

**United States Patent** [19]  
**Brafford**

[11] **3,800,381**

[45] **Apr. 2, 1974**

- [54] **COVERED ROLL FOR PAPER MAKING**
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- [22] **Filed: June 19, 1972**
- [21] **Appl. No.: 263,859**

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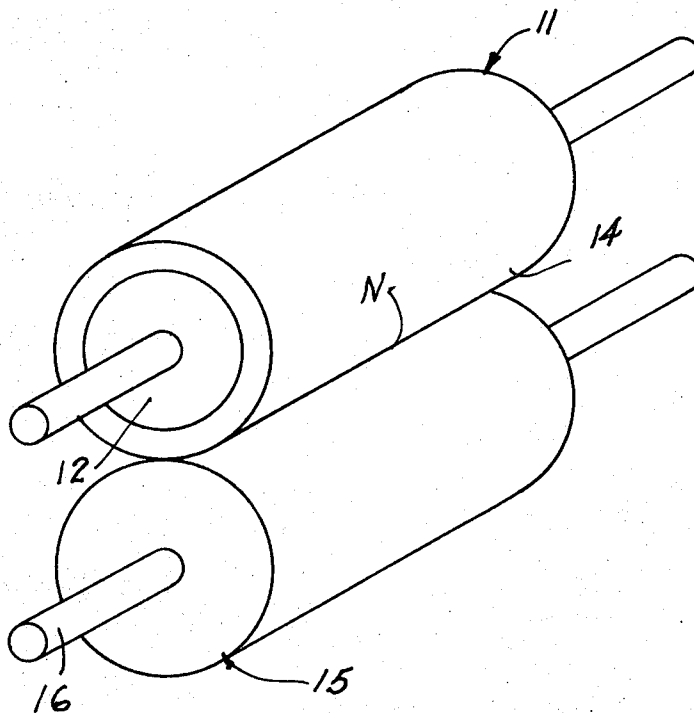
- [52] **U.S. Cl.**..... **29/132**
- [51] **Int. Cl.**..... **B21b 31/08**
- [58] **Field of Search**..... 29/132, 131

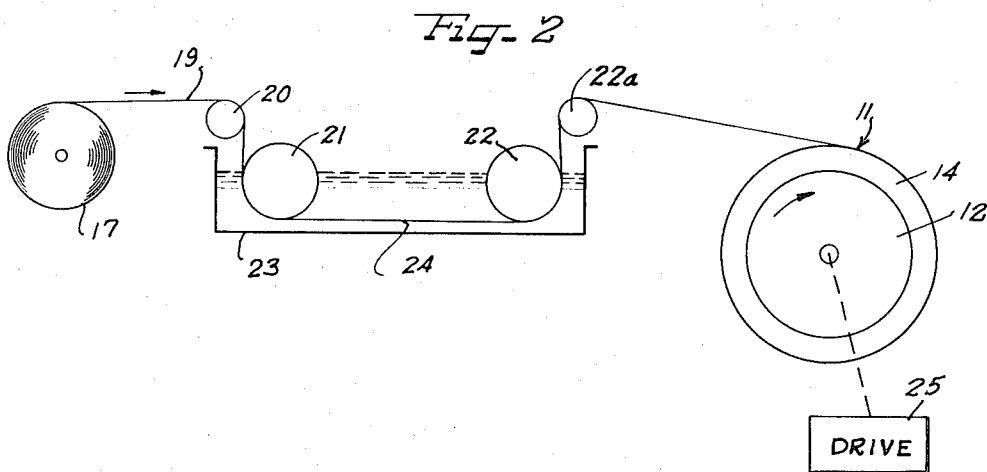
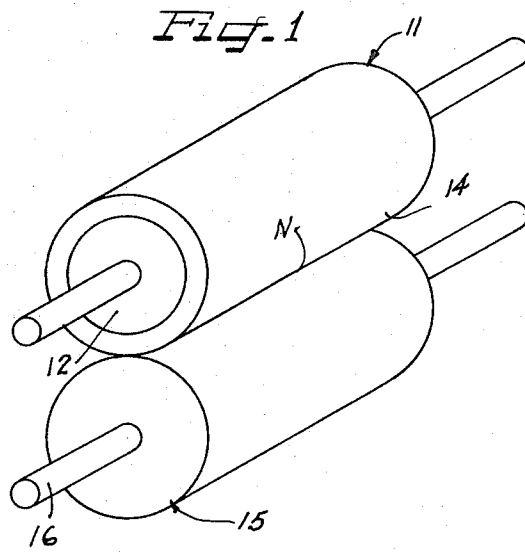
[57] **ABSTRACT**

A roll and method of making the roll wherein the roll is adapted to operate at high speed and high nip pressures and has an outer cover formed of a wet lay process with a reinforcing mat of nonwoven needled polyester fibers wetted and impregnated, with a material selected from the group of depolymerized natural rubber, low molecular light weight styrene butadiene, liquid urethane and liquid polybutadiene, at room temperature and is placed on the outer surface of the roll is a wet lay-up process.

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**1 Claim, 2 Drawing Figures**





## COVERED ROLL FOR PAPER MAKING

## BACKGROUND OF THE INVENTION

The invention relates to improvements in rolls and particularly rolls of the type which are used in paper making machines that must be able to encounter high rates of speed and high nip loads for continuous operation.

More particularly, the invention relates to an improved roll and method of making rolls for a paper making machine wherein the roll has a surface having a nonwoven fibrous mat of needled polyester fibers wetted and placed on the surface of the roll by a lay-up process with the mat wetted and saturated with a liquid rubber.

Rubber covered rolls have been employed for many years in the paper industry. These have particularly been used extensively in the press section of paper making machines, often in the form of grooved rolls or suction rolls and also as plain rolls. These are usually used in a press defining relationship with a mating roll that has a hard outer surface such as a steel roll. Through the nip a wet paper web is carried by an endless felt and water is squeezed out of the web in the nip and into the felt. Often granite rock rolls or bone hard rubber covered rolls will be mated with another hard cover roll such as formed of material such as disclosed in my patent 3,588,978. Such a combination is effective in removing water because of the high unit pressures produced at the relatively narrow or sharp nip. However, such a narrow or sharp nip requires great care in matching roll crown with nip loading and difficulties are encountered as a range of nip loadings becomes necessary because of differences in operating conditions or types of papers being made. Also, further problems are encountered when wads of paper fiber pass through the nip or accidental felt fold-overs occur which cause extremely high local stresses. This often will result in damage to the felt or the press roll or both.

To decrease the problems of roll crown and roll damage above referred to, it has been the practice to mate a hard roll with a relatively softer roll. Such softer roll coverings often have been comprised of rubber compounds such as natural rubber and of rubber type such as polyurethane. The coverings of such a roll with these compounds is done by a casting process. Because pressed rolls exist in a great variety of diameters and lengths, each roll requires a specially made mold, and the cost of casting such roll covers has been substantial.

The search for improved roll covering materials has been important to the development of the paper making industry, and rolls have been manufactured from various materials such as cast iron, bronze, aluminum, stainless steel and the like and also have been covered with material such as rubber, fiber glass, plastic compositions. In manufacturing processes such as paper making machines, the roll must operate under conditions where the peripheral speed attains 6,000 feet per minute and nip pressures attain 600 pounds per linear inch. The environment in which some operations take place may be corrosive and may involve temperature changes which create requirements for operational aptitudes of the roll.

It is accordingly an object of the present invention to provide an improved roll construction formed of material which is capable of operating at high speeds and high nip loading conditions without rapid wear and without adverse effects due to normal operational hazards.

A still further object of the invention is to provide an improved roll which has a soft cover that can be made expediently and relatively inexpensively and which operates reliably so that it produces a uniform and superior grade of paper.

A further object of the invention is to provide an improved method of making soft covered rolls which enables making rolls of various diameters without special expensive equipment for diameter change.

A still further object of the invention is to provide an improved process for making a softer roll covering wherein the covering is capable of operating at high speeds and high nip pressures.

Other objects, advantages and features, as well as the equivalent methods and structures which are intended to be covered hereby, will become more clear in the teaching of the principles of the present invention in connection with the disclosure of the preferred embodiments in the specification, claims and drawings, in which:

## DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective somewhat schematic view of a pair of rolls operating in a paper making machine with the upper roll constructed in accordance with the present invention; and

FIG. 2 is a schematic view illustrating a process for making the roll.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

As illustrated in FIG. 1, a pair of rolls 11 and 15 form a nip N therebetween. The upper roll 11 has a core 12 of iron or the like with a supporting shaft 10 and as will be appreciated, the roll 11 and the roll beneath it 15 will be mounted in suitable bearing supports equipped with a mechanism for applying a controlled nip pressure. The upper roll 11 has a soft outer surface 14 which is applied to the inner core 12 in a method that will be described. The lower opposing roll 15 is formed of a hard material such as steel and is supported on a shaft 16. In some instances it may be desirable for uniform nip pressures that the lower roll 15 be a controlled deflection roll. Various types of these rolls are known to the art and satisfactory rolls may be found of the type that use a stationary inner core which can bend freely away from the nip with a rotating outer roll shell and means to provide a hydraulic support between the core and the roll shell to transmit the nip load. The hydraulic support may be in the form of a captive sealed body of liquid or in the form of an elongate axially extending piston set in a cylinder on the shaft with the piston supporting a sliding Kingsbury thrust type bearing shoe and a film of lubricating oil forming between the inner surface of the roll shell and the shoe. Similarly, the lower roll may be a conventional plain roll, and the upper roll may be an antideflection roll with the core 12 being in the form of a roll shell and being carried by controlled deflection means such as above described.

FIG. 2 illustrates the application of the roll cover to the roll 11. It has been discovered that a softer roll covering can be applied using a wet lay process at substantial savings over the conventional casting process. The roll cover 14 is comprised of a reinforcing fibrous mat, preferably of nonwoven needled polyester fibers. The mat is impregnated with a type of liquid rubber preferably selected from the group of depolymerized natural rubber, low molecular weight styrene butadiene, liquid urethane or liquid polybutadiene. As shown in FIG. 2, the nonwoven reinforcing mat, the material 19 is fed off a supply roll 17 over a guide roll 20 and down into an open container 23 of liquid rubber. Guide rolls 21 and 22 feed the material through the liquid rubber to permit it to be wetted. It has been found that the liquid rubber referred to possesses a room temperature viscosity low enough to wet out the reinforcing mat. The wetted reinforcing mat leaves the container 23, passes over roll 22a and is applied to the outer surface of the roll as shown. This may be done by driving the roll with a drive 25 at a relatively low speed so that the mat is built up in layers on the roll 11.

When the material is cured, a smoothing machining will be performed to obtain a uniform smooth outer surface and a uniform diameter on the roll.

The build-up of the mat may be accomplished in various other forms such as by the laying on of individual wetted sheets on the outer surface or by laminating several sheets and then applying them to the outer surface of the roll, but the laying on process on individual wetted layers forms a strong monolithic i.e., nonporous soft cover.

This cover for the roll will stand higher machine speeds than conventional rubber or cast polyurethane covered rolls, and is readily capable of taking speeds at

6,000 feet per minute and nip loads at 600 PLI which are being accomplished or approached in paper making machinery. The cover applying process eliminates the needs for molds required in a conventional casting process.

As has been stated above, the rolls of the present invention may be employed in a wide variety of uses or industries. The roll presents a soft cover which can operate at high speeds and high loading conditions and what is important, it will offer substantial increases in the operating life for a roll covering which is important in the paper making industry where the delay for shutdown for the failure of any one part is costly. Rolls according to the present invention may be used in various locations in a paper making machine, but are particularly well suited to use as press rolls.

The hardness can be controlled by density of the lay on and choice of wetting material, and a hardness in the range of 4 to 40 P&J is preferred.

I claim as my invention:

1. A soft roll adapted to operate at high speed and high nip pressures for a press in a paper making machine having an outer shell comprising:
  - a sheet form web material formed from a fibrous mat formed from nonwoven needled polyester fibers being applied in layers on the roll;
  - and a rubber impregnating said mat and being cured and forming a monolithic nonporous cover having a hardness in the range of 4 to 40 P & J, said rubber being selected from the group consisting of depolymerized natural rubber, low molecular weight styrene butadiene, liquid urethane and liquid polybutadiene.

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