Aug. 30, 1960 J. J. KEYSER 2,950,507

WORKING ROLL ARRANGEMENT FOR TEXTILE MACHINERY

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FIG. 2

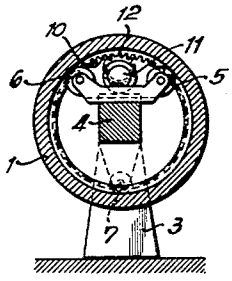
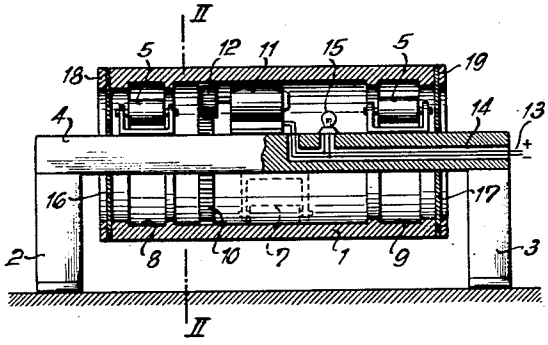


FIG. 1



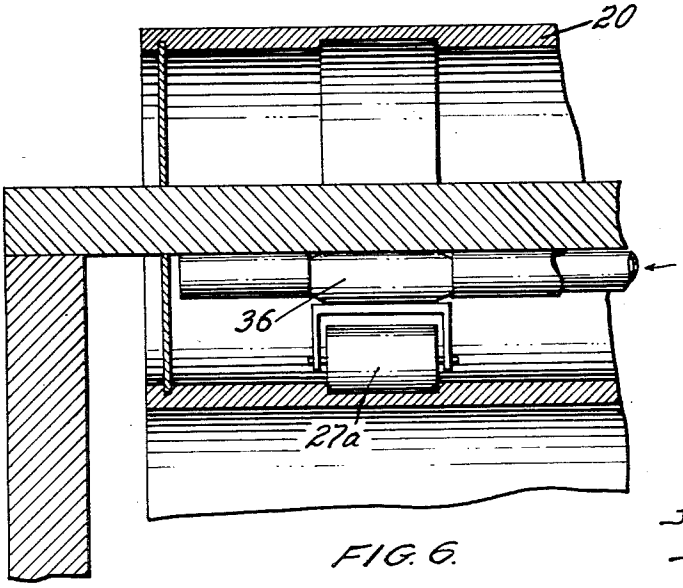


FIG. 6.

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FIG. 4

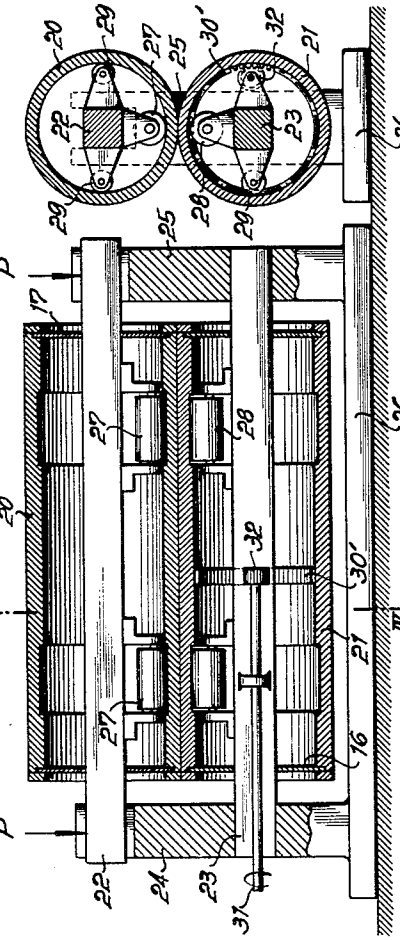
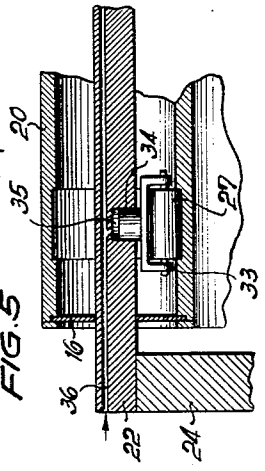


FIG. 3

FIG. 5



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United States Patent Office 2,950,507 Patented Aug. 30, 1960

2,950,507

WORKING ROLL ARRANGEMENT FOR TEXTILE MACHINERY

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Filed Jan. 5, 1955, Ser. No. 479,916

Claims priority, application Germany Jan. 9, 1954

4 Claims. (Cl. 19—65)

The present invention relates to working rolls and, while not specifically limited to, is of particular use in connection with textile machinery.

Numerous processing machines have rotating rolls by means of which a relatively wide and flat portion of a work piece is advanced and simultaneously subjected in a continuous manner to a processing effect. Depending on the processing effect upon the work piece, such rolls, which henceforth will be designated as "working rolls," may carry out a mere surface processing action as for instance drying rolls or card rolls in the textile industry or they are utilized to exert pressure upon the work piece. Such pressure may be brought about by a single roll having line contact with the work piece as is the case with flat printing methods or with steam rollers, or two rotating rolls may be provided, which press against the work piece of fiber material in the form of fiber tufts or fiber fleece passing therebetween as is the case with rolling mills, roll crushers or with web squeezers of the textile industry which web squeezers are employed for removing impurities from the fiber tufts. Frequently such working rolls, for functional reasons or reasons of stress, have large diameters up to three yards and more.

The arrangement of all of such working rolls is principally the same. In most instances both ends of such rolls are journalled by pivots or studs and are driven through one of said studs or at a point on the outer circumference of the roll. With roller pairs, each roller may be driven individually or through the intervention of an intermediate transmission interconnecting the two rollers.

The required pressure which frequently amounts to several tons is exerted upon bearings displaceable in lateral frame walls, for instance hydraulically or by spring means and is conveyed to the work piece through studs and rolls. This power flow not only requires correspondingly large studs and bearings due to the high occurring stresses, but the rolls themselves must have a great diameter in order to prevent inadmissible deflection or bending. It is a well-known fact that any deflection or bending will result in a non-uniform pressing of the work piece over the working width of the roll. Such non-uniform pressure affects many working steps and represents a problem well-known in connection with rollers of the textile industry. In order, for the above reasons, to prevent any deformation of such rollers, the rollers are generally made solid. This, however, requires a large amount of material. At the same time it is intended by such a solid roll construction to increase the weight of the roll in order to gain the effective pressure.

It is, therefore, an object of this invention to provide an improved working roll, especially for use in connection with textile machinery, which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a working roll, especially for use in connection with textile machinery, which will make it possible to considerably

and safely reduce the weight of the working roll and the bearing means therefor.

Still another object of this invention consists in the provision of a working roll, especially for use in connection with textile machinery, which will have a considerably lower inertia than heretofore known working rolls of the same outer dimensions and material.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic longitudinal section through a working roll according to the invention for surface treatment of a work piece.

Fig. 2 is a vertical section taken along the line II—II of Fig. 1.

Fig. 3 is a diagrammatic longitudinal section through a pair of working rolls for exerting pressure upon a work piece passing between said two rolls, both rolls being designed in conformity wth the present invention.

Fig. 4 represents a section along the line IV—IV of Fig. 3.

Fig. 5 represents a modification over the arrangements shown in Figs. 1 to 4, and

Fig. 6 is a slight modification over the arrangement according to Fig. 5.

General arrangement

The drive and operation of working rolls of the above mentioned type have been improved according to the present invention by designing the working roll or rollers as tubular roller or rollers respectively and supporting the same by supporting rollers arranged inside the respective working roller and in rolling engagement therewith. The tubular working roller has a substantially cylindrical inner surface with grooves therein which are engaged by driving and guiding elements carried by a stationary shaft extending through the working roller. The driving elements serve for rotating the working roller, whereas the guiding means both support the respective roller and substantially prevent any axial movement thereof.

The fixed or stationary shaft about which the tubular working roll rotates is advantageously designed as a beam, preferably of uniform strength, the driving, guiding, and pressing elements being connected to said beam.

Both ends of the tubular working roll according to the invention are preferably closed by detachable cover plates or the like which, if desired, may be non-rotatably connected to the fixed or stationary shaft while being slidable in longitudinal direction thereon. However, if desired said cover plates may also be arranged so as together with the hollow roll to rotate about the stationary shaft. The stationary shaft itself may be designed hollow for housing conduits and/or transmission elements for driving the driving, guiding, or pressing devices. The bearing portions of the hollow shaft in the side frame parts may be subjected to variable pressure. In other words, two superimposed working rollers of a web squeezer may be subjected to a pressure which may be varied in conformity with the material to be processed.

Structural arrangement

Referring now to the drawings in detail and Figs. 1 and 2 thereof in particular, the arrangement shown therein illustrates a hollow or tubular working roll 1 which may for instance represent a drying roller or a roller of the textile industry. This roll 1 is rotatable about a non-rotatable shaft 4 journalled in lateral frame parts or side plates 2, 3. Preferably, the shaft 4 is designed as a beam of uniform strength, i.e. the deflection or bending of the shaft 4 is constant throughout the length of shaft 4 so

that a completely uniform pressure distribution over the entire working width of the roll will be possible. For the sake of clarity, the shaft 4 has been illustrated as a beam having a square cross section, however, it will be understood that the beam may also have another cross section and may for instance be designed as lattice girder in order to fulfill the desired purpose.

All guiding and driving elements are mounted within the tubular roll and supported by the shaft 4. Thus, for instance, the tubular roll 1 is supported by two roll arrangements 5, 6 arranged symmetrically with regard to the vertical longitudinal central plane. Said roll arrangements may be supplemented by a further roll arrangement 7 shown in dash lines. The roll arrangements may, as will be clear from Fig. 1 run in separate guiding tracks 8, 9 thereby preventing the tubular working roll 1 from axial displacements.

In addition to the roll arrangements or guiding devices 5, 6, 7, the drive may also be provided in the interior of the tubular roll 1. With the specific embodiment shown in the drawing, the hollow roll 1 is provided with an inner gear ring 10. This gear ring meshes with a pinion 12 driven by a drive motor 11 which is connected to the shaft 4. The supply of current to the drive motor 11 is effected through the conductor 13 passed through a bore 14 in the shaft 4. A diagrammatically illustrated illuminating device 15 may illuminate the interior of the tubular roll 1.

The two ends of the tubular roll 1 are, in addition to the disc-shaped closing means or plates 16, 17, closed in such a manner that the interior of the tubular roll is completely enclosed and the elements arranged therein are protected against dust and dirt. The closing elements 16, 17 are displaceable upon the shaft 4 according to the specific example shown and by means of sealing rings 18, 19 rest against the tubular roll 1. In this instance, the roll rotates between the plates 16, 17 stationarily mounted upon the shaft 4. When the shaft 4 has a round cross section the plates may be fixedly connected to the tubular roll 1 and may rotate together with the latter about the shaft 4. The sealing rings 18, 19 and the respective adjacent closing elements 16, 17 may be detachably connected to the tubular roll 1 by bolts passing through the respective sealing rings and closing elements into the tubular roll 1. The closure means 16, 17 can at any rate be so designed that they can be detached from the tubular roll 1 in order to allow repairs of the elements within said roll 1.

When rolls of larger diameter are involved, the closure means 16, 17 may also be provided with manholes or inspection glasses or may consist entirely of transparent material so as to allow observing and watching the interior of the roll 1 from the outside.

Tubular working rolls of the type described above are particularly advantageous when the working rolls are intended to exert a pressure upon the work piece as is the case for instance with rollers of the textile industry. With such pressure rolls, the problem of preventing deflections, in other words the problem over the entire length of the rolls to exert uniform pressure upon the work piece passing therethrough is of particular importance. This problem has been advantageously solved according to the present invention by the arrangements shown in Figures 3 to 6.

According to Figs. 3 and 4, the rolling arrangement comprises a pair of hollow or tubular rolls 20, 21 each of which is principally designed and journalled in the manner described above in connection with Figs. 1 and 2. The tubular rolls 20, 21 preferably rotate about shafts 22, 23 designed as beams of uniform strength and journalled in the frame portions 24, 25 of the frame 26 so that the shafts 22, 23 may be displaceable relative to each other. One of said two shafts 22, 23 may be stationarily journalled in the frame parts 24, 25. According to Figs. 3 and 4, shaft 23 is stationarily journalled in the frame parts 24, 25. In this instance the pressure is brought about by means of suitably known pressing devices such as springs, screw spindles, hydraulic or pneumatic cylinders or pistons or the like indicated by arrows P in the drawing. This pressure is conveyed through the shaft 22, which is vertically displaceably journalled in the frame parts 24 and 25, and is transmitted from the interior of and to the tubular roll 20 through the intervention of two or more supporting rollers 27 which are connected to the shaft 22. The tubular roll 21 rotating about the fixed shaft 23 in its turn takes up the counter pressure by means of its inner supporting rollers 28, said counter pressure then being conveyed to the machine frame 24, 25, 26 through the shaft 23.

The arresting of the tubular rolls 20, 21 in axial direction thereof may likewise be effected from the interior thereof, as shown for instance in Fig. 4, by means of the guiding rolls 29 journalled on the shafts 22 and 23, said guiding rolls 29 having a diameter less than the diameter of the supporting rollers 27, 28 conveying pressure and engaging corresponding guiding tracks provided in the roll.

The rolls for feeding the work piece passing therebetween may be driven in the manner shown in connection with Figs. 1 and 2 by a motor arranged in the interior of the tubular roll 21 and connected to the beam 23. The shaft of said motor has connected thereto a pinion meshing with the interior gear ring 30' of the tubular roll 21. If, in special instances, it should be desirable to provide the drive motor outside the machine, the drive shaft 31 may be passed along the stationary beam 23 and through the stationary cover 16 into the interior of the hollow roll at that point where the pinion 32 at the end of the shaft meshes with the gear ring 30.

Instead of conveying the required pressure through the beam 22 into the roll arrangement, the entire pressure arrangement irrespective of whether it operates hydraulically or by spring means may be arranged in the interior of at least one of the two tubular rolls 20, 21. Such an embodiment is shown in Fig. 5. In this instance, the beam or shaft 22 is fixedly connected to the frames 24, 25. The pressure devices are movable relative to the fixed shaft 22 and are adjustable to a certain pressure. This may, for instance, be effected so that the pressure rollers 27 are journalled on a support 33 which is provided with a piston-like extension 34 slidably engaging a cylinder 35 arranged in the fixed shaft 22. The extension 34 communicates through a bore 36 with a pressure fluid source outside the machine, as for instance pressure oil, and from there is supplied with oil under a certain pressure. It is also possible to arrange along the shaft 22 a body in form of hose means 36 or the like (see Fig. 6) which is filled with pressure fluid from the outside and along its entire length presses against pressure rolls 27*a* (one only being shown) which are arranged side by side and convey the pressure on their part upon the entire length of the inner wall of the tubular roll.

The designing of working rollers as tubes within the scope of the invention also has among others the advantage over solid rolls of the same outer diameter that when starting and stopping, less accelerating or braking torques have to be exerted because the inertia moment of a tube is less than that of a solid cylinder of the same outer diameter and the same material. A calculation discloses that these torques, assuming the same angular acceleration with rolls having an outer diameter of 2R and an inner diameter or 2r, yield the following ratio:

$$\frac{\text{Torque hollow roll}}{\text{Torque solid roll}} = \frac{R^4 - r^4}{R^4}$$

The greater the inner radius r of the hollow roll can be selected, the less will be the torque or in other words the faster can an acceleration or braking operation be effected with the same torque.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In combination in a working roller arrangement for textile machinery: a frame, a first stationarily mounted shaft, a first tubular roller having a substantially cylindrical inner surface spaced from said first shaft, first roller means supported by said first shaft and arranged in rolling engagement with said cylindrical inner surface for rotatably supporting said first tubular roller, said cylindrical inner surface being provided with a gear ring, pinion means within said first tubular roller and meshing with said gear ring for rotating said first tubular roller, a second stationarily mounted shaft carried by said frame in spaced relationship to said first shaft, a second tubular roller arranged for engagement with said first tubular roller and having a substantially cylindrical inner surface spaced from said second shaft, second roller means carried by said second shaft and arranged rotatably to support said second tubular roller, said tubular rollers being arranged to be pressed against each other, and flexible hose means mounted on and along the length of said second shaft and arranged to convey pressure to said second tubular roller for pressing the same against said first tubular roller.

2. In combination in a working roller arrangement for web squeezers: a stationary shaft, frame means fixedly supporting said shaft at both ends thereof, a tubular working roller having a substantially cylindrical inner surface coaxial with but spaced from said stationary shaft and having annular grooves provided on said inner surface and symmetrically arranged on opposite sides of the vertical plane of symmetry of said working roller, supporting means fixedly connected to said stationary shaft, roller means carried by said supporting means and engaging said grooves at the bottom as well as the side walls thereof to thereby guide said working roller and prevent the same from effecting any substantial axial movement relative to said stationary shaft, and driving means drivingly connected to said working roller for rotating the same.

3. In combination in a working roller arrangement for web squeezers: a stationary shaft, frame means fixedly supporting said shaft at both ends thereof, a tubular working roller having a substantially cylindrical inner surface coaxial with but spaced from said stationary shaft and having annular grooves provided on said inner surface and symmetrically arranged on opposite sides of the vertical plane of symmetry of said working roller, said stationary shaft being provided with cylinders having their axes extending substantially in vertical direction and transverse to said stationary shaft, fluid conduit means arranged in said stationary shaft and communicating with said cylinders for conveying pressure fluid thereto, said conduit means being adapted to be connected to a pressure fluid source, supporting means including plunger means reciprocably mounted in said cylinders and also including roller holding means, roller means supported by said holding means and engaging said grooves at the bottom as well as the side walls thereof to thereby guide said working roller and prevent the same from effecting any substantial axial movement relative to said stationary shaft, and driving means drivingly connected to said working roller for rotating the same.

4. An arrangement according to claim 2, which includes closure discs detachably arranged at the end portions of said working roller.

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