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HAY CRUSHING ROLL CONSTRUCTION

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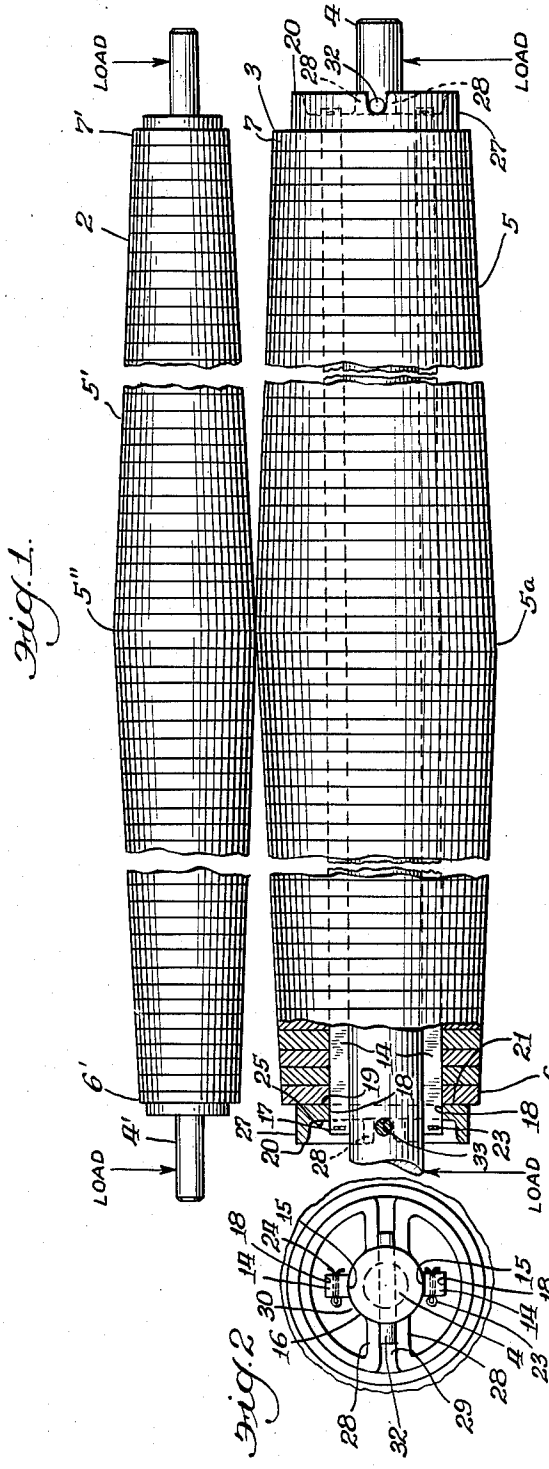


Fig. 1.

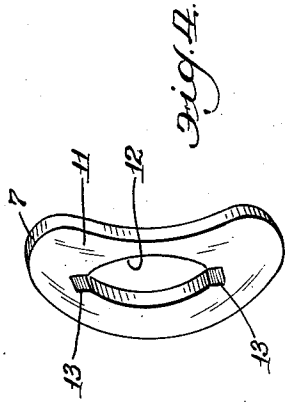


Fig. 4.

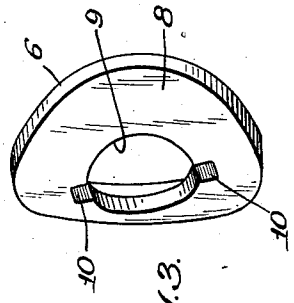


Fig. 3.

Fig. 2

Inventor:
Charles V. Everett
Paul O. Pippel
Atty.

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HAY CRUSHING ROLL CONSTRUCTION

Charles V. Everett, Warrenville, Ill., assignor to International Harvester Company, Chicago, Ill., a corporation of New Jersey

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4 Claims. (Cl. 56—1)

This invention relates to hay crushing devices and more specifically to a roll construction particularly adapted for crushing hay and the like.

Recent developments of hay crushing units provide a pair of opposed crushing rolls which have bodies formed of resilient material such as tire carcass disks. The rolls are quite extensive in length of the order of 6 feet or more and include a center shaft by which the roll is driven and mounted at opposite ends. There are two such rolls urged into engagement with each other and because of the yielding nature of the material as well as the shafts, it has been found necessary to compensate for the deflection between the rolls intermediate their ends. The solution of this problem has been in crowning the rolls at their center portions and tapering the rolls toward opposite ends and so arranging the rolls that at each contact point of the rolls, the diameters are in a fixed ratio. This ratio between the rolls is in the same ratio as the driving means for the individual shafts and prevents one roll from having a different circumferential speed than the other which causes scuffing and undue wear.

In the disk type roll, a serious problem has occurred in trying to retain the disks against relative rotation. It has been found that there is a limit to the amount of endwise pressure which may be exerted on the disks and that within these limits, the pressure is not sufficient to prevent relative rotation between the disks. Various attempts have been made to key the disks to the shaft but it has been found that by grooving the shaft and inserting keys or in welding or making integral keys on the shaft the modulus of elasticity of the section is different than the other sections and that in view of the deflection of the shafts when the rolls are engaged highly destructive vibrations are developed with resultant rapid deterioration of the rolls.

It is a general object of the invention to provide a novel means for keying the disks to the shaft assembly while obviating all of the foregoing disadvantages.

A more specific object of the invention is to provide a novel loose key arrangement wherein the keys are interconnected with the shaft assembly in driven relation thereby at points outwardly of the body of the roll whereby the keys are independently flexible and laterally movable independent of the shaft proper.

These and other objects of the invention will become more apparent from the specification and the drawings, wherein:

Figure 1 is a side elevational view of a pair of crushing rolls made in accordance with the invention, one of the rolls being shown in partial longitudinal section;

Figure 2 is an end view of the lower roll; and

Figures 3 and 4 illustrate the disks which are used in making up the rolls.

Describing the invention in detail and having particular reference to the drawings, there are shown a pair of generally parallel rolls illustrated in full lines under unloaded conditions. The rolls 2 and 3 are substantially

identical construction except for size and therefore detailed description will be made only of roll 3.

The roll 3 comprises a center shaft 4 the ends of which are carried in suitable self-aligning bearings, as will be readily understood by those skilled in the art. The center shaft is preferably cylindrical and there is mounted on the shaft 4 intermediate its ends the elastomer body 5 of the roll which is constituted of a plurality of disks of elastomer fiber impregnated material such as tire carcass and these disks are stacked in side by side arrangement. The disks identified as 6 and 7 are alternating and each disk 6 comprises an annulus 8 with a center opening 9 which admits the shaft 4 and a pair of diametrically opposed slots 10. Similarly, the disk 7 has an annulus 11, a center aperture 12 for the shaft 4, and a pair of diametrically opposed grooves 13.

At diametrically opposite sides of the shaft 4 there are disposed a pair of loose keys 14, 14 which are preferably square in cross section although they may be of other design with corresponding difference in the grooves 10 and 13. These shafts 14 are of the same physical character, that is insofar as weight, size, flexibility, etc. are concerned, and are preferably formed of steel. The keys 14, 14 seat as at 15, 15 tangentially against the periphery 16 of the shaft 4 and are in no way connected thereto. The shafts 14 extend through the apertures and the slots 10 and 13 of the disks 6 and 7.

Each bar or key 14 has an end portion 17 which projects loosely through an opening 18 in the radial wall 19 of an end cap 20, the radial wall 19 having its inner side abutting as at 21 against the adjacent disk 6 or 7. The ends 17 of the keys 14 project outwardly of the wall 19 and are provided with transverse pin openings 23 for reception of the cotter keys 24, the cotter keys being spaced outwardly of the outer face 25 of the adjacent radial wall 19 of the end cap. The end cap may be provided with an annular flange 27 which may be integral with the outer periphery of the wall 19 and extend outwardly therefrom and the outer side may be provided with radial ribs 28, 28 spaced transversely and defining a groove 29 therebetween, the ribs 28 merging with the interior of the peripheral ring 27 and terminating at the central opening 30 in the end cap through which the shaft 4 is admitted.

The slot 29 admits a pin 32 therein which is adapted to line up with the opening 33 in the adjacent end of the shaft after the end cap is pressed inwardly compressing the disks so as to interlock the cap with the shaft. Thus the end cap and the shaft may be termed the shaft assembly and there being provided means for loosely interlocking the keys with the shaft assembly so that the shaft assembly drives the keys which in turn drive the disks.

This structure has been actually used and has been found to eliminate the foregoing disadvantages and difficulties by accommodating independent deflection of the keys, the keys also serving to drive the disks.

It will be seen that the rollers 2 and 3 have their bodies 5 and 5′ tapered from their center portions 5*a* and 5″ which are of maximum diameter and that the end portions 6 and 7 of body 5 and 6′, 7′ of the roll 5′ are of minimum diameter and that a constant ratio is maintained between the diameters of the two rolls at each corresponding section and this ratio corresponds to the ratio of the driving means for the shaft 4 and 4′.

What is claimed is:

1. In a transversely deflectable roller, the combination of a center shaft having load sustaining ends, a roller body of elastomer material supported on the shaft intermediate its ends, and keying means extending through a complementary aperture in said body only and generally parallel to the shaft and said keying means having end portions projecting outwardly of the ends of the body,

and securing means on the ends of the shaft embracing said body therebetween and connected to the shaft for rotation therewith and having openings receiving the ends of said keying means therein thereby securing the keying means to rotate with the shaft, said keying means in assembled position with said securing means being movable axially with respect thereto.

2. In a transversely flexible generally cylindrical roller, a cylindrical center shaft having opposite load-sustaining ends, bar-like key means extending axially of the shaft outwardly of the periphery thereof and having end portions adjacent to the respective ends of the shaft, a cap secured to each end of the shaft and having openings therein for receiving the end portions of said key means therein restricting circumferential movement thereof, and a body of elastomer material having a cylindrical opening therein receiving the shaft therethrough and having a slot receiving the said key means therein, said key means in assembled position being axially loose with respect to said caps.

3. The invention according to claim 2 and said keying means comprising a pair of bars disposed at diametrically opposite sides of the shaft.

4. In an assembly for crushing hay and the like, the combination of a pair of superposed crushing rolls each having bodies of elastomer material in pressed engagement with each other, said bodies tapered from a maximum diameter intermediate their ends to minimum diameter at their ends, the diameters of said rolls being of a constant fixed ratio throughout their lengths at each point of contact with each other and keying means extending through each said body, and means connected to each shaft and anchoring the said keying means thereto against circumferential movement with respect to the associated shaft, said keying means having end portions loosely connected to said last-mentioned means.

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