooling medium may be circulated through the mass of elastomeric veneer and thereby remove heat of hysteresis built up therein during operation, the diameter of each of said conduit ranging from ⅛ to ¾ inch, the hardness of said outer region ranging from 0 to 20 plastometer, the thickness of said outer region ranging from 3/16 to ⅝ inch, the spacing between said conduits ranging from ½ to one inch, the pressure of said fluid cooling medium ranging from 5 to 250 pounds per square inch, the operation of the outer surface of said roll being isolated from the operation of said conduits.

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BILLY J. WILHITE, *Primary Examiner.*

U.S. Cl. X.R.

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