Nov. 2, 1948. P. R. HEYGEL 2,452,755

COMPRESSED LAMINATED MACHINE ROLL

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Fig. 1.

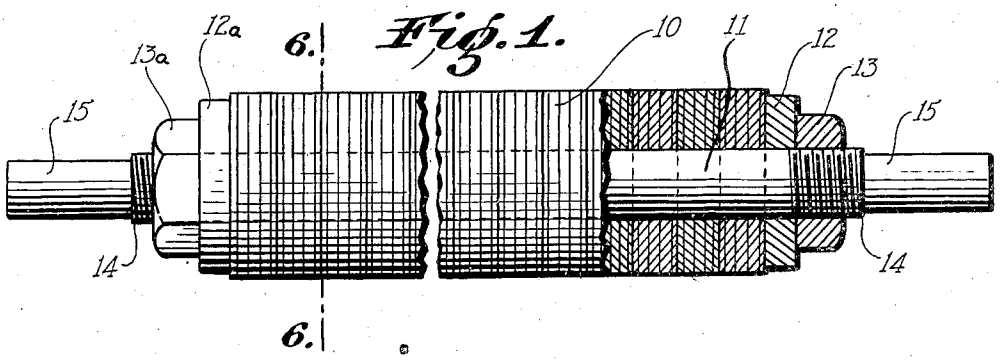


Fig. 2.

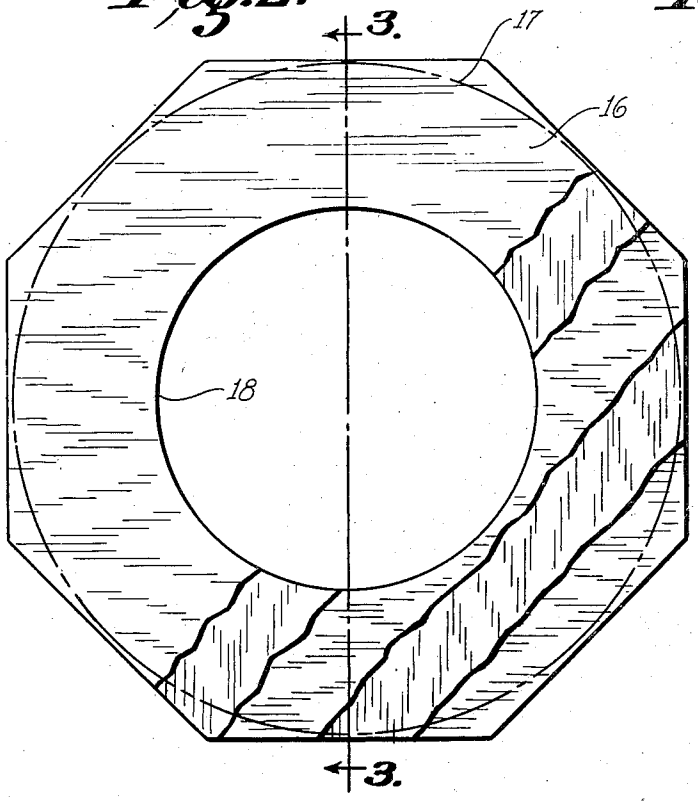


Fig. 3.



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COMPRESSED LAMINATED MACHINE ROLL

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4 Claims. (Cl. 242—68)

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This invention relates to machine rolls, and more particularly to a compressed laminated machine roll especially adapted to replace for certain purposes the steel rolls commonly used in paper machinery and the like.

In the manufacture of paper and paper products, a wide variety of slitting and rewinding operations are performed to obtain the paper in suitable web form for subsequent operations such as ribbing, embossing, printing, coating, and so forth. It is usual after the slitting operation to rewind the webs as bobbins on a steel rewind shaft having a diameter corresponding to the diameter desired for the bobbin core. The bobbin cores are mounted on the rewind shaft and the separate strips of the slit web are rewound on the cores to form bobbins of sufficient diameter to contain a given linear amount of paper.

Steel rewind rolls of the type used for this purpose are characteristically quite heavy. A rewind roll 5 inches in diameter, which is a common bobbin core size, and about 50 inches long is apt to weigh from 240 to 275 pounds; and after the bobbins have been wound the total weight may reach 400 pounds or more. The weight factor is correspondingly more pronounced with increase in size of the rewind rolls, which may be as large as 8 inches or more in diameter and about 100 inches long. As a result, the installation of such rolls for the rewinding operation and their removal after the bobbins have been wound present substantial handling difficulties. Since the necessity for removing a wound roll and replacing it with a new one occurs frequently, these handling difficulties are troublesome and costly.

Attempts to remedy these difficulties by employing hollow constructions or other similar expedients to lighten the rolls have not worked well because when significant weight reduction is effected in this manner the strength of the roll is so far impaired that springing occurs as the bobbins build up during the rewinding operation. Solid wooden rolls are not satisfactory because they are subject to warping and vibration during high speed winding.

According to the present invention I provide a light weight, laminated wood roll with a small metal core, that is the full equivalent of the conventional, solid, steel roll, and thus avoid the weight disadvantages inherent in the use of the solid, steel rolls. The laminated roll of my invention is made up of plywood blanks mounted on a steel shaft of relatively small diameter, the blanks being compressed to form a dense annular body which may be machined and finished to obtain a smooth roll surface. I have found that rolls constructed in this manner are as serviceable as the solid, steel rolls ordinarily used and yet weigh less than a third as much.

One of the principal features of the laminated

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roll of my invention is the relatively very high pressure under which the wood laminations are held in the finished roll. This pressure may be in the order of 10,000 pounds to 50,000 pounds per square inch. The wood laminations are subjected to pressures of this magnitude during assembly of the roll and such pressures are "locked in" the finished roll.

This high state of compression is important from the standpoint of preventing vibration of the roll when used under high speed operating conditions. I have found that if the roll is not highly compressed in this manner it will vibrate badly and prevent satisfactory use as a winding or rewinding roll for web material, especially in view of the requirements of straight and uniform winding of such material.

An important constructional feature of the roll of my invention is the arrangement of the wood plies or laminations in such a manner that the grain of the wood is transverse to the longitudinal axis of the metal shaft on which this roll is mounted. This type of construction will compress with a minimum amount of spreading and have less tendency toward breaking or weakening of the wood when the roll is highly compressed. These advantages are not obtainable when the grain of the wood is parallel to the longitudinal axis of the roll.

A laminated roll constructed according to my invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a side elevation, partly in section, of a finished roll;

Fig. 2 is a plan view, partly cut away, of the plywood blanks used in constructing the roll; and

Fig. 3 is a corresponding section on the line 3—3 of Fig. 2.

Referring at first to Fig. 1, the annular plywood body of the roll is indicated at 10. The plywood body 10 is mounted, as mentioned above, on a steel shaft 11 which is of comparatively small diameter, and is locked on the shaft 11, in a manner to be described more particularly below, by the end plates 12 and 12*a*, held in place by nuts 13 and 13*a* which engage screw threads 14 formed on the shaft 11. The end plate 12*a* and nut 13*a* are preferably formed integral to facilitate manufacture of the roll. The shaft 11 extends at each end, in reduced diameter, beyond the screw threads 14 to form journals 15 for the roll.

A convenient form of plywood blank 16 from which the annular body 10 may be made up is shown in Fig. 2 and Fig. 3. Plywood is particularly adapted for use in constructing the laminated roll of my invention because of its characteristic arrangement of thin sheets or plies in which the grain of each ply runs lengthwise and the grains of the adjacent plies are set at right angles, as illustrated in Fig. 2. As a result, when

the blanks 16 are mounted on the shaft 11, the grain will be disposed transversely and will substantially radiate from the axis of the shaft 11 so that the blanks will compress with a minimum of spreading when pressure is applied, as described below, to form the annular body 10.

I have obtained very good results by forming the blanks 16 from five-ply stock, although it will be apparent that stock of any other ply or blanks formed from ordinary lumber might also be used. Plywood stock of relatively large ply has some advantage in handling, both as regards making up the blanks and forming the roll, but otherwise the material used for the blanks may be selected on the basis of such factors as cost, availability, convenience, etc.

In order to minimize the amount of finishing required, I form the blanks 16 with an octagonal outline approximating the final diameter desired for the finished machine roll, as indicated for instance by the dotted line 17 in Fig. 2. The blanks 16 are also cut with a central opening 18 corresponding to the diameter of the shaft 11.

To construct the laminated roll, the integral end plate 12*a* and nut 13*a* are placed on the shaft 11 and the plywood blanks 16, with an application of wood glue or the like on their faces, are fitted loosely over the shaft from the other end for substantially the entire length of the shaft, and the second end plate 12 is then also put in place. This assembly is then arranged in a convenient hydraulic press, or the like, for the compression treatment.

The assembly of glued plywood blanks 16 loosely mounted on the shaft 11 are compressed to a dense mass and allowed to stand under pressure until they take a set. The pressure is then released and additional blanks are added to fill the length of the shaft again, and these blanks are compressed in the same manner. This procedure is repeated until a sufficient number of blanks have been added and compressed to form a desired length of roll. When this result has been obtained, the second nut 13 is placed on the shaft 11 and tightened before the pressure is released so that the compressed blanks 16 are locked between the end plates 12 and 12*a*.

Upon removal from the hydraulic press, the roll is characterized in cross-section by the octagonal shape of the plywood blanks 16, as illustrated in Fig. 2. Also, a certain amount of glue is apt to be expressed to the outer surface of the roll during the compression of the blanks 16. It is accordingly necessary to clean up the annular body 10 and finish the outer surface to obtain a usable roll. These operations are conveniently carried out on a lathe, the roll being turned down to a diameter closely approximating the final diameter desired and then sanded or otherwise similarly worked to the final diameter so as to obtain a true and highly finished outer surface. The cross-section of the roll will then appear as indicated by the dotted line 17 in Fig. 2. The outer surface of the roll is next treated with a resinous filler and finishing material, such as shellac or lacquer, which will penetrate the annular plywood body 10 and produce a good smooth waterproof surface.

The laminated roll of my invention may be advantageously substituted for steel rewind rolls of about 4 inches and up in diameter. Laminated rolls 5 inches in diameter and 50 inches long constructed according to my invention weigh about 75 pounds. Laminated rolls of this size substituted for steel rewind rolls of corresponding size previously used on a paper slitting machine have proved entirely satisfactory over a representative test period, and have been found to facilitate operations substantially.

My laminated rolls may also be used to advantage in other instances where large rolls are required in paper machinery or the like. They may be employed, for example, in the equipment used for paper inspection, and they are well suited for use wherever large idler rolls are needed.

Having thus described my invention, I claim:

1. A compressed, laminated machine roll comprising a central steel shaft of comparatively small diameter, and an annular, laminated wooden body carried by said shaft, said wooden body being composed of annular wooden blanks mounted transversely on said shaft in which the course of the grain is substantially parallel to the plane of the blanks, and said wooden blanks being fitted separately on said shaft and then compressed to a dense mass.

2. A compressed, laminated machine roll comprising a central shaft of comparatively small diameter, and an annular plywood body carried by said shaft, said plywood body being composed of a plurality of annular plywood blanks mounted with the course of the grain in said blanks disposed transversely on said shaft and then highly compressed to a dense mass.

3. A compressed, laminated machine roll comprising a central shaft of comparatively small diameter, and an annular plywood body carried by said shaft, said plywood body being composed of a plurality of annular plywood blanks mounted with the course of the grain in said blanks disposed transversely on said shaft and then highly compressed to a dense mass, and means locking the annular body on said shaft in compressed condition.

4. A compressed, laminated machine roll comprising a central steel shaft of comparatively small diameter and an annular plywood body carried by said shaft, said plywood body being composed of a plurality of annular plywood blanks, the inner diameter of said blanks corresponding to the diameter of said shaft and the outer profile of said blanks being sufficient to allow a finishing tolerance in excess of the final diameter desired for said machine roll, said blanks being mounted with the course of the grain in said blanks disposed transversely on said shaft and then highly compressed to a dense mass, and means for locking the plywood blanks on said shaft in compressed condition.

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