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Simpson et al.

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[45] **Jan. 8, 1974**

[54] **ROTATING DRUM WITH ELASTOMERIC PAD-MOUNTED SUPPORTING RINGS**

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[73] Assignee: **Chicago Bridge & Iron Company,** Oak Brook, Ill.

[22] Filed: **Feb. 16, 1972**

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[52] **U.S. Cl.** ..... **144/208 B,** 241/182, 83/698

[51] **Int. Cl.** **B27l 1/00**

[58] **Field of Search** ..... 241/170, 176, 180, 241/183, 186; 144/208 R, 208 B; 83/698

[56] **References Cited**

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Assistant Examiner—W. D. Bray
Attorney—Charles J. Merriam et al.

[57] **ABSTRACT**

A horizontally positioned cylindrical drum, such as for debarking logs, a pair of spaced-apart circumferential metal rings located longitudinally along the drum, and an elastomeric pad means between each of the rings and the drum holding the rings in position thereon. The drum can be supported by, and rotate on, trunnion wheels.

7 Claims, 15 Drawing Figures

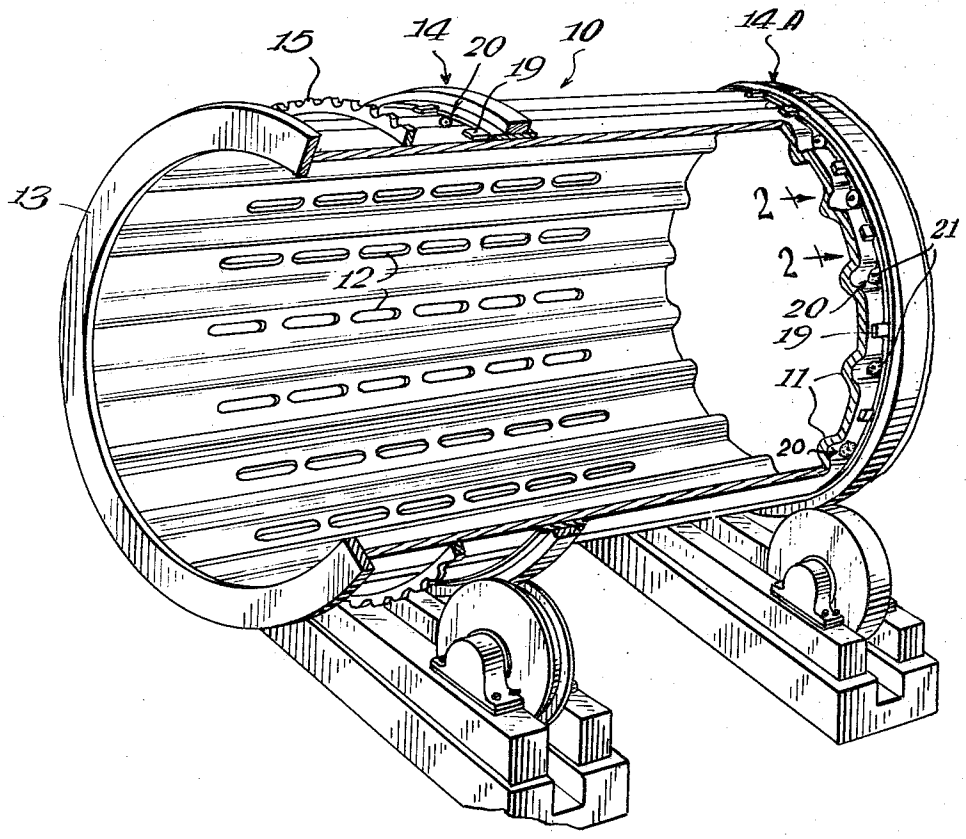
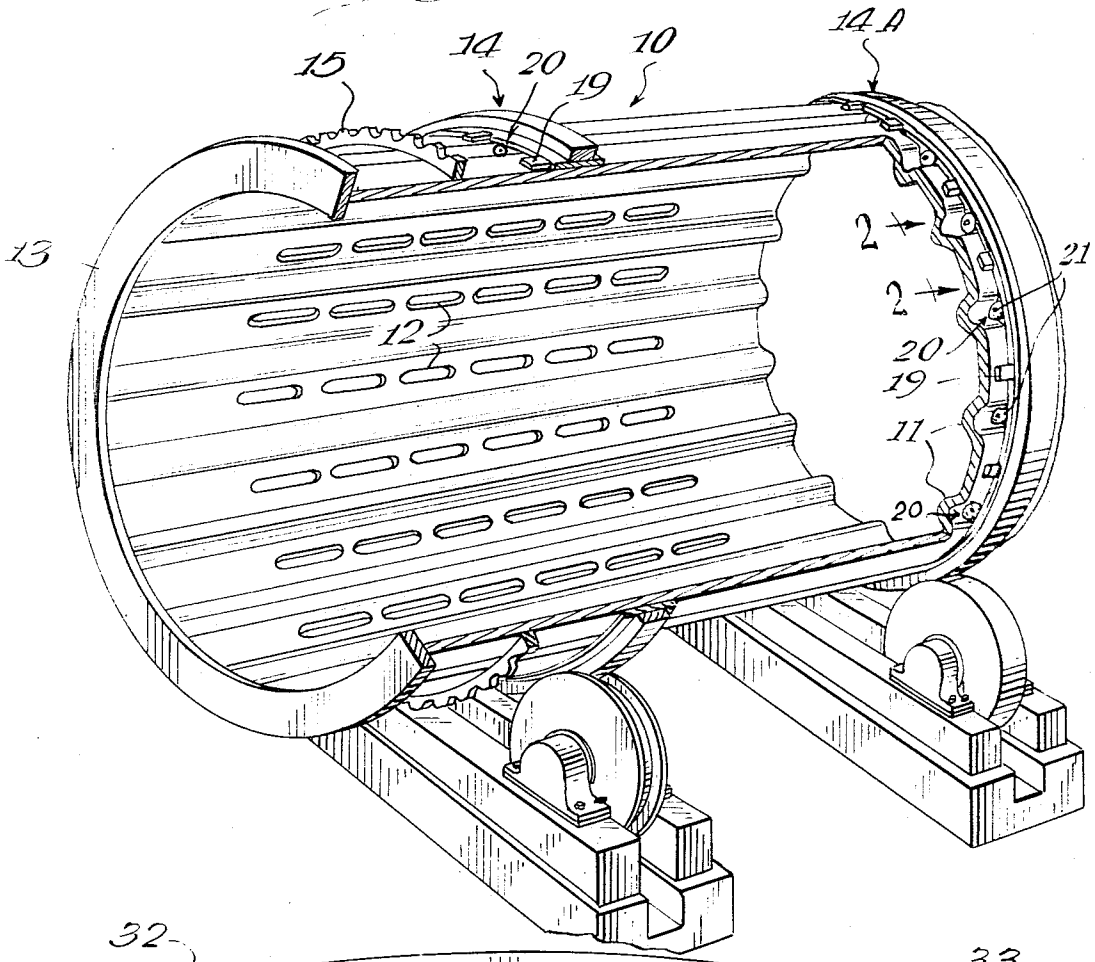


Fig. 1


15
14
20
19
10
14A
13
12
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2
21
20
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11
20

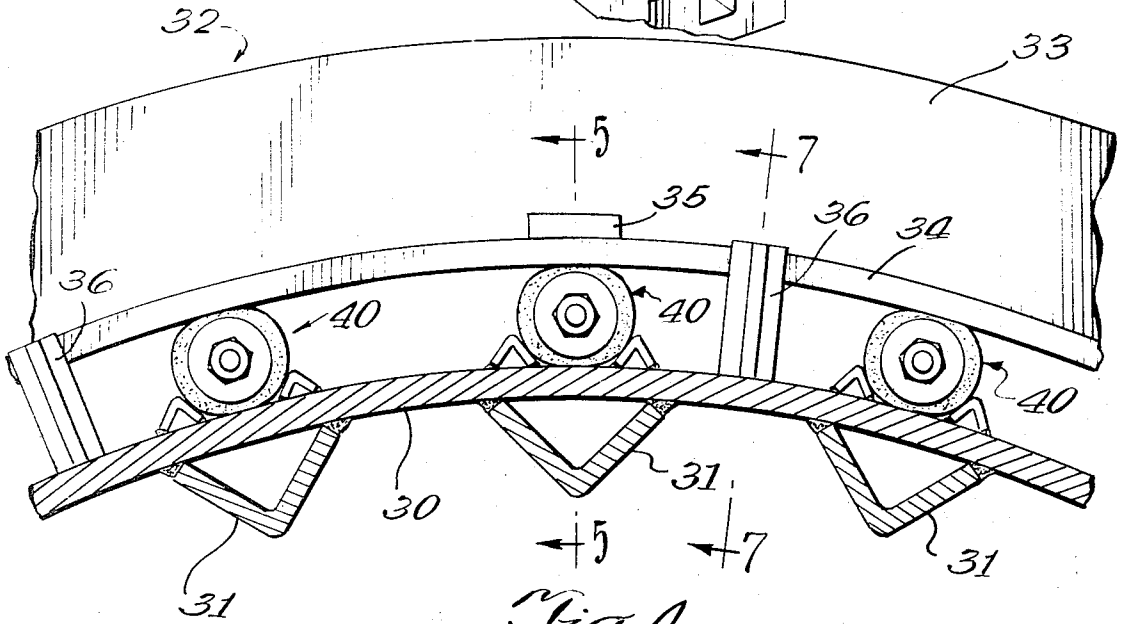

32
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7
31

Fig. 4

Fig. 2

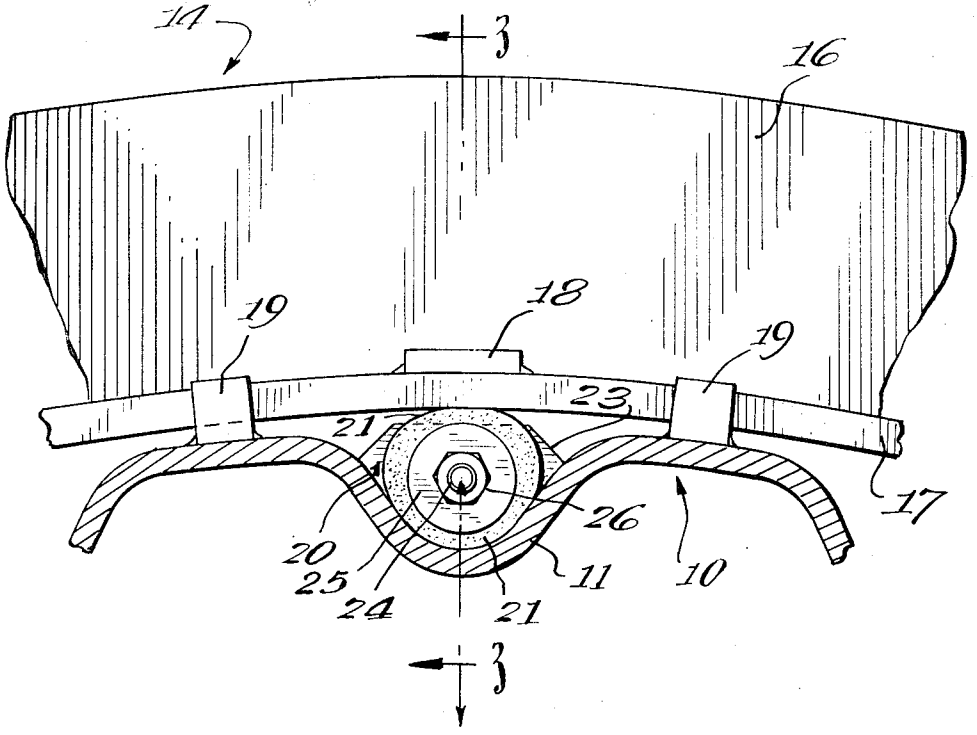
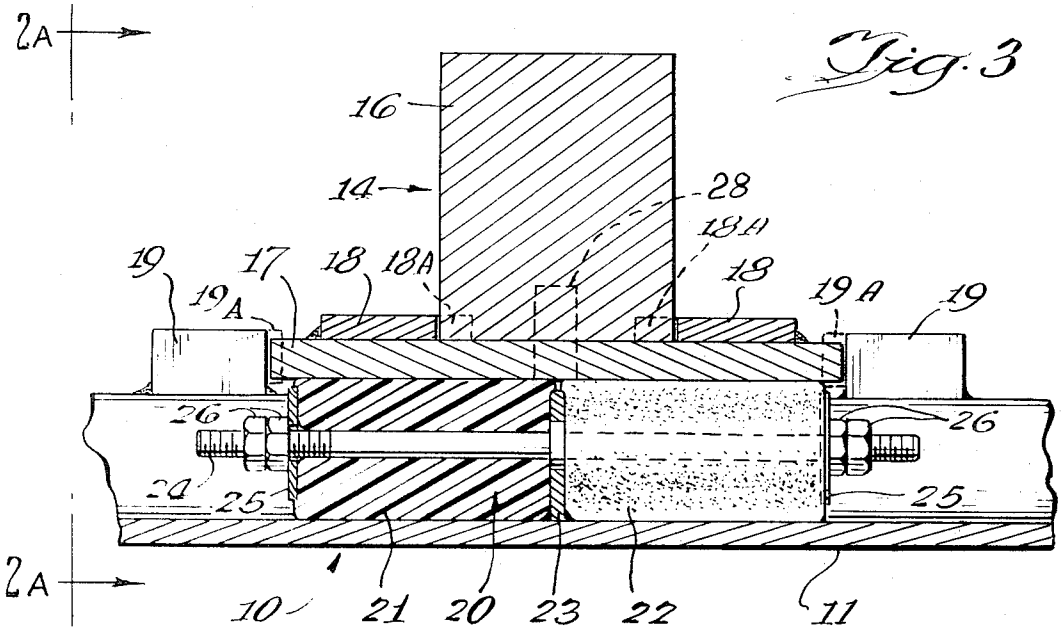

14
3
16
19
18
19
23
21
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26
20
25
24
11
10
21
3

Fig. 3


2A
16
14
28
18A
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17
18
18A
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19A
19
19A
26
26
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25
25
2A
10
21
20
23
22
11

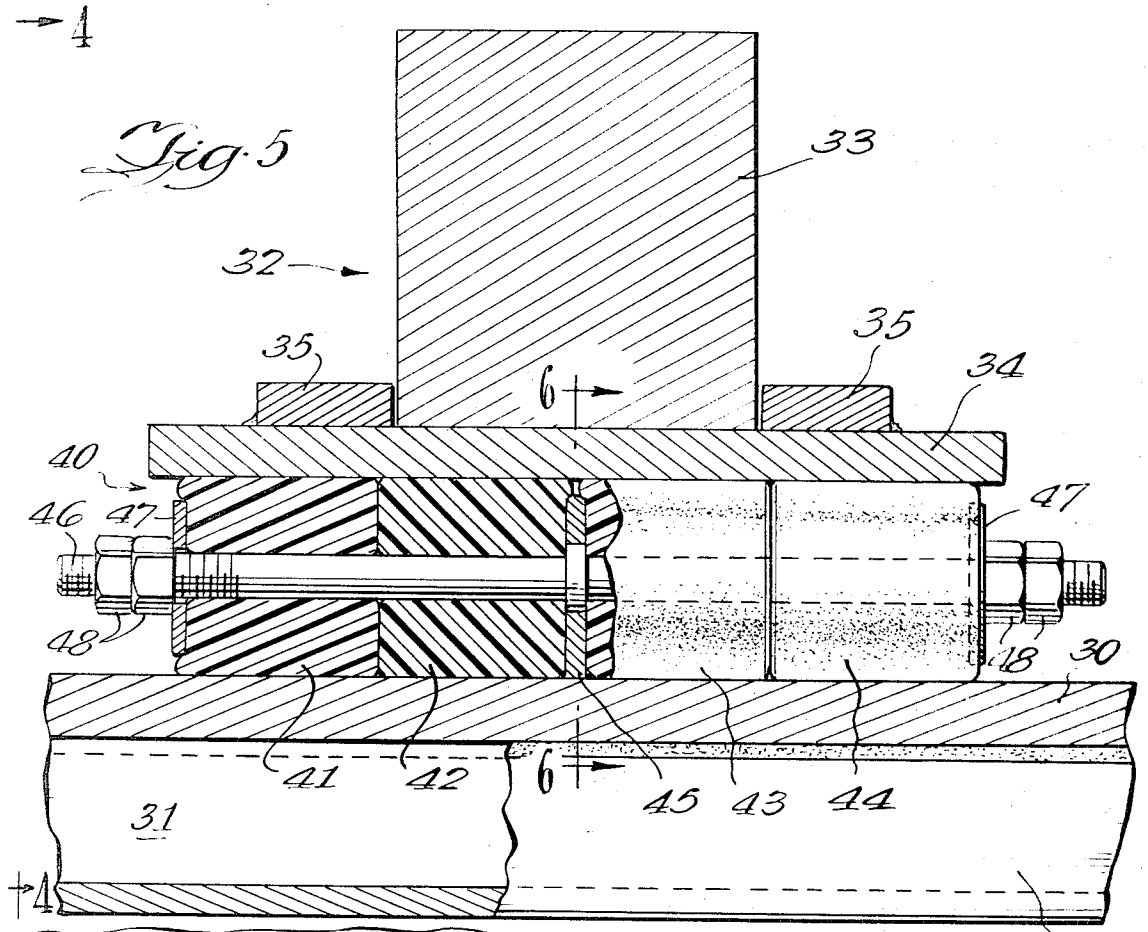


Fig. 5

Fig. 6

Fig. 7

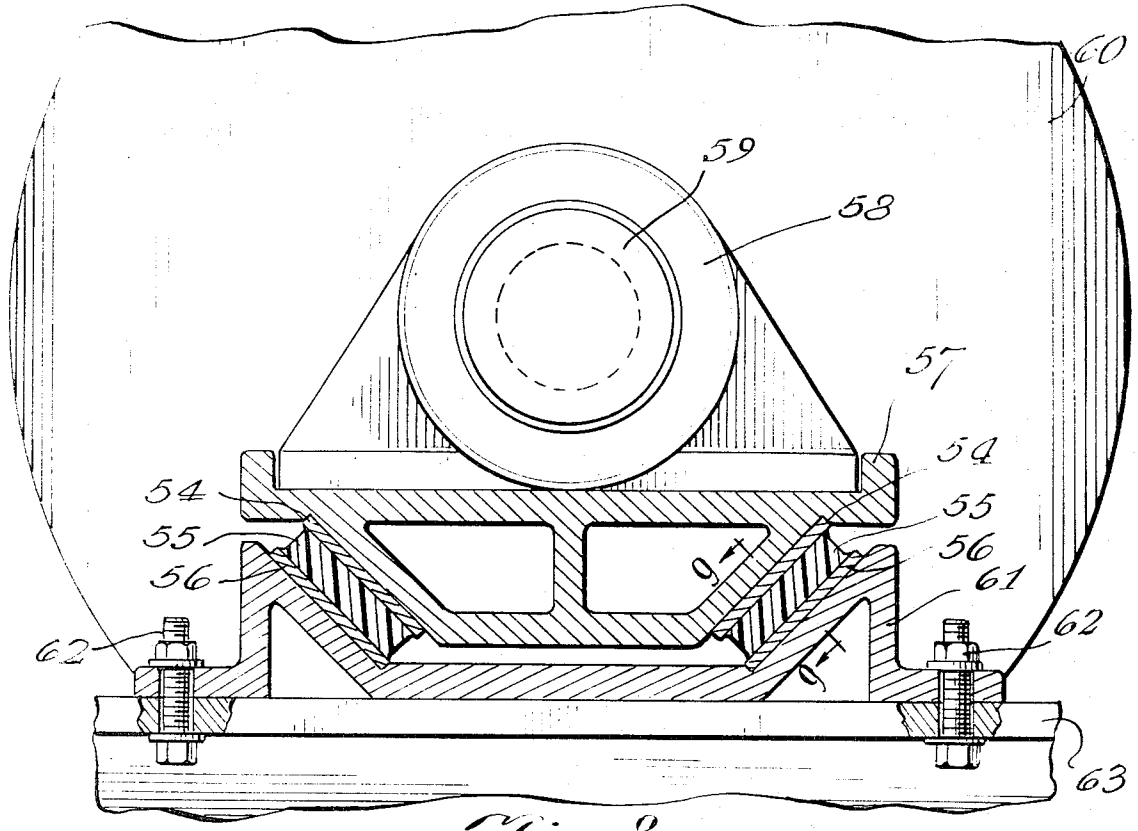


Fig. 8

Fig. 9

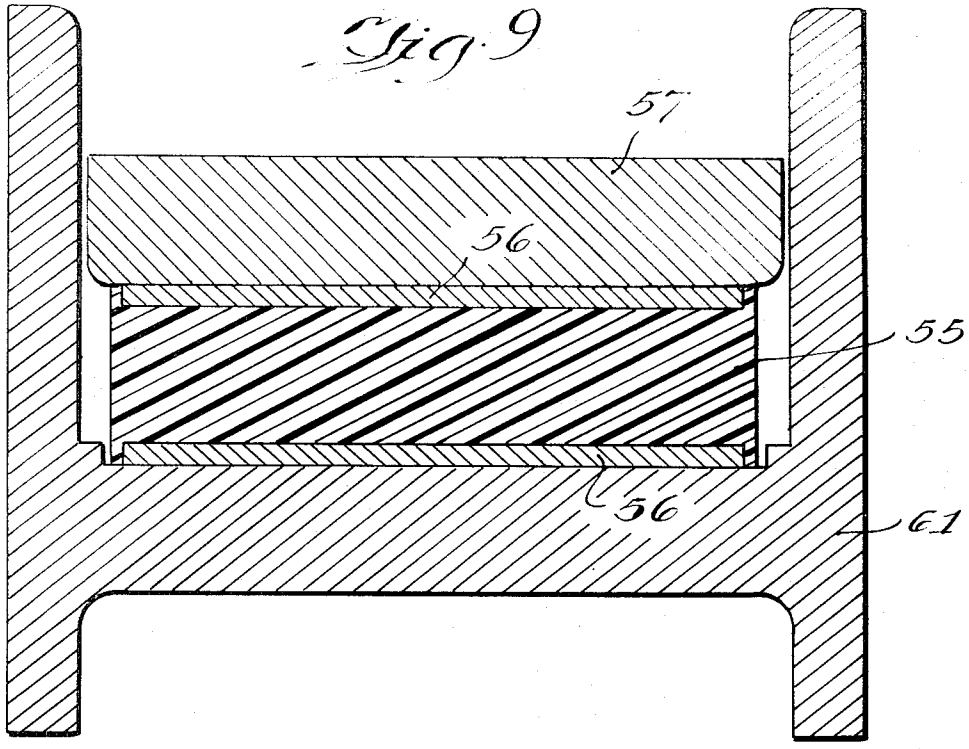


Fig. 10

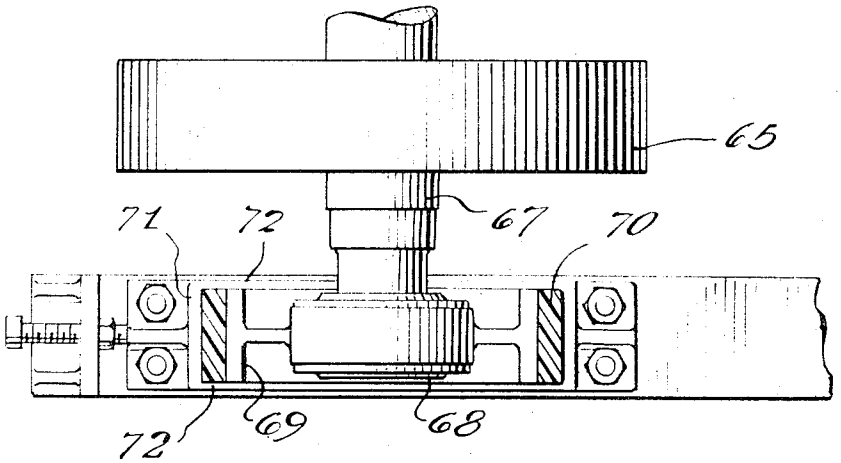
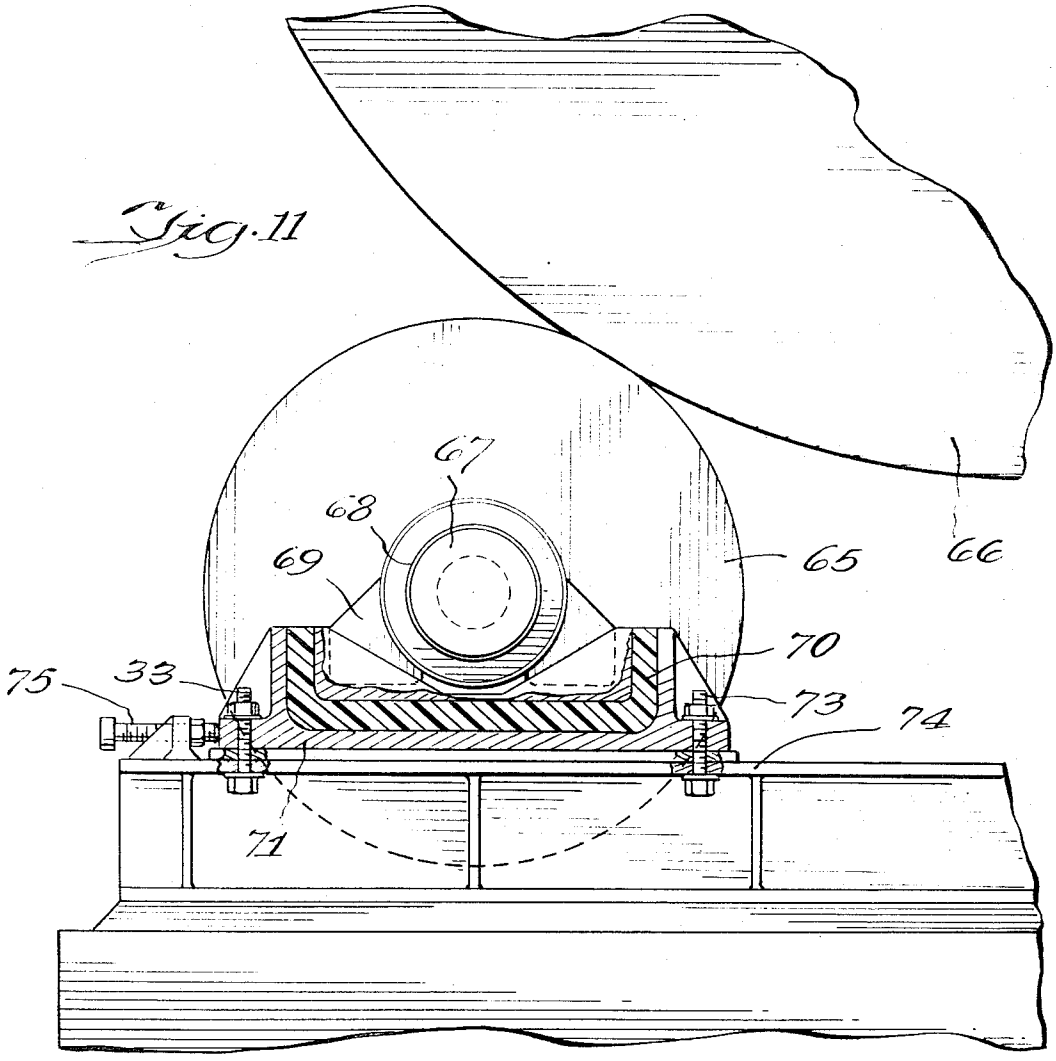


Fig. 11



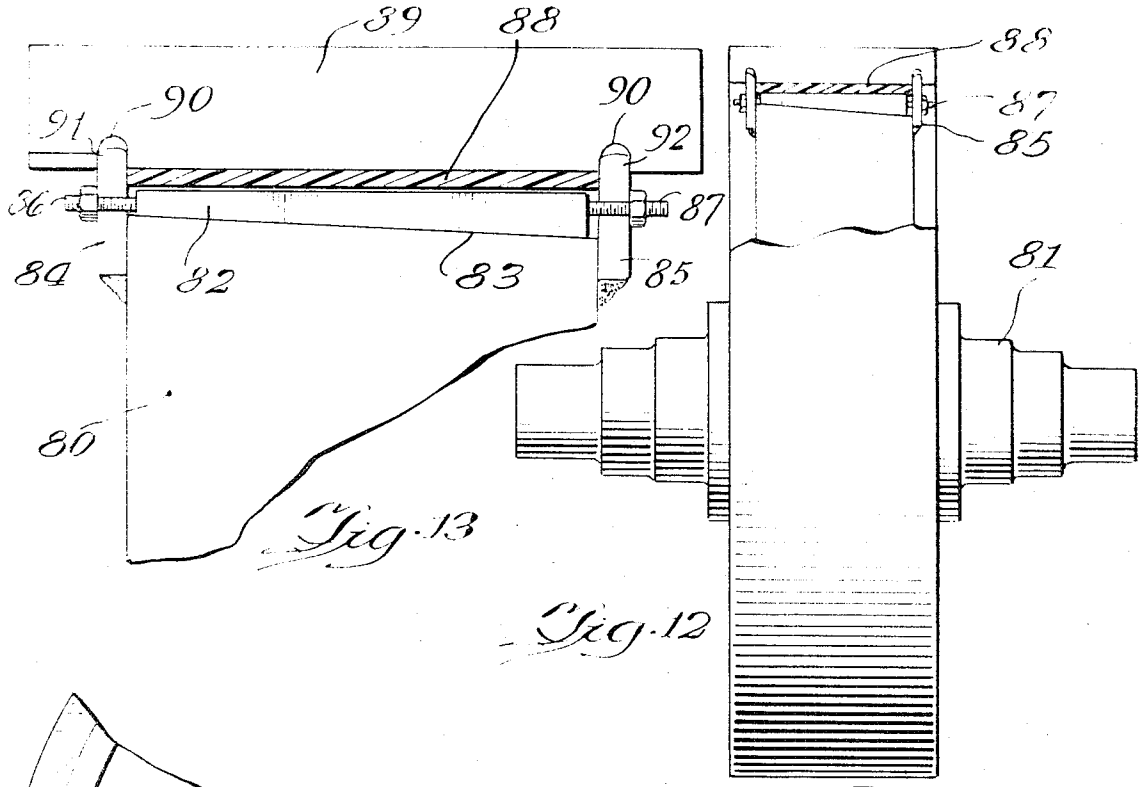


Fig. 13

Fig. 12

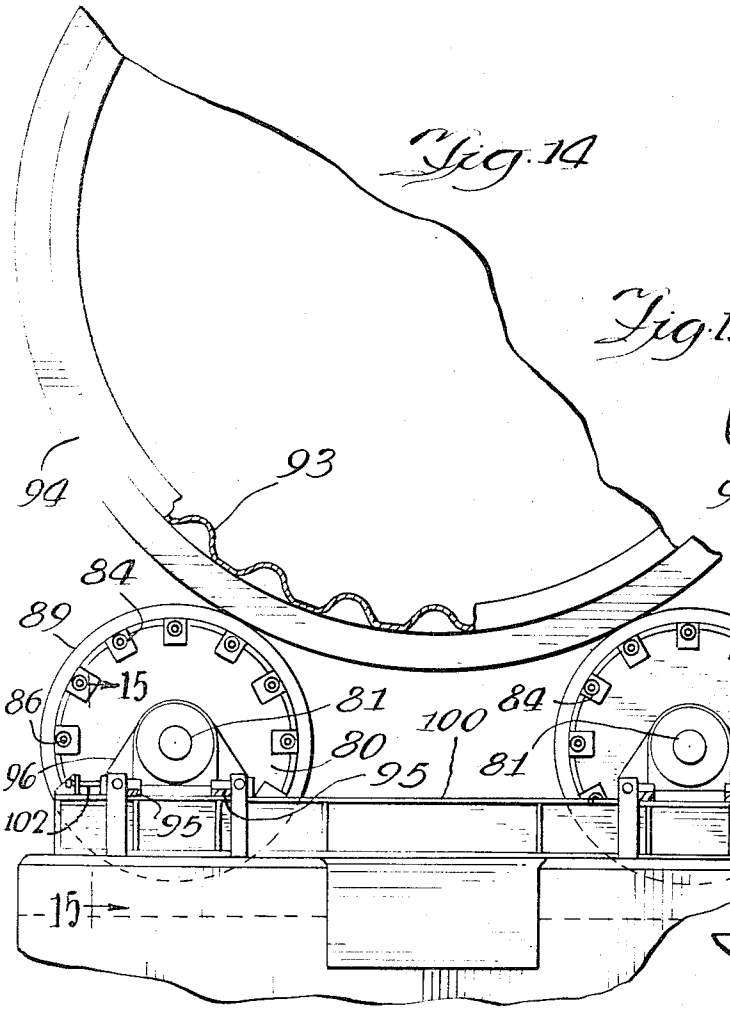


Fig. 14

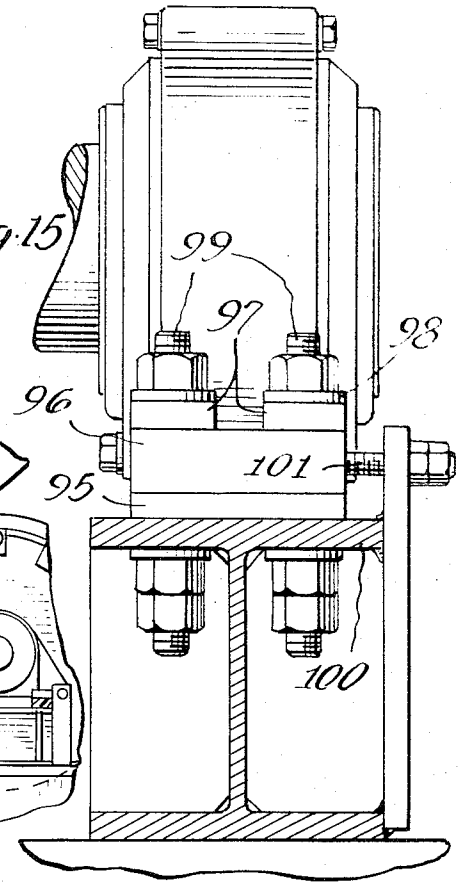


Fig. 15

ROTATING DRUM WITH ELASTOMERIC PAD-MOUNTED SUPPORTING RINGS

This invention relates to industrial processing apparatus which employs a horizontally positioned rotating drum. More particularly, this invention is concerned with improvements in such apparatus in which the drum is supported by trunnion wheels or is suspended by chains.

Many industrial processes employ a rotating horizontal metal drum for processing heavy solid materials. The drum usually has two or more spaced-apart metal rings or tires welded or riveted to the outside of the drum around its circumference. The drum may be rotatably suspended by chains beneath the rings. Alternatively, the rings may ride on trunnion wheels which rotatably support the drum.

When a drum is used to tumble heavy loads, high impact forces are applied to the drum and from it to the rings and chains. It is desirable to minimize these forces as much as possible.

While trunnion wheel supported drum apparatus is suitable for processing operations which do not involve high impact shocks on the drum and auxilary equipment, such apparatus is subject to breakdown, and requires frequent repair and replacement of parts, in processing operations where high impact shocks are applied to the drum. Also, the apparatus is noisy and produces substantial vibrations. This is specifically so in apparatus of the described type used for debarking logs.

Tumbling of a heavy load of logs in a trunnion wheel supported drum to abrade off the bark creates eccentric loads which shift and fall against the drum wall with extremely high impact. The shock from the impact causes welds holding the rings in place to crack, and bolts to loosen, break and fall out. The rings thereby loosen and the apparatus must be stopped and repaired.

It is also a problem with conventional apparatus of the trunnion supported drum type to accurately align the drum so that the rings or tires are evenly supported over the entire width of each nip constituting the contact line between each trunnion wheel and the ring it contacts. Unless accurate alignment is obtained, the impact shock on the nip will be concentrated on one edge of the ring and trunnion wheel nip and cause fracturing of the metal. Because of the difficulty in achieving and maintaining 100 percent alignment, the trunnion wheels and rings around the drum are normally made of tough steel to reduce the likelihood and extent of fracturing of the metal caused by the concentration of force on one edge of the nip. Such steel, nevertheless, is subject to fracture under high impact and, in addition does not wear well since it lacks the requisite hardness.

Furthermore, the use of trunnion wheel supported drum apparatus of the prior art in processing tumbling, heavy material is extremely noisy. The noise is a nuisance to workers and it is desirable to minimize it. Operation of the apparatus also causes severe vibration problems which can lead to failure of the apparatus, or adjacent equipment.

The deficiencies and other shortcomings, such as those enumerated above, in the prior art apparatus show a clear need for improved rotatable horizontally supported drum processing apparatus.

According to the present invention, there is provided apparatus comprising a horizontally positioned cylindrical drum having a pair of spaced-apart metal rings radially positioned around the drum with elastomeric pad means compressed between each of the rings and the drum to hold the rings in position on the drum. The rings are not directly welded, riveted or bolted to the cylindrical drum but rather are held in essentially fixed position thereon by other mechanical means. Potential loosening of the rings through weld rivet or bolt failure, as has commonly occurred with prior art equipment of this type, is thereby avoided. The elastomeric pads between the drum and the rings serve to absorb high impact shocks applied to the drum during rotation or tumbling of heavy, solid materials therein, reduce noise, suppress vibration and extend equipment life.

A drum of the described type can be used suspended by chains or it can be mounted on trunnion wheels for rotation. When chain supported, the rings can be smooth faced, have chain-receiving channels or flanges, or be provided with teeth to form chain-receiving sprocket rings or girth gears. When trunnion supported, the rings can be smooth faced, channeled, flanged or have teeth for driving the drum.

Use of the improved drum having rings mounted on elastomeric pads is particularly advantageous when the drum is trunnion supported because the elastomeric pad means absorbs the shock exerted against the drum and thereby substantially reduces the impact of the rings against the trunnion wheels. To further lessen the impact, the trunnion wheels can be provided with metal rims having elastomeric pads beneath them. It is also contemplated by the invention to have the trunnion bearing supports mounted in elastomeric pads. The base on which the bearing supports and auxiliary equipment is mounted may also contain elastomeric pads. The utilization of elastomeric pads, which can advisably be made of a tough resistant rubber or polyurethane, not only reduces transfer of impact but also very substantially reduces vibration and noise.

The shock absorbing capacity of the elastomeric pad mounting of the rings on the drum makes it possible to better utilize hardened steel for the rings and for the trunnion wheels, or at least the rims thereof. It is advisable to use a hardened steel for the rings, and for the trunnion wheel surfaces, because of the excellent wear obtained with such steel. Hardened steel has been used for the rings previously but welding attachment difficulties have been experienced. The ring mounting system of this invention makes it unnecessary to weld the ring to the drum, thereby avoiding one of the practical barriers to use of hardened steel rings. Furthermore, even if there is some misalignment at the nip, the likelihood of fracture of a hardened steel ring is substantially lowered by the impact suppressing action of the elastomeric pads beneath the ring, as well as optional elastomeric pads beneath the trunnion wheel rims, the trunnion bearing supports and the apparatus base.

The invention will now be described further in conjunction with the attached drawings in which:

FIG. 1 is an isometric view of a trunnion supported corrugated drum having an elastomeric pad means between the drum and the rings or tires;

FIG. 2 is a partial sectional view as seen taken along the line 2—2 of FIG. 1 or the line 2A—2A of FIG. 3;

FIG. 3 is a sectional view along the line 3—3 of FIG. 2;

FIG. 4 is a partial sectional view taken along the line 4—4 of FIG. 5 through a smooth surfaced cylindrical drum showing a plurality of elastomeric pads between a ring and drum for holding the ring in position on the drum;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is a partial sectional view taken along the line 6—6 of FIG. 5;

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 4;

FIG. 8 is an elevational view, partially in section, of a trunnion having an elastomeric pad means between the trunnion bearing support and the base;

FIG. 9 is a sectional view taken along the line 9—9 of FIG. 8;

FIG. 10 is a partial plan view of a trunnion with an elastomeric pad means between the trunnion bearing support and the base;

FIG. 11 is an end elevational view, partially in section, of the trunnion shown in FIG. 10;

FIG. 12 is a plan view, partially broken away, showing a trunnion with a metal rim supported by an elastomeric pad;

FIG. 13 is an enlarged view of the rim and elastomeric pad structure of FIG. 12;

FIG. 14 is an elevational view, partially broken away, showing a corrugated drum supported on trunnions which have elastomeric pads beneath the bearing supports and trunnion wheels as shown in FIGS. 12 and 13; and

FIG. 15 is a partial sectional view taken along the line 15—15 of FIG. 14.

So far as is practical, the same parts or elements which appear in the different views of the drawings will be identified by the same numbers.

With reference to FIG. 1, drum 10 is shown horizontally positioned. It is made of metal plate and is substantially circular in radial cross-section. Drum 10 has integral longitudinal corrugations 11 which are equally spaced from adjacent corrugations. The corrugations facilitate the tumbling of logs to be debarked in drum 10. Openings 12 in the drum 10 permit removed bark to fall from the drum. Plate ring 13 is located on one end of the drum. A similar plate (not shown) can be positioned on the other end of the drum to stiffen and reinforce it.

Rings or tires 14 and 14A are positioned circumferentially around drum 10 in spaced-apart position from each other. Rings 14 and 14A are identical in the particular structure shown in FIG. 1 although it should be understood that they can be made different from each other if warranted by the conditions under which the drum is to be employed, the particular means used to support the drum, and the driving means used to rotate the drum. Also shown in FIG. 1 is a sprocket ring or girth gear 15 which circumscribes drum 10 and which can be used to drive the drum in a rotatable manner.

The system used to mount ring 14 on drum 10 is shown in detail in FIGS. 2 and 3. It should be understood that the same system is used to mount ring 14A on drum 10. Ring 14 is made of a main ring 16 of hardened steel which is not readily weldable, and inside ring or backup ring 17 which is made of readily weldable steel. Tabs 18 are positioned on each side of main ring 16 in close contact therewith and are welded to backup ring 17. Tabs 18 prevent lateral movement of main ring 16 with respect to backup ring 17. Furthermore, main ring 16 and backup ring 17 are united by a tight fit so that they function and rotate as a single unit. One or more of tabs 18 can extend into grooves cut in main ring 16 to prevent slippage between rings 16 and 17. The extension is shown in FIG. 3 in dashed lines as 18A. Alternatively, a single pin 28, as shown in FIG. 3, can be used to prevent slippage between rings 16 and 17. Blocks 19 are welded to the surface of drum 10 on each side of, and close to, backup ring 17. A plurality of blocks 19 are positioned around the circumference of drum 10 to hold the backup ring 17 in position on the drum. One or more of blocks 19 can extend into grooves cut in backup ring 17 to prevent slippage between the ring and the elastomeric pads 20. The extension is shown in FIG. 3 in dashed lines as 19A.

Positioned between drum 10 and ring 14 is a plurality of elastomeric pads 20. In the particular embodiment shown in FIGS. 2 and 3, each elastomeric pad 20 is composed of a rubber rod 21 and a rubber rod 22 which are separated from each other by a retaining plate 23 welded across a corrugation trough surface of drum 10. Each of rubber rods 21 and 22 has a longitudinal axial hole therein. Plate 23 also has a hole somewhat larger than the holes in rubber rods 21 and 22. Bolt 24 extends through rubber rods 21 and 22 and plate 23 and at each end thereof a washer 25 is positioned in contact with the outer end of rubber rods 21 and 22. Nuts 26 are threaded on opposing ends of bolt 24 and are tightened to compress rubber rods 21 and 22 to thereby cause them to enlarge or expand radially into compressive contact with the trough surface of drum 10 and the inner surface of backup ring 17. Elastomeric pads of the described type are positioned periodically around the circumference of the drum between the drum and ring 14. If desired, one such elastomeric pad can be positioned in each trough in the drum. The described system securely anchors ring 14 to the drum surface in a resiliently supporting manner which serves to absorb high impact shocks and to thereby dampen the forces applied to ring 14. In addition to dampening the forces, noise and vibration are inherently reduced.

FIGS. 4 to 7 illustrate another embodiment of the invention which in some respects is like the embodiment described with reference to FIGS. 1 to 3. The main difference between the two embodiments is that in the embodiment of FIGS. 4 to 7 the drum is smooth-surfaced whereas the drum in the embodiment of FIGS. 1 to 3 has longitudinal corrugations. With reference to FIGS. 4 to 7, drum 30 in radial cross-section is a circular metal shell of smooth surface. It is provided internally with longitudinally positioned spaced-apart ribs 31 made of long steel angles welded to the drum surface. Ribs 31 facilitate tumbling of logs in the drum during debarking.

Ring 32 (FIGS. 4 to 7) is composed of a hardened circular main ring 33 and an inner or backup ring 34 of mild steel. Tabs 35 are welded to backup ring 34 on each side of main ring 33 to prevent lateral movement of main ring 33 with respect to backup ring 34. However, main ring 33 and backup ring 34 are positioned tightly together so as to prevent circumferential rotation of one with respect to the other. The described arrangement makes it unnecessary to weld main ring 33, which is of hardened steel normally considered unweldable, to backup ring 34. However, one or more of tabs

35 can extend into slots or grooves in main ring 33 to prevent slippage between it and backup ring 34. Outwardly extending blocks 36 are welded to the outer surface of drum 30 on each side edge of backup ring 34. A plurality of such blocks 36 and of tabs 35 are positioned in spaced-apart arrangement around the circumference of the drum to hold the respective elements of the ring 32 in position so as to prevent lateral movement of them from their intended positions. Also, one or more blocks 36 can extend into slots or grooves in backup ring 34 to prevent circumferential slippage of it on the elastomeric pads.

Positioned in spaced-apart arrangement around the circumference of the drum between the drum outer surface and the inner surface of backup ring 34 is a plurality of elastomeric pads 40. Each of elastomeric pads 40 is composed of four rubber rod sections 41, 42, 43 and 44 of equal size and each of which has and axial hole therethrough. Plate 45 is welded to drum 30. Two of the rubber rods 41 and 42 are placed on one side of plate 45 and the other two rubber rods 43 and 44 are placed on the other side of the plate. A pair of elongated angles 49 and 50 is positioned on the surface of drum 30, with one such angle on each side of the rubber rods, for further retention of the elastomeric pad in position with respect to the drum. Similar angles can be welded to the inside face of backup ring 34 adjacent the rubber rods to aid in maintaining the desired fixed relationship of ring 32 with respect to the drum. Bolt 46 extends through The rubber rods 41 to 44 as well as through plate 45. Washers 47 are placed over the ends of bolt 46 and nuts 48 are threaded on the bolt to compress the rubber rods to cause them to expand radially into compressive contact with the outer surface of drum 30 and the inner surface of backup ring 34. The resulting compressive force of the plurality of elastomeric pads securely holds ring 32 in position with respect to drum 30.

It should be understood with respect to the embodiment illustrated in FIGS. 4 to 7 that a plurality of circumferential rings 32 can be positioned spaced apart longitudinally on the drum. Normally, at least two such rings will be on a drum although a considerably larger number can be similarly positioned to support particularly long processing drums. Furthermore, ring 32 can be provided with teeth if the ring is to be used as a drive ring or if the drum is to be chain supported. In addition, ring 32 can be provided with a circumferential channel or a side flange for trunnion mounting to aid in maintaining the drum on the trunnions.

FIGS. 8 and 9 illustrate a trunnion bearing support on elastomeric pads so that impact forces and vibrations from a trunnion mounted rotating drum can be reduced. Elastomeric pads 55 are bonded to upper metal plates 54 and lower metal plates 56 on each side thereof. Bearing support 57 is mounted on the upper plates 54 and supports bearing 58 in which axle 59 of trunnion wheel 60 is mounted. The lower plates 56 are supported by base 61 which, by means of bolts 62, is fastened to frame 63. The described elastomeric pad support means for the trunnion bearing support absorbs impact shock applied to the trunnion wheel, suppresses noise and reduces vibrations caused by the rotating drum and load therein.

FIGS. 10 and 11 illustrate another means to mount a trunnion wheel on an elastomeric pad assembly to reduce impact shock and to also reduce noise and vibration. Trunnion wheel 65 rotatably supports, in part, drum 66. Trunnion wheel 65 rotates on axle 67 in bearing 68 mounted in bearing support 69. Beneath bearing support 69 is an elastomeric pad 70 which rests on base 71. Vertical sides 72 of base 71 restrict the elastomeric pad and bearing support 69 from sideward movement. Bolts 73 adjustably secure base 71 to the supporting framework 74. Bolt 75 provides for lateral adjustment of base 71, and the trunnion wheel supported thereby, so as to permit adjustment of it with respect to drum 66 to facilitate proper alignment of the trunnion wheel with respect to the ring or tire on the drum.

FIGS. 12 and 13 illustrate a trunnion wheel having a metal rim mounted over and supported by an elastomeric pad. Wheel core 80 is mounted on axle 81. Tapered conical shell sections 82 are positioned around the tapered edge surface 83 of wheel core 80. A plurality of tapered conical shell sections 82 are positioned entirely around the circumference of face 83 in close proximity to one another. A plurality of plates 84 and 85 are positioned on the outside faces of wheel core 80. Each such respective plate has an adjusting bolt 86 and 87 therein to be used for axial controlled movement of tapered conical shell sections 82 on wheel core face 83. Elastomeric pad 88 is positioned circumferentially around conical shell sections 82. Metal rim 89 extends circumferentially around and in close contact with elastomeric pad 88. Elastomeric pad 88 is compressed against the inside surface of rim 89 by means of adjusting bolts 86 and 87 which urge tapered conical shell sections 82 tightly against elastomeric pad 88. Grooves 90, cut on the inside face of rim 89, receive nose portions 91 and 92 of plates 84 and 85 to thereby securely hold rim 89 in position. The described assembly makes it unnecessary to weld rim 89 to wheel core 80. Such an assembly therefore permits utilization of hardened steel for rim 89. The use of a hardened steel rim, plus the use of an elastomeric pad, provides a trunnion wheel having a long-wearing surface and one which can make self-adjustments to achieve alignment with the nip surface of a ring which it contacts on a drum. In addition, elastomeric pad 88 provides a means to absorb impact shocks applied to the rim from the drum. The elastomeric pad also serves to suppress noise and vibrations.

FIG. 14 illustrates the use of two trunnion wheels, of the type illustrated in FIGS. 12 and 13, supporting, in part, corrugated drum 93 having a rim or tire 94. FIGS. 14 and 15 also show the use of elastomeric pads 95 beneath bearing support 96. Elastomeric washers 97 are placed beneath metal washers 98 to further cushion the bearing support held by bolts 99 to base 100. Adjusting bolt 101 permits lateral movement of bearing support 96 to facilitate alignment of the trunnion wheel with the ring on the drum. Adjusting bolt 102 permits additional adjustment of the bearing support to move the trunnion wheel to and from the axis of the drum to achieve further alignment.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

What is claimed is:

1. Apparatus comprising:

a horizontally positioned cylindrical drum having longitudinal troughs;

a pair of spaced-apart circumferential metal rings located longitudinally along the drum; and

elastomeric rods, in the troughs beneath the rings, compressed between each of the rings and the drum thereby holding the rings in position thereon without welding, riveting or bolting the rings on the drum.

2. Apparatus according to claim 1 in which the drum has longitudinal troughs and the elastomeric rods are positioned in the troughs beneath the rings.

3. Apparatus comprising:

a horizontally positioned cylindrical drum;

a pair of spaced-apart circumferential metal rings located longitudinally along the drum;

said drum being externally smooth over a substantial area of the drum beneath the rings; and

elastomeric rods positioned between the rings and the drum surface, said rods being compressed between each of the rings and the drum thereby holding the rings in position thereon without welding, riveting or bolting the rings on the drum.

4. Apparatus according to claim 3 in which the elastomeric rods are compressed by bolts.

5. Apparatus comprising:

a horizontally positioned cylindrical drum;

a pair of spaced-apart circumferential metal rings located longitudinally along the drum;

metal stops joined to the drum and projecting therefrom in close proximity to each side of each ring to restrict movement of the rings longitudinal to the drum axis;

an elastomeric pad means compressed between each of the rings and the drum thereby holding the rings in position thereon without welding, riveting or bolting the rings on the drum; and

a pair of trunnion wheels supporting the drum in rotational contact with each ring.

6. Apparatus according to claim 5 in which the metal rings are substantially wider on the inside surface in contact with the pad means than the outermost surface in contact with the trunnion wheels.

7. Apparatus according to claim 5 in which the contacting surfaces of the rings and trunnion wheels with each other are hardened steel.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,783,918 Dated January 8, 1974

Inventor(s) Arthur R. Simpson and Frank S. Egloff

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 10, after "weld" insert a comma (,); Column 5, line 18, "has and" should be -- has an --; line 30, "The" should be -- the --; Column 7, line 8, "claim 1" should be -- claim 3 --.

Signed and sealed this 30th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents