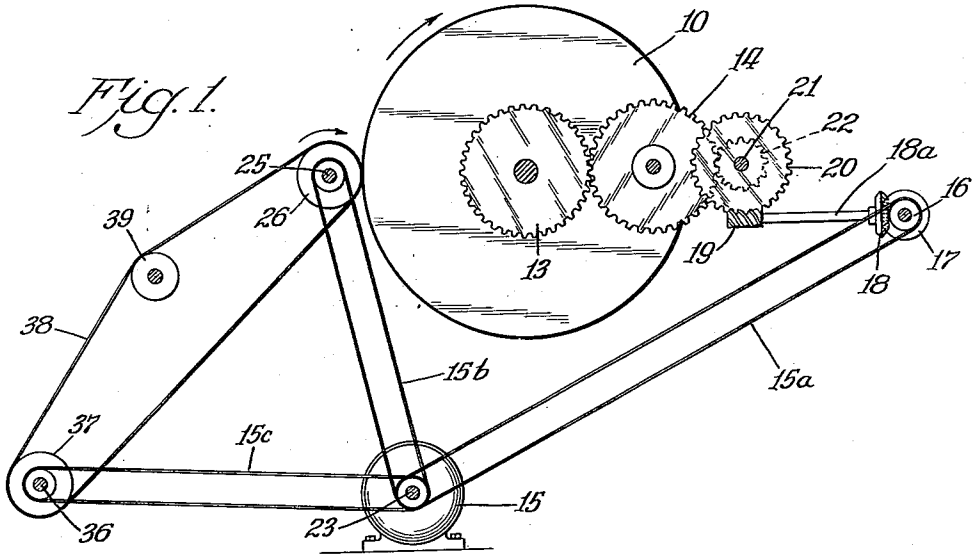
Dec. 18, 1951 R. G. MINARIK ET AL 2,579,391

IN-PLACE RESURFACING OF PONDEROUS CYLINDERS

Filed June 13, 1946

Fig. 1.



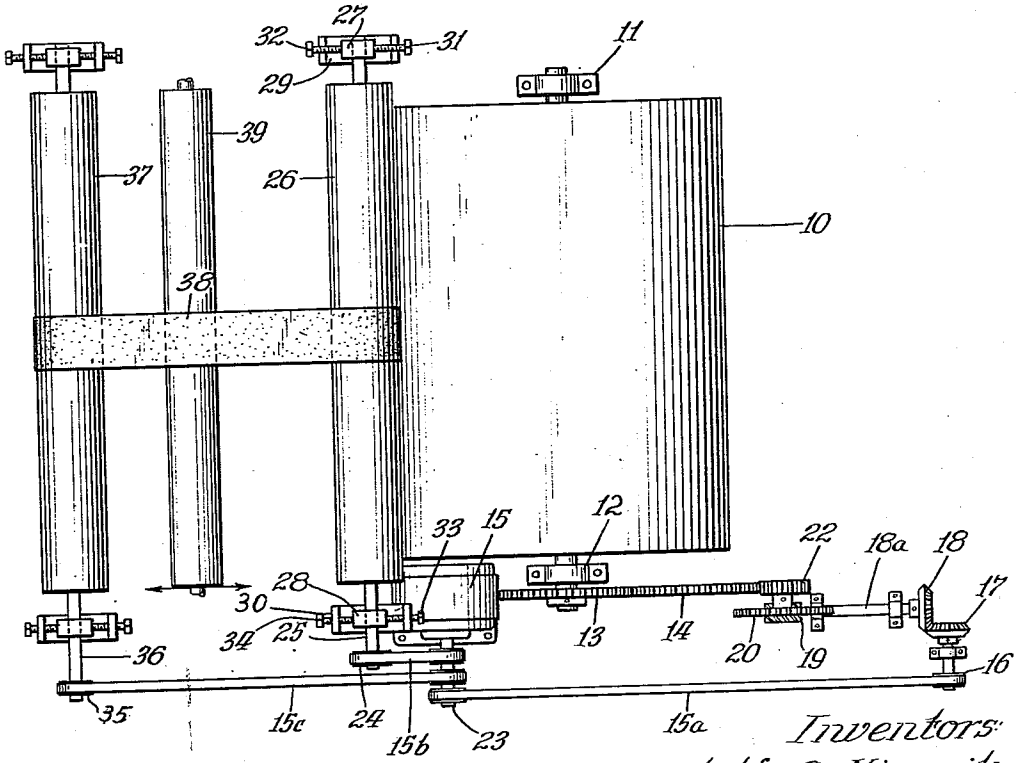


Fig. 2.

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IN-PLACE RESURFACING OF PONDEROUS CYLINDERS

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1 Claim. (Cl. 51—251)

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The invention relates to improvements in in-place surfacing of ponderous cylinders and is of particular value in connection with the re-surfacing of large hollow cylindrical rolls, for example dryers, which are used in industrial establishments such as paper mills.

The invention will be described as it may be applied to the re-surfacing of the main drying cylinders of Yankee type paper machines in which drying is generally all effected on a single cylinder or roll which may be as large as 12 feet in diameter with a 12 foot face. Such a cylinder, designed as it is to stand relatively heavy steam pressure and which has to maintain its shape and dimensions under the varying conditions of service and over long periods of time, must be of exceptionally rugged construction, so that it is extremely ponderous.

After varying periods of service, it has been found that the surfaces of such dryers become slightly eccentric, pitted or otherwise affected by use, and it is necessary from time to time to dress or polish off the outer surface of the cylinder by hand. Eventually a condition is reached where a more drastic treatment, i. e. an entire re-surfacing operation in the nature of a machine operation is required. In such cases, it has been necessary to shut down the operation of the paper machine for a period of weeks, in order to enable the drying cylinder to be de-mounted and shipped back to the factory where the drying cylinder was originally manufactured at which place a complete re-machining job is done. The de-mounting of the cylinder and shipment to the factory, its re-mounting in the re-finishing machine, its re-shipment after re-finishing, and its re-installation in the paper machine, involves an enormous amount of labor and expense. In fact, because the total cost of all these operations, including lost time on the paper machine, is so great, a complete factory re-finishing job such as has been described is only done with the greatest reluctance and at the longest possible intervals. The result is that there is a great temptation to keep the machine running in some cases beyond the time when an entirely satisfactory product can be made, which may also involve considerable loss of good will and profit. The same can be said in other industries using large ponderous cylinders which require re-surfacing from time to time.

The principal object of the present invention is to provide a relatively simple, practical and economical apparatus by the use of which a cylinder of the general class described may be re-surfaced or re-finished with the same degree of efficiency

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and accuracy as in the factory which manufactured such cylinders and which is especially equipped for machining the same. A further object of the invention is to provide a relatively inexpensive apparatus which may be efficiently employed in connection with the initial manufacture and surfacing of such cylinders.

In the drawings which accompany this application, and which illustrate the invention as applied to the re-surfacing of the large drying cylinder of a Yankee type paper machine,

Fig. 1 is a schematic elevation of the apparatus as so applied; and

Fig. 2 is a plan view of the apparatus shown in Fig. 1.

In the drawings, 10 represents the drying cylinder as mounted in the paper machine on its usual bearings 11 and 12. Said cylinders are usually driven by gearing, for example intermeshing spur gears 13 and 14. According to our invention, during the re-surfacing operation, the drying cylinder 10 is supplied with steam of the same pressure as is used in the paper manufacturing operation so as to reproduce the actual service condition. The cylinder through the usual gearing 13 and 14 is revolved at relatively slow speed by a motor 15 through a train of reduction gearing, which, in the present instance, may include a belt 15a trained around a pulley 16 and niter gears 17 and 18, the latter being on a worm shaft 18a equipped with a worm 19 engaging a worm gear 20. The worm gear 20 is keyed to a shaft 21 on which is keyed a small spur pinion 22 arranged to mesh with the cylinder drive gear 14. By this train of gearing, the drying cylinder may be revolved at a speed of about 10 R. P. M.

In addition to the pulley which drives the belt 15a, the motor shaft 23 carries other pulleys which drive additional belts 15b and 15c. The belt 15b is trained around a pulley 24 on the extended end of a shaft 25 of a special form roll 26. In certain cases as shown, and where the drying roll has a very long face, it is convenient to locate the axis of the shaft 25 and roll 26 at a point which is substantially at the same vertical height as the axis of the roll 10. In that way, any variations due to sagging of the form-roll by gravity are minimized.

The shaft of the roll 26 is mounted in bearings 27 and 28 which are supported rigidly and inflexibly in relation to the drying cylinder bearings by housings 29 and 30, and are so placed that the surface of the roll 26 may be brought into approximate engagement with the surface of the drying cylinder 10 which is to be refinished. In

order to enable the gap or space between the peripheries of the rolls 10 and 26 to be regulated or controlled, the bearings 27 and 28 are arranged to slide in their respective housings 29 and 30, and such sliding movement is controlled or effected by means of suitable adjusting screws, for example 31, 32, 33 and 34 by which the roll 26 may be incrementally advanced toward the cylinder 10. Such adjusting screws fit suitably threaded holes in lugs extending upwardly from the housings 29 and 30.

The belt 15c is trained around a pulley 35 on the extended end of shaft 36 of a tension roll 37, which tension roll, for a purpose which will hereafter appear, is also mounted in a manner similar to the mounting of the roll 26, so that the distance between the ends of the roll 37 and the ends of the roll 26 may be respectively adjusted. The belts 15b and 15c are sufficiently flexible to permit the sliding adjustments heretofore referred to.

The sizes of the pulleys on the motor shaft and the roll shaft 25 and roll shaft 36, and the speed of the motor are such that the peripheral speed of the rolls 26 and 37 is equal and is about 2500 linear feet per minute.

Around the rolls 26 and 37, there is trained an endless abrasive belt 38 of conventional type such as is frequently used in the woodworking industry. However, the particular type of abrasive employed is one which will be most effective in the removal of the metal of which the drying cylinder is constructed. It will be found in general more satisfactory to use a relatively coarse abrasive for the initial or roughing operation and then finish or polish the rough ground surface with another belt coated with an abrasive of smaller particle size.

In operation, the position of the roll 26 relative to the cylinder 10 is so adjusted that the space between the faces of rolls 10 and 26 will be slightly less than the thickness of the belt, and hence the outer abrasive surface of the belt 38 will engage the surface of the cylinder 10 within the arc of contact between the belt and the form roll 26. The spacing of the tension roll relative to the form roll is so adjusted that the tension of the belt is effective to secure a driving effect from both of the rolls 26 and 37.

Obviously, it is necessary to provide some arrangement by which the belt 38 may be caused to travel from one end of the roll 26 to the other so that all portions of the face of the driving cylinder 10 will receive the same abrasive treatment. In order to insure full abrasive treatment of the edges of the drying cylinder 10, the form roll 26 is desirably at least as long as, or longer than, the drying cylinder to permit the edge of the belt to reach the edge of the cylinder before the direction of traverse is reversed. With a belt about 12 inches to 18 inches wide, it is found convenient to effect traverse of the belt 38 at the rate of about 6 inches per minute, so that, for a drying cylinder having a 12-foot face, the belt 38 will travel from one end of the cylinder to the other in approximately 25 minutes. It will be understood that during the time which is required to effect a complete surfacing operation on the cylinder 10, it will be necessary not only to make repeated traverses of the belt 38 along the cylinder, but it will be necessary from time to time to effect a micrometric movement of the ends of the shaft 25 towards the roll 10. In the case of a drying cylinder having a 12-foot face and 12 feet in diameter, a complete rough-

grind operation can be made in about 6 hours. During this period, it may be necessary or advisable to replace or renew the belt 38 from time to time, but such belts are relatively inexpensive compared with the entire cost of the operation. These belts are found to be very uniform in thickness, so that no difficulties are ordinarily encountered because of varying belt thickness.

It is apparent that, due to the nature of the operation, the contour of the face of the cylinder 10 will be a reproduction, in reverse, of the contour of the face of the form roll 26, that is to say, the high spots on the cylinder will be incrementally reduced until the profile of the cylinder face parallels the profile of the face of the form roll 26 throughout the entire circumference of the cylinder. Therefore, if it is desired to provide a crown (over-size central diameter) on the cylinder 10, the face of the form roll 26 should be inversely crowned, i. e. if it is desired that the drying cylinder 10 have in the middle of the face a finished diameter which is say .02 inch greater than at the ends, it is merely necessary to form the surface of the form roll 26 with an inverse crown of the same dimensions, i. e. with a diameter in the middle of the face which is .02 inch less than the diameter at points adjacent the ends of roll 10.

Various means may be employed for the purpose of effecting traverse of the belt 38 along the rolls 26 and 37. Any slow moving traversing arrangement, automatic or otherwise, may be employed in connection with a suitable belt-shifting mechanism. However, in the present instance we have found that it is convenient to effect the traverse of the belt by canting the axis of the roll 37 with respect to the axis of the form roll 26. This adjustment may be made by shifting one end of the roll 37 toward or away from the form roll 26, according to the desired direction of the traverse of the belt. For this purpose, the bearings which support the shaft 36 are constructed so as to be movable in their mountings in the manner provided for the feeding adjustment, previously described, of the form roll 26. In view of the fact that a complete traverse of the belt from one end to the other of the roll requires about one-half hour, the manual adjustment of the bearing slide in this manner presents no particular difficulty, especially in view of the fact that the operator is naturally in attendance throughout the entire operation.

Another method of effecting traverse of the abrasive belt is to employ an additional guide roll 39 for the abrasive belt 38 and located between the form roll 26 and the tension roll 37. By inclining the axis of guide roll 39 relative to the direction of belt travel of the abrasive belt 38, said abrasive belt 38 will be caused to travel laterally in accordance with the inclination of the guide roll axis.

By inclining the axis of the form roll or of the cylinder being ground, so that the said axes do not lie in the same plane, while still keeping said axes substantially parallel with each other, the contour of the finished ground cylinder can be made more concave or less convex, i. e. with less crown than would be represented by the reverse crown of the form roll. Therefore, by that expedient, a form roll having a relatively large inverse crown can be used to grind a cylinder so as to produce a positive crown which is less than the inverse crown or concavity of the form roll.

We claim:

Apparatus for grinding the surface of a heavy cylinder comprising a substantially cylindrical form roll which is at least as long as said cylinder, means for rigidly and inflexibly supporting said form roll and the cylinder for rotation on substantially parallel axes, a tension roll, means for rotatably supporting said tension roll on an axis substantially parallel with the axis of said form roll, means for rotating said cylinder, means for incrementally moving said form roll toward the cylinder, an endless belt trained around said rolls and having a width which is a minor fraction of the length of said form roll, means for positively rotating at least one of said rolls, said belt having an outer abrasive surface contacting the face of said cylinder in abrading engagement within a zone overlying the arc of contact between said belt and the face of said form roll, and means for inducing said belt to repeatedly traverse the face of said form roll so as to operate upon the entire length of the face of said cylinder to thereby incrementally reduce any high spots on the face of said cylinder until the profile of the face of the cylinder parallels the profile of the adjacent face of the form roll throughout the entire circumference of the cylinder.

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