Dec. 11, 1951 L. HORNBOSTEL 2,578,552

DRIER SECTION FOR PAPER MACHINES

Filed Oct. 6, 1948 3 Sheets-Sheet 1

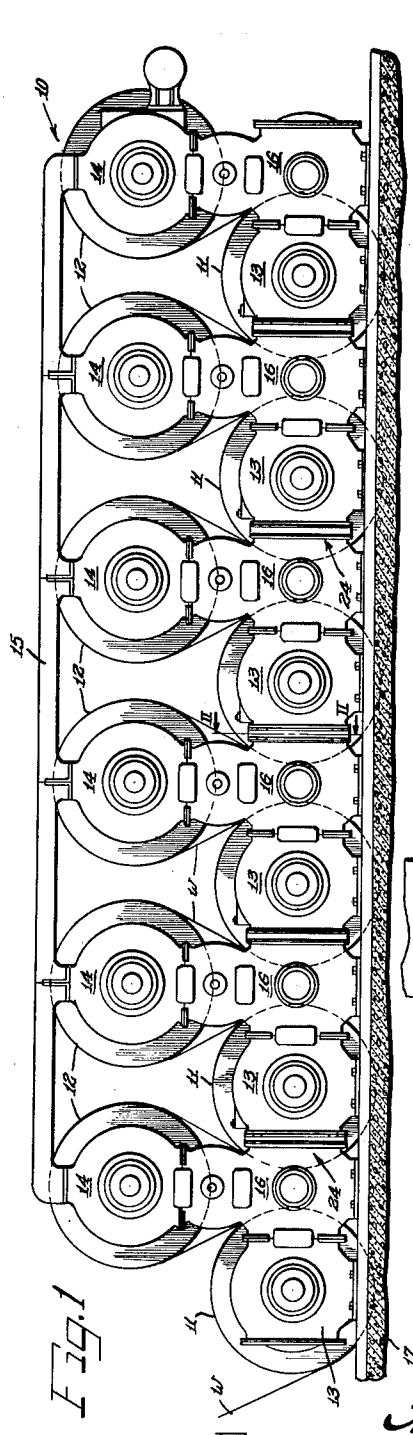


Fig. 1

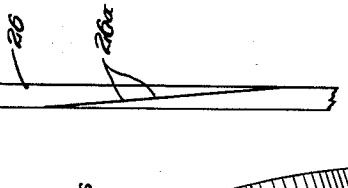


Fig. 5

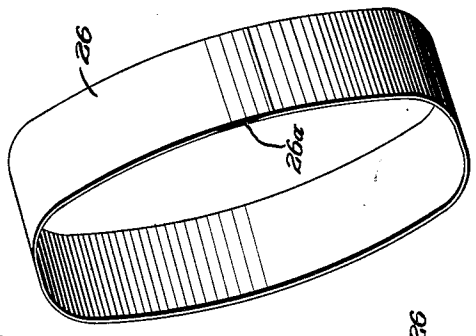


Fig. 4

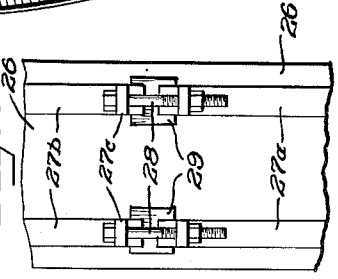


Fig. 3

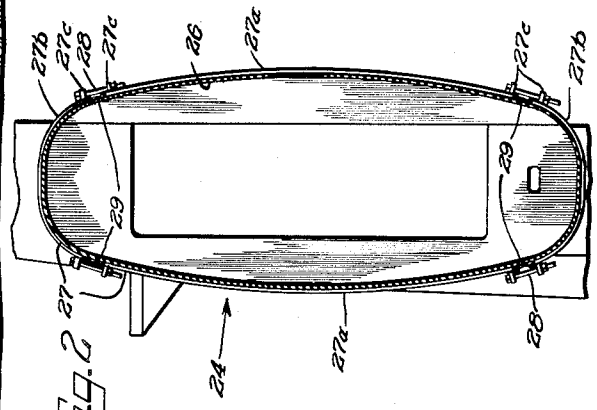


Fig. 2

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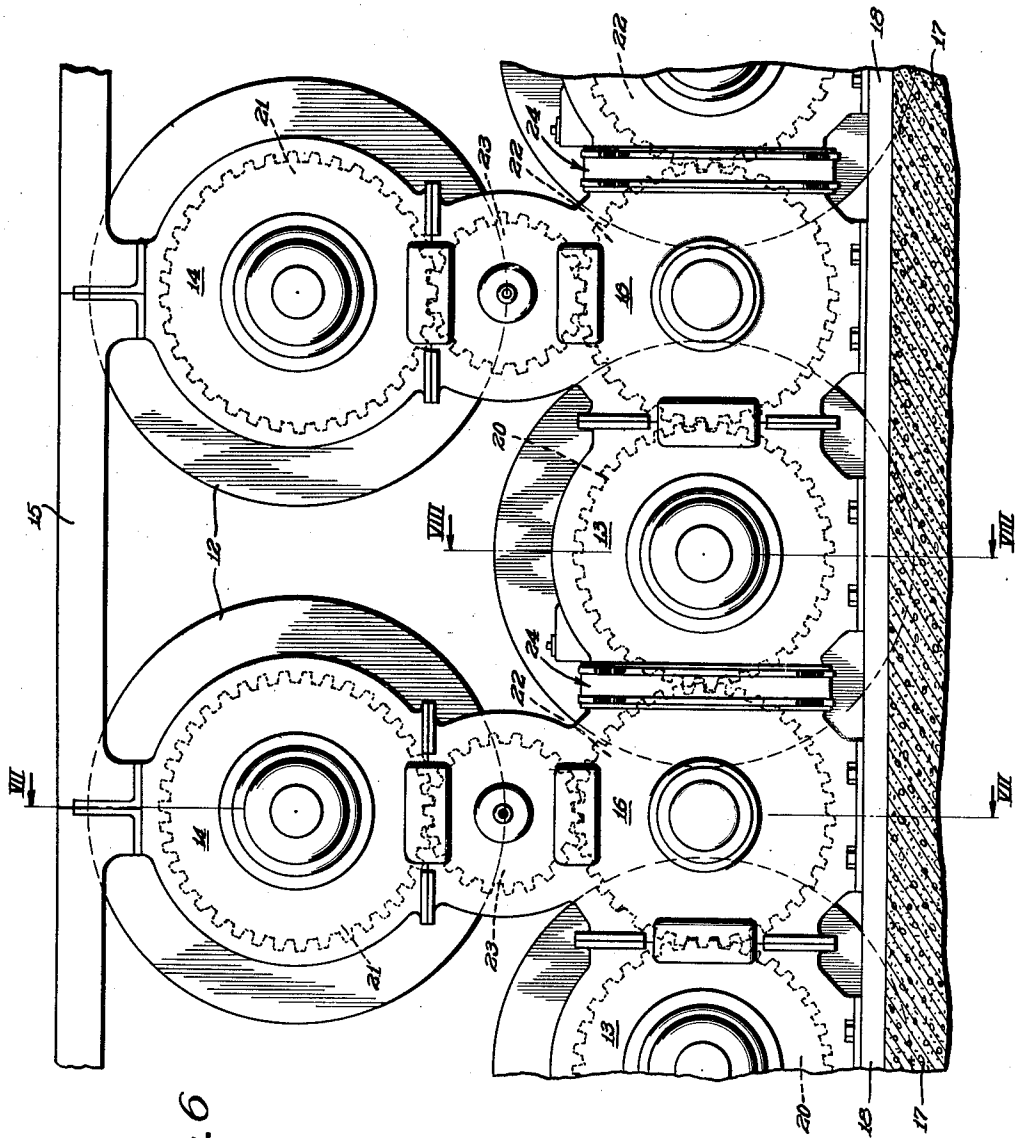


Fig. 6

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Fig. 7

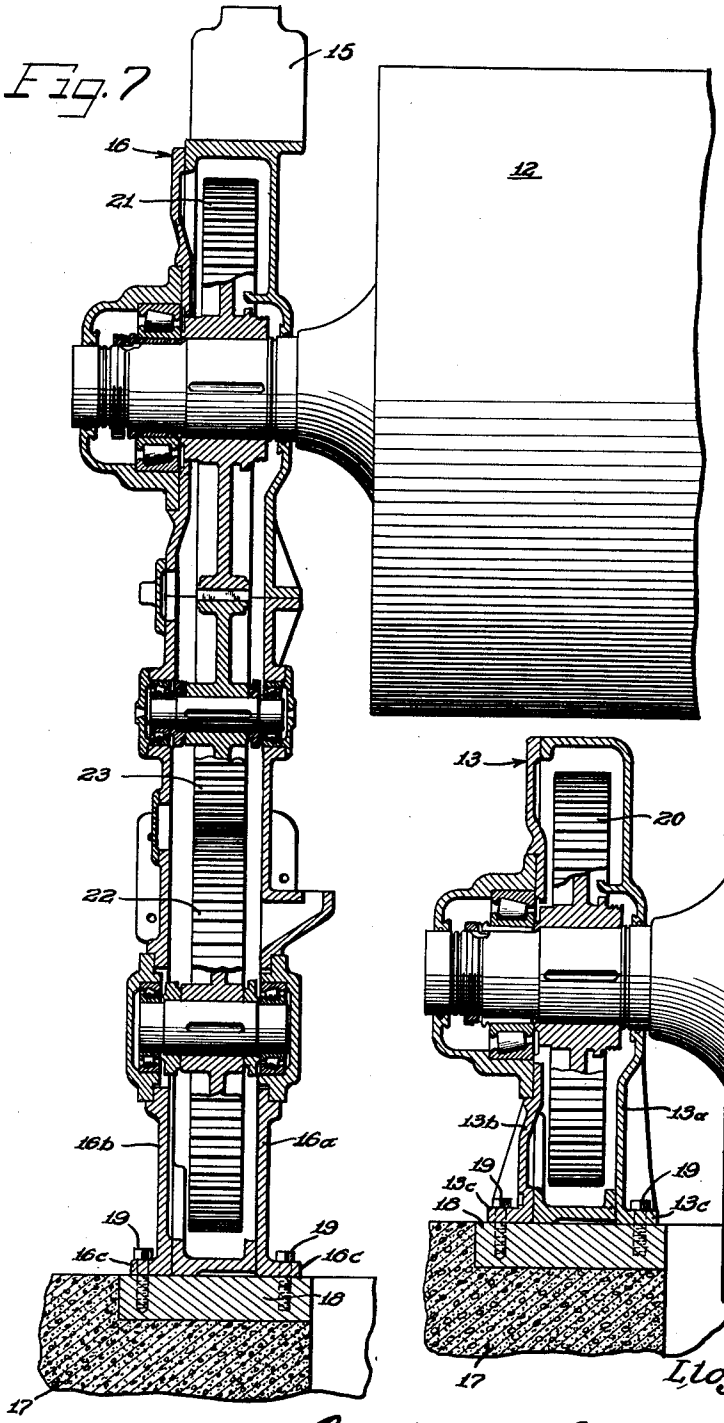


Fig. 8

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UNITED STATES PATENT OFFICE

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DRIER SECTION FOR PAPER MACHINES

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Application October 6, 1948, Serial No. 53,043

10 Claims. (Cl. 34—121)

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This invention relates to an expansion joint equipped drier section for a paper machine and more particularly relates to an expansion boot and gear case assembly to accommodate longitudinal expansion and contraction of a drier section such as occurs when the section is subjected to changes in temperature.

The drier drums in a modern section of a paper machine are driven by gears enclosed in a back drier framing which also provides bearing supports for the drums. In the past, it has been the practice to bolt each gear case to the adjacent case, thereby forming a rigid rear frame extending along the entire length of the drier section. In order to accommodate expansion and contraction of this rigid rear frame, it has been the usual practice to bolt only the middle gear case to the rear sole plate of the machine, thereby allowing the other cases to slide on the sole plate toward and away from the middle case. Secure anchoring of the cases was therefore impossible and heavier constructions were required.

Under these conditions, thermal expansion resulted in a relatively large longitudinal displacement along the sole plate as the paper machine was started up and steam was introduced into the drier drums thereby causing misalignment of the firmly anchored front bearing and the slidable rear bearing supports. This misalignment was progressively increased toward the ends of the drier section.

In the drier section embodying this invention, a flexible expansion joint is interposed between separated individual gear cases of the bottom row of drier drums and each gear case is securely bolted to the sole plate of the machine for fixed positioning of the bearing supports. The gear cases expand toward each other and the gears are deep cut to accommodate this movement without binding. This constitutes one object of my invention.

Another object of my invention is to provide a gear casing arrangement for paper machine drier sections whereby removal and replacement of a portion of the back framing of a paper machine is simplified.

A further object of my invention is to provide an expansible joint which facilitates removal or installation of individual drier drums without necessitating the disturbance of adjacent equipment.

Another object of my invention is to provide an expansion joint which will permit accurate longitudinal alignment of a drier section on a paper machine.

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Another object of my invention is to provide an expansion joint which reduces manufacturing costs of drier drum gear casings.

A further object of my invention is to provide an expansion boot for a drier section of a paper machine which is economical to manufacture, simple to install, and efficient in operation.

Further objects and the specific nature of this invention will become evident to those skilled in the art by making reference to the following detailed description and the appended drawings which, by way of example but not by way of limitation, illustrate one preferred type of embodiment incorporating the features of my invention.

On the drawings:

Figure 1 is a rear side elevational view of a drier section of a paper machine embodying the features of my invention;

Figure 2 is an enlarged cross-sectional view taken on line II—II of Figure 1;

Figure 3 is an enlarged fragmentary side elevational view of the draw bolt structure shown in Figure 2;

Figure 4 is an isometric view of the flexible boot member of the expansion joint;

Figure 5 is a fragmentary end view of the flexible boot member shown in Figure 4 illustrating how the boot may be formed for cementing purposes;

Figure 6 is an enlarged partial rear side elevation of the drier section of Figure 1, showing the gears in dotted line;

Figure 7 is a cross-sectional view taken on line VII—VII of Figure 6; and

Figure 8 is a cross-sectional view taken on line VIII—VIII of Figure 6.

As shown on the drawings:

Referring to Figure 1, a drier section 10 on a paper machine is indicated as comprising a row of horizontally aligned bottom drier drums 11 in spaced side-by-side relation and a row of top drier drums 12 with the drums in the top row disposed above the spaces between the drums in the bottom row. A paper web W is threaded through the section in the customary manner around the bottoms of the bottom drums and the tops of the top drums to travel in a serpentine path.

The rear side of the drier section 10 is supported by a back drier framing, best seen in Figures 1 and 6. The back drier framing is made up of several elements. A row of bottom gear casings 13, one for each corresponding bottom drum 11, are arranged in longitudinally aligned assembly at the back end of the drier section. A

row of top gear casings 14 is horizontally and longitudinally aligned at the back of the drier section, there being one top gear casing for every top drier drum. The top gear casings 14 are connected to a longitudinal brace member 15. A row of intermediate gear casings 16 are interpositioned between the bottom casings 13 and support the top casings 14.

The bottom, top and intermediate casings 13, 14 and 16, respectively, are each provided with suitably machined flanges to facilitate aligned assembly in the manner indicated in Figure 1. Thus, as shown on the drawing, each top casing 14 has a horizontally disposed bottom flange face which engages and is secured to a corresponding top flange face of an intermediate casing 16 for firm assembly therewith. Each intermediate casing 16, in turn, has a vertically disposed flange face which engages and is secured to a corresponding vertical flange face of a bottom casing 13 in firm assembly.

It will be noted that each bottom casing and each intermediate casing is suitably formed to define a second flange face. These second flange faces of adjacent casings 13 and 16 are aligned but longitudinally spaced so that they do not contact one another in abutting assembly. Thus one pair of adjacent top and bottom drums is carried by a set of rigidly connected casings 13, 14 and 16 while the next pair is carried by a similar rigidly connected set of casings but spaced from the adjoining sets. The structure joining these sets will be hereinafter described in detail.

A drier section 10 is usually installed on a concrete machine room floor (best seen on Figures 6, 7 and 8) indicated generally at 17. Sole plates 18 comprising heavy metal slabs finished on their upper surfaces are embedded in this floor 17. The sole plates 18 may be further anchored to the concrete by means of heavy anchor bolts which may, for example, engage steel beams underlying the floor (not shown).

Referring specifically to Figure 7, an intermediate gear casing 16 supporting a top drier drum 12 is shown as comprising a gear casing body 16a and a casing cover 16b. The body and the cover of the intermediate gear casing 16 are provided with projecting feet 16c through which a plurality of heavy bolts 19 are drawn to secure the intermediate gear casing 16 in firm assembly with the sole plate 18.

In Figure 8, a bottom gear casing 13 supporting a bottom drier drum 11 is shown as comprising a casing body 13a and a casing cover 13b. The body and the cover of the bottom gear casing 13 are provided with projecting feet 13c through which a plurality of heavy bolts 19 are drawn to secure the bottom gear casing 13 in firm assembly with the sole plate 18.

The drier drums have their rear axles mounted within the supporting gear casings by means of conventional bearing assemblies; however, it should be noted that the bottom drier drums 11 and the top drier drums 12 are also interrelated through a continuous gear train best seen by the dotted line configurations shown on Figure 6 (gear sections are also shown on Figures 7 and 8). Each pair of top and bottom drier drums is connected by a gear train shown as comprising a bottom gear 20, a top gear 21, an intermediate gear 22, and a reversing gear 23.

It should be apparent that the relative longitudinal displacement of the individual elements of the drier section will be accompanied by a thermal expansion of the gear train along the longitudinal axis of the drier section 10. Therefore, the gear teeth of the gears 20, 21, 22 and 23 are preferably cut deeper than would be necessary under uniform temperature conditions to accommodate extensive longitudinal gear displacement.

As shown in Figures 1 and 6, the spaced gear casings 13 and 16 are connected by a flexible joint assembly indicated generally at 24.

Various structural details of the joint assembly 24 are shown in Figures 2 through 5 wherein the joint is indicated as comprising an elastic boot 26, a plurality of steel strap segments 27, a number of draw bolts 28 and a number of backing plates 29.

The elastic boot 26 is preferably made of "neoprene" which is a polymer of chloroprene or a co-polymer of chloroprene and isoprene. In addition to being elastic and flexible, "neoprene" has oil resistant properties and does not tend to swell under temperatures normal to those existing under operating conditions of a drier section.

As may be seen in Figures 4 and 5, the boot 26 is preferably formed of a rectangular strip of material which is skived at both ends as at 26a to provide an enlarged cementing surface. The ends 26a are lapped and joined by cementing with any suitable adhesive, thereby forming boot 26 into a ring-like sleeve which can be disposed over the adjacent flange faces of one of the bottom gear casings 13 and one of the intermediate gear casings 16. The boot 26 is clamped directly on the bottom gear casing 13 and the intermediate gear casing 16 by the straps 27.

The steel strap segments 27 are preferably shaped to form a pair of upright sections 27a and a pair of arcuate end portions 26b and are fitted on each end with apertured lugs 27c adapted to be aligned when the segments 27 are placed in surrounding relationship to the boot 26 fitted onto the flange faces of the gear casings. The draw bolts 28 can be drawn through the lug portions of the strap segments 27 for clamping the boot 26 into a leak-proof expansion joint form on the gear casings.

As may be seen on Figures 2 and 3, to prevent the ends of the strap segments 27 from digging into the soft boot 26, backing plates 29 are inserted between the boot 26 and the adjacent ends of the strap segments 27.

Thus, the gears driving the individual drier drums are completely enclosed and sealed within firmly anchored back drier frames, thereby retaining the oil with which the gearing is continuously bathed and excluding all dirt and dust present in the drier room.

It should be apparent from the foregoing description that the expansion joint described in the instant disclosure forms an oil-tight joint and eliminates the necessity of finishing adjoining flanges of the bottom and intermediate gear casings. By eliminating the necessity for precision machine finishing to produce oil-tight joints, bottom and intermediate gear casings may be produced with substantial savings in manufacturing costs.

It should be further evident to those skilled in the art that I have described an arrangement whereby a unique flexible expansion joint may be used in a drier section on a paper machine which results in greatly improved operating

characteristics. Thus, a drier section embodying my expansion joint constructed in accordance with my invention will not only be maintained in firm longitudinal alignment, but will fully accommodate all longitudinal displacement resulting from thermal expansion.

Although I have resorted to the use of particular detail in the descriptions of this invention for the sake of clarity, it should be apparent to those versed in the art that variations may be made without departing from the spirit of my invention. Accordingly, I desire to be limited only by the scope of the appended claims and the prior art.

I claim as my invention:

1. A drier section comprising, in combination, a row of bottom drier drums in spaced side-by-side relation, a row of top drier drums overlying the spaces between said bottom drums, a plurality of bottom gear casings for supporting said bottom drier drums, a plurality of intermediate gear casings for supporting said top drier drums, means firmly anchoring said bottom gear casings and said intermediate casings with a space between each intermediate casing and one adjacent bottom casing, and an expansion joint surrounding each of said spaces and anchored to the adjacent casings, said expansion joints being constructed to accommodate longitudinal expansion and contraction of said drier section and to seal the casings in full communicating relation.

2. A paper machine drier section comprising, in combination, a plurality of bottom drier drums, a plurality of top drier drums, said bottom and top drier drums being aligned in longitudinal and horizontal spaced relationship to receive a web of paper threaded over said drums, a plurality of bottom gear casings, a plurality of top gear casings, a plurality of intermediate gear casings, said intermediate gear casings arranged to support said top gear casings and each of said bottom gear casings being firmly assembled on one side to a corresponding intermediate gear casing, a plurality of gears in said gear casings connected to said drier drums, said gears comprising a continuous gear train for driving said drier drums, said gears having under-cut gear teeth to provide a variable gear mesh for accommodating longitudinal expansion of said gear train, a plurality of expansion joints, each of said expansion joints being assembled on the other side of said bottom gear casing and the adjacent intermediate gear casing to accommodate longitudinal expansion of said drier section, and a drier room sole plate firmly anchoring each of said bottom gear casings and each of said intermediate gear casings.

3. In a paper machine drier section made up of a plurality of drier drums supported by drier framing including bottom gear casings, a flexible expansion joint comprising, in combination, a flexible synthetic rubber oil-resistant expansion boot for insertion between the bottom gear casings, and clamping means for securing said casings and said boot in sealed longitudinally expansible assembly.

4. In a paper machine drier section made up of a plurality of drier drums supported by enclosed back drier framing including bottom gear casings and intermediate gear casings, a flexible expansion joint comprising, in combination, a flexible synthetic rubber oil-resistant expansion boot for insertion between bottom gear casings and intermediate gear casings, and clamping

means for securing said casings and said boot in sealed longitudinally expansible assembly, said clamping means including a plurality of yieldable steel clamping straps for adjustable engagement with said boot.

5. A flexible expansion joint adapted for use in a paper machine drier section made up of a plurality of drier drums supported by enclosed back drier framing including bottom gear casings and intermediate gear casings, comprising, in combination, a flexible synthetic rubber oil-resistant expansion boot for insertion between bottom gear casings and intermediate gear casings, clamping means for securing said casings and said boot in sealed longitudinally expansible assembly, said clamping means including a plurality of yieldable steel clamping straps for adjustable engagement with said boot, and a plurality of draw bolts attached to the ends of said clamping straps for adjustably tightening said clamping straps.

6. A flexible expansion joint for use in a paper machine drier section made up of a plurality of drier drums supported by enclosed back drier framing including bottom gear casings and intermediate gear casings comprising, in combination, a flexible synthetic rubber oil-resistant expansion boot for insertion between bottom gear casings and intermediate gear casings, clamping means for securing said gear casings and said boots in sealed longitudinally expansible assembly, said clamping means including a plurality of segmented steel clamping straps with draw bolts affixed thereto for adjustable engagement with said boots, and a plurality of end plates for insertion between the abutting ends of said segmented straps and said boot for insulating said boot against abrasion.

7. In a drier section on a paper machine driven by gears encased in a back drier framing of the type where a drier section is made up of a plurality of top and bottom drier drums each having a separate gear casing and an intermediate gear casing, an expansion joint comprising, in combination, a flexible boot inserted between adjacent separate gear casings and intermediate gear casings, a plurality of segmental steel straps, draw bolt lugs affixed to the ends of said straps thereof for cooperating with each other in spaced opposed relation, draw bolts in said lugs for drawing up said straps in sealed assembly with said boot and said gear casings, and a plurality of end plates between the boot and straps and spanning the ends of the strap segments to prevent abrasion between the ends of said straps and said flexible boot.

8. A gear case assembly for drums and the like which comprises a series of rigid casing means having bearing supports therein, each casing means rotatably supporting intermeshed gears on said bearing supports, means firmly anchoring each set of casing means to a common support, and flexible covers connecting adjacent sets of casing means in sealed relationship while accommodating passage of gear peripheries therethrough to provide a continuous chain of gears completely enclosed within the casing while accommodating expansion and contraction of the assembly.

9. Gear casing and rear frame means for paper machine drier sections having superimposed rows of horizontally aligned drier drums which comprises a plurality of sets of casing means each carrying intermeshed gears, each set of casing means being in spaced longitudinal

relation, a common support, means anchoring each set of casing means to said common support, and flexible boots connecting adjoining spaced casing means in sealed relation and receiving the gears of the adjacent casing means therethrough in intermeshed engagement to provide a continuous intermeshed gear train.

10. In a paper machine drier section made up of a plurality of drier drums supported by drier framing including bottom gear casings, a flexible expansion joint comprising, in combination, a flexible expansion boot for insertion between the bottom gear casings and clamping means for securing said casings and said boot in sealed longitudinally expansible assembly.

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