June 25, 1935. W. E. BRINDLEY 2,005,885

ROLL

Filed Jan. 23, 1932 2 Sheets-Sheet 1

Fig. 1.

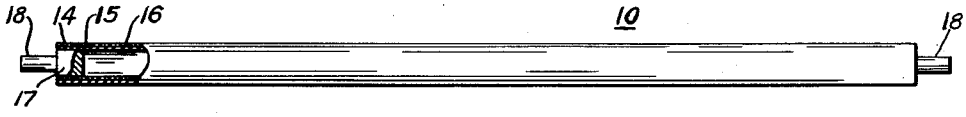



Fig. 2.

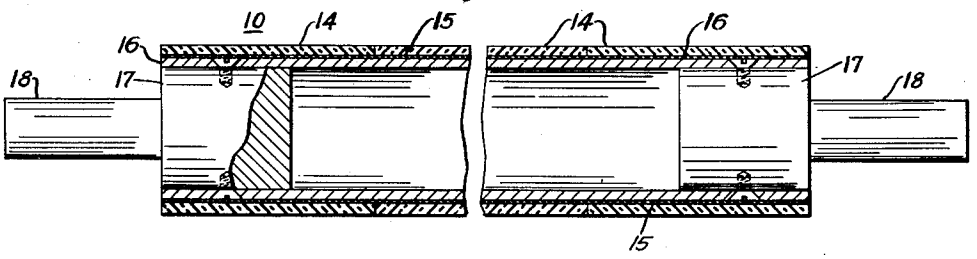



Fig. 3.

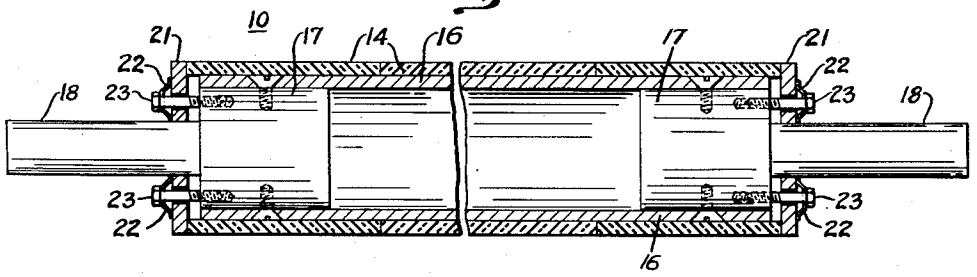
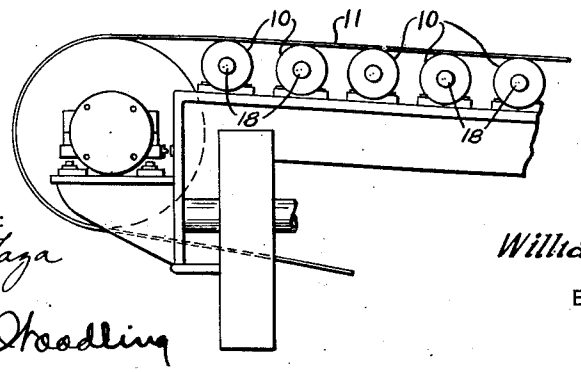



Fig. 4.




WITNESSES:

Leon J. Vaga

George V. Hoadley

INVENTOR

William E. Brindley

BY W. R. Haley

ATTORNEY

June 25, 1935. W. E. BRINDLEY 2,005,885

ROLL

Filed Jan. 23, 1932 2 Sheets-Sheet 2

Fig. 5.

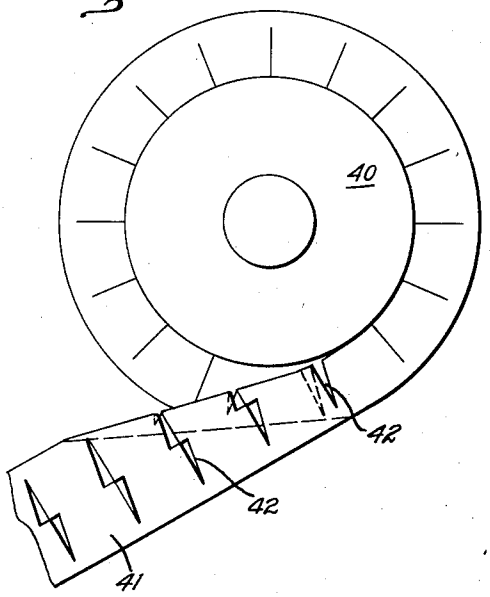



Fig. 6.

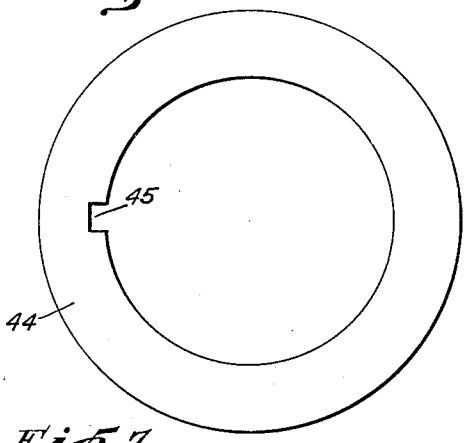



Fig. 7.

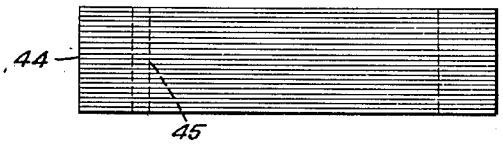



Fig. 8.

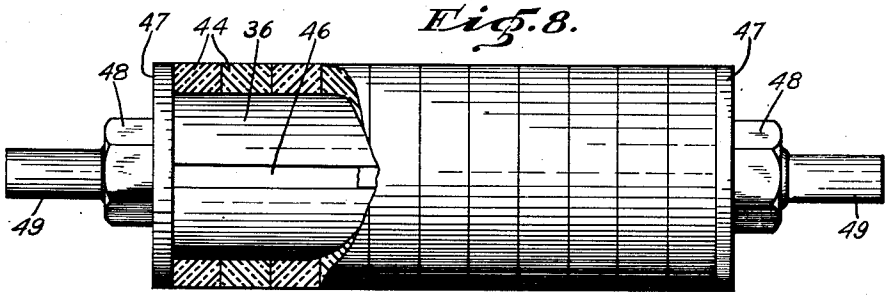
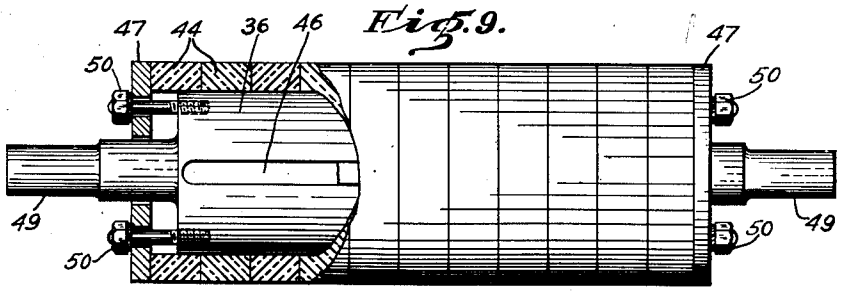



Fig. 9.




WITNESSES:
R. S. Williams
George A. Hoadley.

INVENTOR
William E. Brindley.
BY W. R. Cooley
ATTORNEY

Patented June 25, 1935 2,005,885

# UNITED STATES PATENT OFFICE

2,005,885

## ROLL

William E. Brindley, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, a corporation of Pennsylvania

Application January 23, 1932, Serial No. 588,444

7 Claims. (Cl. 92—77)

My invention relates to rolls and more particularly to rolls that are suitably adapted for paper making machines, calenders and the like.

The unfavorable conditions under which a roll for a paper making machine operates calls for a roll which shall be relatively light, mechanically strong, well balanced and unaffected by the chemicals of the paper pulp carried by the wire mesh.

In addition, in order to obtain the best results the surface of the rolls should have a low coefficient of friction and substantially no affinity for the paper pulp.

In order to meet these requirements, the rolls, heretofore have been constructed of aluminum or other light metal and covered by a protective coating such, for example as brass, copper, or rubber. However, in actual practice, I find that aluminum rolls covered with brass, copper or rubber, have many objectionable features.

While the copper and brass covered aluminum rolls are not very seriously affected by the chemicals of the paper pulp, they are too heavy to give satisfactory service. The excess weight produced by the copper and brass coverings means that the fourdrinier, which carries the rolls and the wire mesh, cannot be shaken so fast as it could be with lighter rolls and, for this reason, a poor grade of paper is produced, because the higher the rate at which the fourdrinier is shaken the better the results. Also, the excess weight subjects the shaking equipment and the frame to additional stresses and strains.

Furthermore, the excess weight makes the rolls harder to handle in case of removal from the machine. This latter feature is very important because the rolls, quite frequently, have to be removed from the machine and because of their length and the position in which they are mounted, this is an awkward and difficult job. Then too, the copper and brass covered aluminum rolls are expensive to manufacture.

The aluminum rolls covered with hard rubber have also proved unsatisfactory, because the heat from the vulcanizing process by which the hard rubber is applied to the roll causes the rolls to become distorted and unbalanced. This distortion and unbalanced condition is quite pronounced in rolls for paper machines, as the rolls vary in length from 50 inches for the smaller sized machines to 300 inches for the larger sized machines. This unbalanced condition is extremely objectionable in either a slow or high speed machine, but particularly in a high speed machine. In all machines, regardless of the speed, since the rolls are driven by the frictional engagement of the wire mesh an unbalanced roll tends to stand still, as there may not be enough frictional engagement of the wire mesh to overcome the unbalance of the roll. This condition is cumulative. Consider a roll which stands still for only a short period of time. Under this condition the wire mesh will gradually wear a flat surface on the circumference of the roll and eventually the roll will not rotate at all. This in turn causes the expensive wire mesh to wear out and deteriorate very rapidly.

The undesirable effect caused by an unbalanced roll is further augmented in a high-speed machine, because the rapid rate at which the fourdrinier equipment is shaken. I find, by reason of this distortion and unbalanced condition, an aluminum roll covered with hard rubber gives unsatisfactory results.

Aluminum rolls covered with soft rubber are, likewise, objectionable. While soft rubber can be applied without heating the roll, as in the case of hard rubber, it tends to flow or creep, thus producing an uneven surface. This creeping action of the soft rubber causes the roll to become non-concentric, unbalanced and bumpy. In addition, the ends of the rolls become somewhat tapered as the soft rubber has a great tendency to creep outwardly towards the ends of the roll. A non-concentric, unbalanced or bumpy roll is primarily objectionable because it causes trouble in the formation of the paper sheet. Every impulse or impact caused by a non-concentric portion or a bump in the roll produces a mark across the sheet, resulting in a poor grade of paper. For these reasons, an aluminum covered roll covered with soft rubber gives poor results.

In order to overcome the foregoing objections and difficulties, an object of my invention is to provide for covering the body portion of a roll with a moulded fibrous material.

Moulded fibrous material because of its durability does not tend to creep as soft rubber but maintains a uniform wall thickness and remains concentric and perfectly balanced. Also moulded fibrous material is lighter than aluminum, thus producing a still much lighter roll than a pure aluminum roll. This means that the rolls are easy to handle in case of removal from the machines. Furthermore, the rolls, since the moulded fibrous material is lighter than aluminum, are easy to balance, both statically and dynamically.

Then too, moulded fibrous materil is impervious to oils, moisture, heat, weak acids and alka-

lines, whereas metal rolls without a protective covering are quite rapidly pitted so that wear is increased on the roll and on the wire mesh. The wear on the wire mesh is, furthermore, materially reduced because the coefficient of friction of moulded fibrous material when wet is very low. The wire mesh is very expensive and thus by preventing wear and deterioration results in a great saving.

A roll covered with fibrous moulded material has but little affinity for the paper pulp carried by the wire mesh and, for this reason, the rolls tend to clean themselves when in service instead of the fibres sticking to the roll as it does with coverings of other material. Since the rolls are kept clean in service, clogging of the wire mesh is substantially eliminated, with the result that a superior quality of paper is produced. This sticking action of paper pulp to the roll is cumulative, that is to say, on each revolution of the roll a little bit more of the paper pulp is added to that which is already present, until eventually the surface becomes uneven and bumpy. Particularly, in the case of press rolls for paper machines (not shown) it is very important that the top press roll have as little affinity for the pulp and paper fibres as possible, because any sticking of the sheets of paper to the press rolls causes the paper to tear which means that it is necessary to thread the sheets of paper through the machine again with a considerable loss of time and a corresponding decrease in production.

Inasmuch as, the moulded fibrous material is unaffected by temperature and moisture, the rolls may be stored indefinitely without a change in the characteristics of the covering material.

Other advantages and a fuller understanding of my invention may be had by referring to the following detailed description taken in connection with the accompanying drawings in which:

Figure 1 represents a side elevational view of a roll constructed in accordance with the features of my invention, parts of which being cut away at one end to show the various elements.

Fig. 2 is an enlarged longitudinal sectional view of a roll embodying the features of my invention and having the central portion removed.

Fig. 3 is an enlarged longitudinal sectional view of a roll embodying modified constructional features of my invention.

Fig. 4 is a side elevational view of a fragmentary portion of a paper making machine.

Fig. 5 is an end view showing the manner in which strips of fibrous material may be wound helically or edgewise about a mandrel for making moulded fibrous sections having the grain of the fibres substantially perpendicular to the axis of the roll upon which they are to be mounted.

Fig. 6 is an end elevational view of a moulded fibrous section formed in the manner illustrated in Fig. 5.

Fig. 7 is a plan view of the moulded fibrous section shown in Fig. 6.

Fig. 8 is a side elevational view, partly in section, of a composite roll covered with a plurality of moulded fibrous sections having the grain of the fibres perpendicular to the axis of the roll, and

Fig. 9 is a view similar to Fig. 8, but illustrating a modified form of securing the moulded fibrous sections upon the cylindrical body portion.

Referring to Figs. 1, 2, 3 and 4 the reference character 10 represents a roll constructed in accordance with the features of my invention.

As illustrated in Fig. 4, the top surface of the rolls 10 define a plane upon which an endless wire mesh 11 rides for carrying the paper pulp.

A roll comprises, generally, a cylindrical body portion 16 having pluks 17 secured within the ends thereof by means of the illustrated machine screws. Integrally formed with each plug 17 is an outwardly extending trunnion 18 about which the roll rotates when mounted in a paper making machine, as illustrated in Fig. 4.

In accordance with my invention I provide for covering the cylindrical surface of the body portion 16 with one or more moulded fibrous sections 14. The moulded fibrous sections 14 are in the form of a cylindrical tube, having a slightly larger internal diameter than the external diameter of the body portion 16. The moulded fibrous sections 14 may also be of any desired length.

For purposes of securing the moulded fibrous sections upon the cylindrical body portion 16, I prefer to utilize a cement 15 or other suitable binding agent. While there are various ways of adhesively securing the moulded fibrous sections to the aluminum body portion 16, I preferably employ the following method:

1. Clean the aluminum body portion 16 so that no trace of grease or oil remains.

2. Heat the aluminum body portion 16 and the moulded fibrous sections 14 in an oven to a temperature of 75° to 80° C. (165° to 185° F.) for 15 minutes.

3. Remove the aluminum body portion 16 and the moulded fibrous sections 14 from the oven and uniformly apply an adhesive mixture to that portion of the body which will receive the first moulded fibrous section.

4. Press the first moulded fibrous section upon the cylindrical body portion 16.

5. Apply the adhesive mixture to each successive section, but slightly more at the joint, and press the remaining moulded fibrous sections on in the same manner as the first one was pressed on.

6. After the moulded fibrous sections 14 are pressed upon the cylindrical body portion 16, return the composite roll to the oven or heater, and subject to a temeprature of approximately 75° to 80° C. for a period of 60 minutes.

7. Remove the composite roll from the oven and allow it to cool to the room temperature.

8. After the composite roll is cooled to room temperature, place in a lathe or grinder and surface to the required diameter.

9. Balance the composite roll both statically and dynamically.

Because of the snug fit, very little adhesive mixture will remain between the cylindrical body portion 16 and the moulded fibrous sections 14. For this reason, the moulded fibrous sections 14 have no tendency to pull away from the body portion 16. The adhesive mixture, in addition, to securing the moulded fibrous sections upon the body portion 16 provides a water-proof seal between the butt joints of the adjacently disposed moulded fibrous sections, with the result that the pulp solution and other foreign material cannot contact the aluminum body portion.

Because of the relatively great length of the rolls, the moulded fibrous sections have a slight tendency to swell longitudinally. This action serves to further tighten the butt joints, and thereby insure additional security to a water-proof bond.

In Fig. 3, the moulded fibrous sections 14 are secured upon the cylindrical body portion 16 by means of the end plates 21. As illustrated, the

end plates 21 are secured to the plugs 17 by means of the spring clips 22 and the machine screws 23. The spring clips 22 yieldingly compress the moulded fibrous sections 14 closely together, thereby providing a water proof seal between the butt joints and, at the same time, allow the moulded fibrous sections to swell longitudinally.

As is well known in the art, the moulded fibrous sections may be made by winding a thin sheet of fibrous material either parallel or at right angles to the axis of the body portion 16. The views of Figs. 1, 2 and 3 illustrate a roll having the moulded fibrous sections made by winding a sheet of fibrous material parallel to the axis of the body portion 16. Whereas, in Figs. 8 and 9 the sheet of fibrous material is wound edgewise, thus making the fibres of the moulded fibrous sections 44 substantially perpendicular to the axis of the body portion 16.

Rolls having the fibres of the moulded fibrous sections perpendicular to the axis, are preferably suitable for press work. Rolls of this type have a certain degree of resiliency necessary for obtaining good results. Press rolls for paper machines, in the past, have been constructed of granite, but these are abrasive and cut the paper sheets. The resiliency, together with the other properties of the moulded fibrous sections, makes a press roll, constructed in accordance with the features of my invention, very suitable for paper work.

The moulded fibrous sections, having the grains of their fibres substantially perpendicular to the axis of the roll upon which they are mounted, may be constructed in accordance with the teachings of the Patent 1,725,124 issued to F. J. Banister on Aug. 20, 1929, and assigned to the assignee of this invention. That patent shows forming a unitary structure from layers of fibrous materials by impregnation with thermosetting resinoid such as phenolic condensation resin and then molding under heat and pressure. Either a laminated structure or a non-laminated structure thus is obtained according to the disposition of the fibrous layers.

Generally, a narrow strip of fibrous material 41, as illustrated in Fig. 5, is wound helically or edgewise about a mandrel until the desired longitudinal length is obtained. The narrow strip of fibrous material 41 is properly apertured at uniform spaced intervals such that when it is folded longitudinally the apertures present V-shaped notches 42 which compensate for the differences in the internal and external diameters. However, it is to be understood that any other well known method may be employed for constructing moulded fibrous sections having the grain of their fibres substantially perpendicular to the axis of the roll upon which they are to be mounted. The helically wound fibrous sections are finally moulded with a heat-hardened binder, thus forming a cylindrical section as shown in Figs. 6 and 7. This construction gives increased mechanical strength and durability which makes the rolls very suitable for pressing purposes.

Press rolls frequently have to be reground to true up the surface, thus correcting for wear any non-uniformity that may occur from hard usage. I find that press rolls covered with moulded fibrous sections can be readily machined and ground, producing a very smooth and uniform surface.

As illustrated in Fig. 8, the moulded fibrous sections 44 are secured upon the cylindrical body portion 36 by means of the end plates 47. The end plates may be secured in position by any suitable means. In Fig. 8 the outwardly extending trunnions 49 are threaded to receive a nut 48. A modified form of securing the plates 47, is shown in Fig. 9 wherein the plates 47 are secured to the cylindrical body portion 36 by means of stud bolts 50.

By the foregoing construction the moulded fibrous sections are pressed closely together thus giving the property of one continuous moulded fibrous covering for the body portion 36. As preferably illustrated, the moulded fibrous sections and the body portion 36 are provided with slots 45 and 46, respectively, so that the moulded fibrous sections may be keyed upon the cylindrical body portion 36.

Rolls constructed in accordance with my invention are economical to manufacture. The cylindrical portion and the moulded fibrous sections may be constructed in different plants and be either assembled by the manufacturer before they are shipped or by the user.

Furthermore, the cylindrical body portions may be covered indefinitely with the moulded fibrous sections without scrapping the metal body portion. When making repairs it is only necessary to replace the particular moulded fibrous sections that may be damaged or worn.

Another marked advantage of rolls covered with fibrous sections is that the sections may be assembled by the user instead of sending the metal body portions away to be recovered, as is the case at the present time where rubber covering is utilized.

Since certain changes in my invention may be made without departing from the spirit and scope thereof, it is intended that all matters contained in the foregoing description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. A method of making a composite roll comprising constructing a cylindrical body portion, forming a plurality of cylindrical fibrous sections bound together by a hardened binder, heating the cylindrical body portion and the cylindrical fibrous sections, applying an adhesive material to the cylindrical body portion, pressing the cylindrical fibrous sections upon the cylindrical body portion, and drying the composite roll.

2. A method of making a composite roll comprising constructing a cylindrical body portion, forming a plurality of cylindrical fibrous sections bound together by a hardened binder, cleaning the body portion, heating the body portion and the fibrous sections to a temperature of 75° to 80° C. for 15 minutes, applying an adhesive mixture to the body portion, pressing the fibrous sections upon the body portion, heating the composite roll to a temperature of 75° to 80° C. for a period of 60 minutes, allowing the composite roll to cool to room temperature, refacing the surface to the desired diameter and balancing the composite roll.

3. A method of applying a moulded fibrous material upon a roll comprising heating the roll and the moulded fibrous material, applying an adhesive material to the roll, pressing the moulded fibrous material upon the roll, drying the composite roll, and refacing the surface to the desired diameter.

4. A method of applying a moulded fibrous material upon a roll comprising cleaning the roll,

heating the roll and the moulded fibrous material to a temperature of 75° to 80° C., applying an adhesive mixture to the roll, pressing the moulded fibrous material upon the roll, heating the composite roll to a temperature of 75° to 80° C., allowing the composite roll to cool, refacing the surface to the desired diameter.

5. A long light roll comprising a long tubular metallic member, means for rotatably mounting the tubular metallic member, and a plurality of tubular members molded from a fibrous material and a resinous binder disposed on the tubular metallic member and in end to end relation, the molded tubular members being cemented to the tubular metallic member and to one another thereby substantially covering the metallic member and presenting a long roll surface of molded material.

6. A long light roll comprising a long tubular aluminum member, plugs mounted in the end of the tubular member, trunnions carried by the plugs and a plurality of light tubular members molded from a fibrous material and a resinous binder disposed in end to end relation on the aluminum member, the molded tubular members being cemented to the aluminum member and to one another to provide a roll substantially covered by the molded material and a long roll surface.

7. A long light roll for paper mills in which a chemically treated pulp is handled, comprising a long light tubular aluminum member, trunnions carried by the tubular member, a plurality of light tubular members molded from a fibrous material and a resinous binder disposed in end to end relation on the aluminum member, the molded tubular members being cemented to the aluminum member and to one another providing a long roll surface having a low coefficient of friction and which is unaffected by chemically treated pulp and moisture.

WILLIAM E. BRINDLEY.