July 7, 1942. E. E. BERRY 2,288,675

PRESS ROLL FOR PAPER MAKING MACHINES

Filed May 29, 1939

Fig. 1.

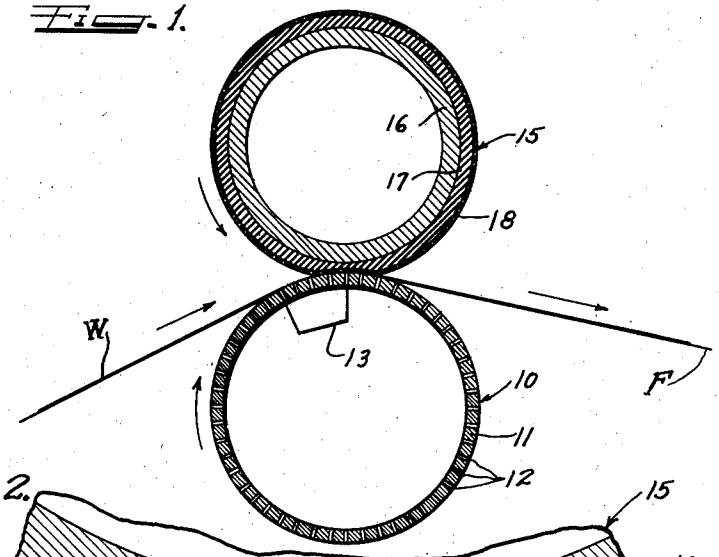


Fig. 2.

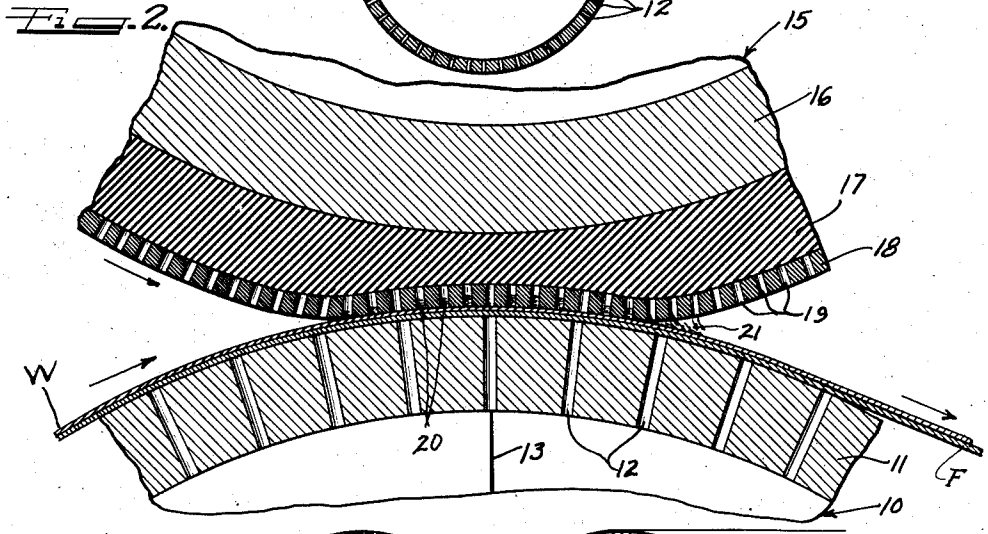
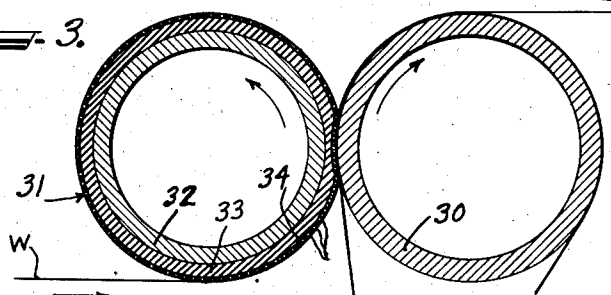


Fig. 3.



INVENTOR
EARL E. BERRY.

BY Charles T. Hill ATTY.

Patented July 7, 1942 2,288,675

UNITED STATES PATENT OFFICE

2,288,675

PRESS ROLL FOR PAPERMAKING MACHINES

Earl E. Berry, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application May 29, 1939, Serial No. 276,377

2 Claims. (Cl. 92—49)

This invention relates to press rolls for dewatering wet webs such as paper and particularly relates to the surface construction of press rolls.

Heretofore, press roll surfaces have been solid and dense or porous and open. The solid, dense surfaces, when pressed against a wet paper web, have a surface attraction for the web causing the same to tightly adhere thereto. A pulling of the web off of such surfaces disrupts the surface fiber formation of the web. The pulling force necessary to remove the sheet from the roll may be sufficient to break the sheet. Porous and open press roll surfaces, such as felt covers, do not wear well, leave marks in the wet web, and soak up water from the web thereby becoming soggy.

According to this invention press rolls are surfaced with relatively dense material having excellent wearing qualities but including radial holes or perforations capable of trapping air therein as they enter the nip of a press roll assembly. The trapped air in the holes is compressed as the holes pass through the nip of the press roll assembly either because of compression of the surface material defining the holes, or by entry of water from the wet web into the holes, or both. The compressed air in the holes, immediately upon passage out of the nip area of the press roll assembly, will blow the web off of the roll surface, thereby eliminating the heretofore encountered disadvantage in the use of dense surfaced press rolls.

While rubber-covered perforated suction rolls have heretofore been known, the perforations or holes extending through the rubber cover are aligned with holes in the metal suction roll so that air cannot be entrapped. The present invention now provides for the sealing of holes extending radially inward from the surface of the press roll at a point beneath the surface so that any air entering the holes from the surface of the roll will be trapped by a sheet or web covering the surface.

The press rolls of this invention preferably include a metal cylinder covered with a layer of resilient material such as rubber. The rubber layer, in turn, is covered with a perforated rubber belt of denser construction than the resilient rubber. This perforated rubber belt has excellent wearing qualities due to its density and, if desired, can be vulcanized to any hardness providing some flexibility is retained. Small, uniformly arranged holes or perforations are formed through the belt and these holes have well-defined flat mouths at the surface of the belt so as to present a flat, smooth surface for the rolls.

The perforated rubber surfaces of this invention can be made by doctoring rubber latex on a pitted, heavy fabric belt. The surface of the belt receiving the latex has uniformly spaced pits therein closed at the bottom. When the latex is doctored on the belt, air is trapped in each pit and, when heat is applied to the under surface of the belt, the trapped air becomes hot and expands, blowing bubbles through the film of latex, thereby perforating the same. The perforated film is dried and the process repeated as many times as are required to build up a latex belt of the desired thickness. The latex material can be vulcanized to any hardness desired.

It is, then, an object of this invention to provide a relatively dense surfaced press roll capable of repelling webs pressed thereagainst.

Another object of the invention is to provide a press roll surface having blind holes extending inwardly therefrom to trap air as they are advanced into the nip of a press roll assembly.

A further object of the invention is to provide a press roll covered with a perforated rubber belt wherein the perforations are sealed beneath the outer surface of the roll.

Another object of the invention is to blow web material off of press rolls by means of air trapped in the press roll surfaces during the pressing operation.

A further object of the invention is to compress air in the circumference of a press roll for blowing a paper web off of said circumference.

Another object of the invention is to provide a press roll covered with a resiliently backed perforated rubber belt.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings.

On the drawing:

Figure 1 is a vertical cross-sectional view illustrating, in somewhat diagrammatic form, a two-press roll assembly equipped with a top press according to this invention.

Figure 2 is a greatly enlarged fragmentary vertical cross-sectional view of the nip area of the assembly shown in Figure 1.

Figure 3 is a diagrammatic vertical cross-sectional view of a horizontal press roll assembly including a press roll of this invention.

As shown on the drawing:

In Figures 1 and 2 the reference numeral 10 designates generally a suction roll. As is customary, the suction roll 10 includes a metal cylinder 11 having holes or perforations 12 extending radially therethrough. A suction box or head 13 is mounted in the cylinder 11 to define a localized suction area.

A top press roll 15 cooperates with the suction roll 10 to define a pressure nip receiving a web of paper W therethrough. The web W is carried on a felt F. The pressure nip is preferably located so as to be in part communication with the localized suction area defined by the suction box 13.

The top press roll 15, according to this inven-

tion, includes a metal cylinder 16, a layer of resilient rubber 17 covering the cylinder 16, and a perforated rubber belt 18 surrounding the rubber layer 17 and defining the outer circumference of the roll. The rubber layer 17 can be vulcanized to the cylinder 16 and rubber belt 18 and serves as a cushion backing for the rubber belt.

As best illustrated in Figure 2, the rubber belt 18 has a plurality of holes or perforations 19 extending therethrough. These holes 19 are sealed at the bottoms thereof by the rubber layer 17 so that the peripheral surface of the roll 15 has a plurality of blind holes extending radially inwardly therefrom.

As illustrated in Figure 2, the rubber belt 18 is dense and relatively incompressible as it passes through the nip area. The rubber layer 17, however, is compressed at the nip area. The rolls 10 and 15 rotate in the direction indicated by the arrows and air is wedged into the nip area. Some of this air becomes trapped in the holes 19 of the belt 18 as the belt contacts the web W. This trapped air in the holes 19 may initially be under slight compression due to the air wedge formed by the rotating rolls. However, water pressed out of the web W may also enter the holes 19 as indicated at 20 to further compress the trapped air in the holes. Immediately upon passage of the web out of the nip area, however, the trapped air is released and acts to blow the web W off of the rubber belt 18 as indicated at 21. If water has been pressed into the holes 19, the same will be spewed out by the trapped air, but will not have an undesirable effect on the web W since the holes are preferably of minute size and cannot store appreciable amounts of water.

The top press roll 15 therefore operates to exert a desired pressure against the web W for squeezing water out of the web but at the same time its surface will not retain the web thereon as is customary with heretofore known dense surfaced rolls. The web W therefore need not be pulled away from the top press roll and its surface will not be damaged.

If desired, the rubber belt 18 can be compressed at the nip area thereby decreasing the length of the holes 19 therein and thus increasing the pressure of the air trapped in the holes so that the compressed air will blow the web off of the surface of the belt as soon as this pressure is released.

In the horizontal press roll assembly disclosed in Figure 3, the reference numeral 30 designates a metal cylinder in pressure relation with a press rodd 31 according to this invention. The cylinder 30 and the roll 31 have their axes in the same horizontal plane so as to define a vertical pressure nip therebetween. A web of paper W is trained around the under side of the roll 31 and passes upwardly through the vertical pressure nip where it is subjected to pressure for removal of water therefrom. The removed water can drop by gravity out of the nip.

The roll 31 includes a metal cylinder 32, a resilient rubber layer 33 surrounding the cylinder 32, and a perforated rubber belt 34 covering the rubber layer 33 to form the outer circumference for the roll. The roll construction can be identical with the construction of the top press roll 15 described in Figures 1 and 2. The perforations or holes 35 in the rubber belt 34 are covered with the web W before they reach the nip area but air can be wedged into the holes as they contact the web. This trapped air can be further compressed by water squeezed into the holes from the web at the nip area, or, if desired, the rubber belt 34 can be slightly compressed at the nip area whereby the lengths of the holes will be decreasd to bring about a further compression of the trapped air. As a result of these actions, the web W will be blown off of the belt 34 as soon as it passes through the nip area. The web is then free to follow around the top of the roll 30.

The rubber belts 18 and 34 are preferably formed by blowing air through a plastic material such as latex so as to create uniform small holes through the belts without damaging the flat surfaces thereof. While mechanically drilled rubber belts would be operative, the mouths of the drilled bores would be rough and might damage the paper web. The mouths of the sealed holes on the press rolls of this invention, however, are smooth and flat and the rolls have uniform smooth surfaces.

The rubber belts can have very small holes therethrough ranging in diameters from .012 to 0.004 inch. From 1100 to 6400 holes per square inch can be provided.

The perforated rubber belts preferably have a very dense structure and will not become soggy during use as do belt or other fibrous covers for press rolls.

It will, of course, be understood, that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A press roll comprising a metal shell, a soft rubber covering for said shell, and a perforated relatively hard rubber covering over the soft rubber in bonded relation thereto, said hard rubber covering presenting a smooth web-receiving surface on said roll with a myriad of blind holes therein, said hard rubber covering being compressible to decrease the volumes of the holes when the covering is subjected to nip pressure.

2. In a press roll assembly including a suction roll, a press roll in pressure relation therewith defining a nip therebetween, means for directing a web of paper around said suction roll into said nip, a suction head in said suction roll defining a suction area extending into said nip, and means for rotating said rolls, the improvements which comprise said press roll having a perforated hard rubber covering presenting a web-receiving roll surface with a myriad of radially extending blind holes communicating with the atmosphere, and an underlying resilient cushion bonded to and backing up the hard rubber covering, said rubber covering being compressible in said nip of the assembly to decrease the volumes of the blind holes as they pass through the nip whereby rotation of said rolls will trap air in the holes as the same are advanced into contact with the web on the suction roll and whereby the trapped air will be compressed due to the decreases in volumes of the holes to blow the web off of said press roll after passage through the nip area.

EARL E. BERRY.