United States Patent

Kuesters

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[54] **ROLLING AND SQUEEZING APPARATUS**

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[58] **Field of Search**.....29/110, 113 R, 113 AD

[56] **References Cited**

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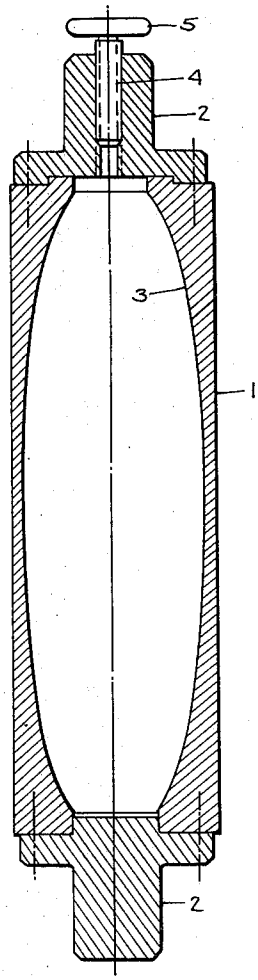
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[57] **ABSTRACT**

An improved rolling and squeezing apparatus comprising a rotating hollow roll shell having an inside surface the generatrix of which is symmetrical about its midpoint and is non-linear in at least some portions, and pressure means acting on said inside surface.

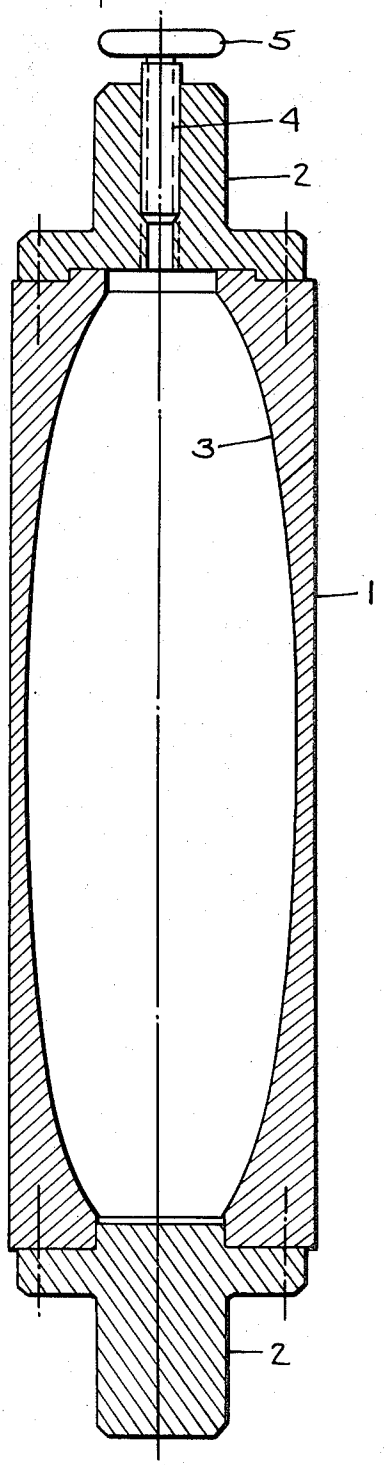
2 Claims, 1 Drawing Figure



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Fig. 1.



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ROLLING AND SQUEEZING APPARATUS

This invention relates to a rolling and squeezing apparatus for the pressure treatment of material webs. Applications of the principle of the invention can be used in many fields including, for example, demoisturizing, smoothing, embossing, and printing paper, textile and other materials; drawing, stretching and sheeting plastic and rubber sheets, and for calendering and rolling materials to a predetermined thickness. More particularly, the invention relates to a roll containing an adjustable pressure means which exerts force on the interior of the roll to control its outside shape and crown during operation.

In the manufacture and processing of paper, rubber, plastic, metals and textiles it is common, in order to impart desired effects, to squeeze the material between rolls. It is well known that the rolls, as they are pressing against the material and one another, undergo deflections between their journals and thereby exert unequal pressure in processing the material. Various proposals have been attempted to eliminate this drawback, the most common of which is to provide a crown on the roll so designed that, for a given material to be rolled at a certain speed and pressure, the deflection will result in equal pressure exertion. However, this solution is only satisfactory for the design operating range and little versatility is possible because different materials, pressures and speeds require different crown designs to exert uniform pressures.

Other proposals have been suggested to overcome the roll deflection problem which have included the use of means exerting forces to counteract the roll deflection forces, but these mechanisms are relatively complex and expensive.

It has also been suggested, in U.S. Pat. No. 2,970,339,to provide a hollow roll with a pressure medium contained therein whereby the outside surface of the hollow roll can be variably crowned depending upon the force exerted by the pressure medium. In this proposal, the inside surface of the hollow roll is of a twin frusto-conical shape where the bases of the cones lie together in the center of the roll. While this construction provides for a roll with a variably adjustable crown, it also results in undesirable deflections, and therefore, undesirable effects on the material being rolled.

As disclosed by the above mentioned U.S. Pat. No. 2,970,339the hollow roll is made of material rendering its wall rigid and of sufficient strength to withstand normal operative forces applied thereto when the roll is functioning with other rolls as in the case of a calender, for example. The roll is ordinarily made of metal. The outside of the roll, forming its working surface, is substantially cylindrical and both its outside and inside are machined so that the wall surfaces are uniformly concentric. Because the bases of the cones of the roll's internal surface lie together at the center of this roll, this portion of the roll has the minimum thickness and, therefore, provides the greater expansion of the roll's working face during crowning of the roll. The fluid used inside of the roll to effect the expansion is a non-compressible material which is flowable.

An object of the present invention is to provide an improved roll structure which utilizes a hollow roll shell and is loaded on the inside surface of the shell by pressure means in such a manner as to obtain particularly satisfactory nip pressures throughout a broad range of operation.

A further object of the invention is to provide an improved rolling and squeezing apparatus capable of controlling deflection for obtaining a uniform nip load which is inexpensive to construct and avoids the disadvantages of the structures heretofore available.

A still further object of the invention is to provide an improved roll assembly capable of continuous high speed long operating life with a minimum of maintenance and servicing attention.

Other objects, advantages and features of the invention may be appreciated by referring to the following detailed description, in which:

FIG. 1 is a sectional view through the longitudinal axis of a roll and is an embodiment of the present invention.

The roll assembly shown in FIG. 1 includes a hollow roll shell which squeezes the web of material to be processed between its working surface 1 and another roll (not shown). The hollow roll shell is mounted in a frame (not shown) for rotation by means of extension 2. The extensions 2 and the hollow roll shell may be manufactured of any suitable material including metal and plastics.

Pressure means within the hollow roll shell act on its inside surface 3 to offset the operational forces causing deflections. The pressure means may be, for example, a flowable plastic material or an incompressible fluid such as oil. A fluid displacer 4 is provided in an extension 2 so that adjustment of the handwheel 5 which moves the piston 4 inwardly against the flowable material in a controllable manner and thereby produces pressure throughout the interior of the hollow roll shell. Likewise, pressure within the hollow roll shell may be generated by means of a pump connected to the interior chamber. If flowing pressure means are employed the temperature of the hollow roll shell can be controlled so as to maintain optimum operating temperatures.

The generatrix of the inside surface 3 of the hollow roll shell is symmetrical about its midpoint and is, at least in some portions, non-linear. The non-linear portions may be of a parabolic shape so that the forces exerted on the surface satisfactorily counter the operational forces of deflection. With such a configuration the hollow roll shell can, upon adjustment of the pressure means, correspond with the mating roll within operating ranges to eliminate unequal pressure treatment of the material being rolled.

The parabolic shape of the non-linear portions of the generatrix can be segmented so long as the non-linearity of such portions is maintained, and so long as each segment itself is parabolic. Parabolas of the second and fourth order, of the quadratic and biquadratic form, may be employed to form the generatrixes.

Where complete non-linearity of the generatrix is not employed, the linear portion may pass through and be symmetrical about the midpoint of the generatrix and be parallel to the longitudinal axis of the hollow roll shell.

In the preferred embodiment, the ratio of the thickness of the hollow roll shell to its outside diameter should not exceed 1:10 at its center or central portion where the greater expansion occurs.

The embodiment described can be adapted and modified for particular applications without departing from the spirit and scope of the invention.

What is claimed is:

1. A substantially cylindrical metal roll having a chamber underlying its working face and having a wall decreasing in thickness towards the center of the roll, said roll and its wall being rigid and of sufficient strength to withstand normal operative forces applied thereto, uncompressible but flowable material positioned within and filling said chamber, and means engaging said material for applying pressure thereto for expanding the roll to provide it with a crown intermediate the ends thereof; wherein the improvement comprises the inside surface of said wall having a substantially parabolic shape making the longitudinal center of the wall the thinnest portion and extending in both directions from the center symmetrically to the ends of said wall defining said chamber.

2. The roll of claim 1 in which at the longitudinal center of said wall the ratio of the thickness of said wall to its outside diameter does not exceed 1:10.

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