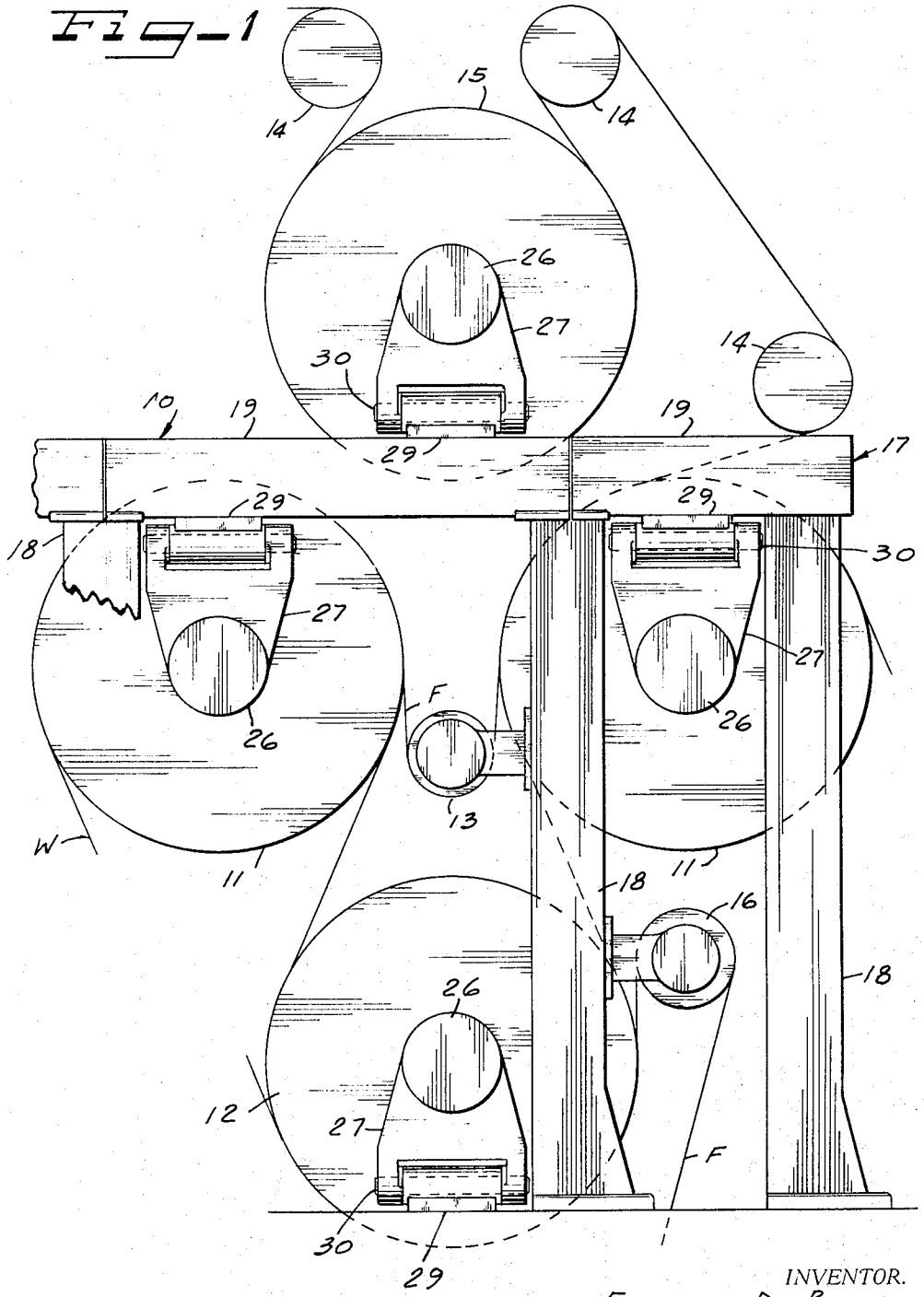
Dec. 26, 1967 E. D. BEACHLER 3,359,646

HEAT COMPENSATING DRYER BEARING

Filed Oct. 24, 1965 2 Sheets-Sheet 1

Fig-1



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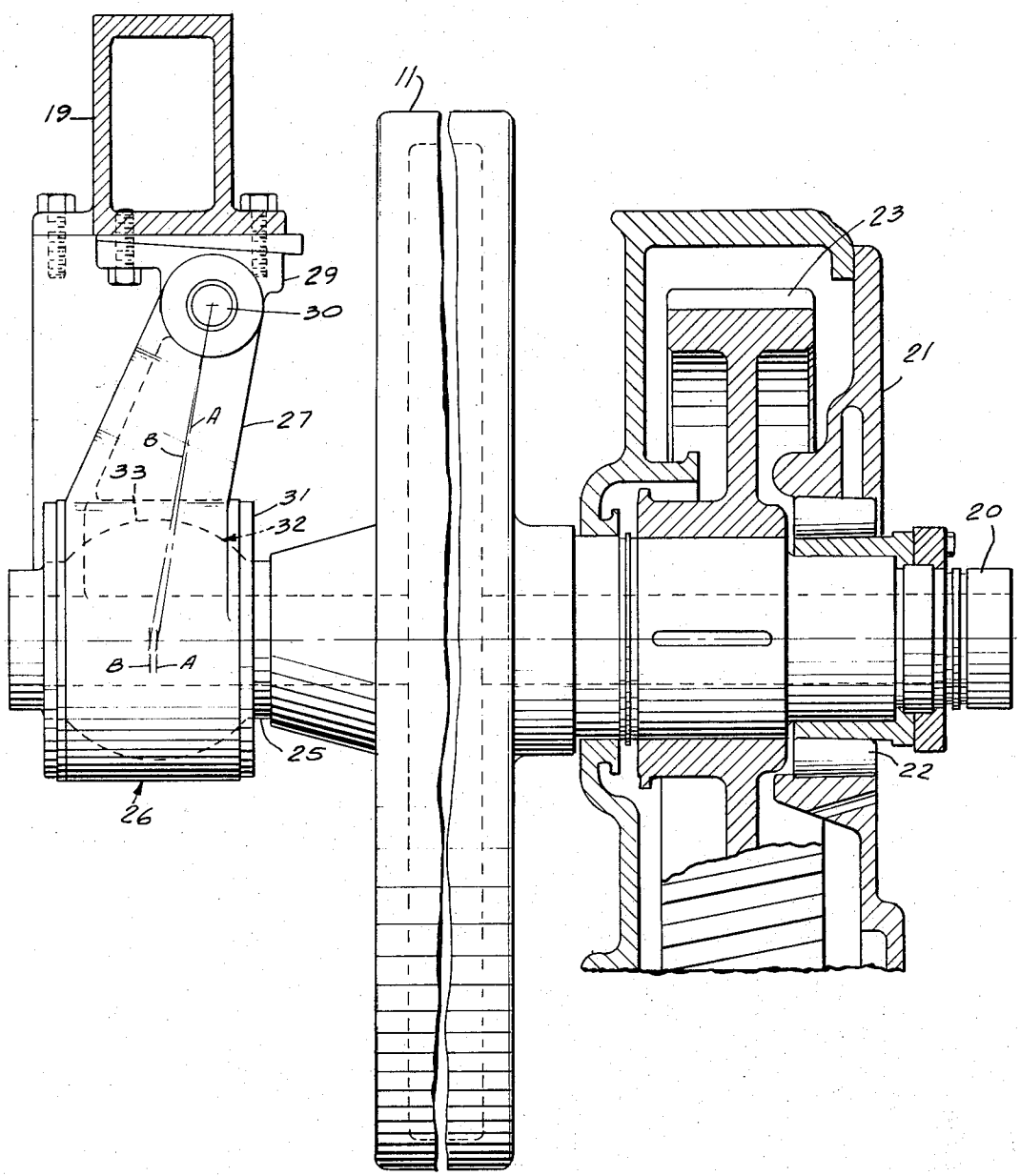
BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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Filed Oct. 24, 1965 2 Sheets-Sheet 2

Fig - 2



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United States Patent Office 3,359,646 Patented Dec. 26, 1967

3,359,646

HEAT COMPENSATING DRYER BEARING

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Filed Oct. 24, 1965, Ser. No. 504,865
2 Claims. (Cl. 34—121)

ABSTRACT OF THE DISCLOSURE

Dryer for fibrous webs in which steam is passed through the drying cylinders through the support and drive shafts for the cylinders. Expansion and contraction of each drying cylinder and the support and drive shafts therefor, caused by differences in temperature between a cool and heated condition of the cylinder and its shafts, is compensated for by mounting one shaft on an axial thrust bearing and by mounting the other shaft on a self-aligning bearing. The self-aligning bearing is supported on a swing arm pivoted to the frame of the machine, for movement about an axis extending transversely of the axis of rotation of the shaft, and spaced a substantial distance from the axis of rotation of the shaft and angularly inwardly above the transverse axis of the self-aligning bearing, to accommodate expansion and contraction of the shafts and drying cylinder, and to offset the thrust on the thrust bearing caused by the steam loads on the shafts and drum.

Background of the invention

At the dry end section of paper machines, the moisture bearing web is directed in a serpentine path in wrapping relation with a series of drying cylinders arranged in tiers, with the drying cylinders in one tier staggered with respect to the drying cylinders in the other tier. The web is partially wrapped about the cylinders by felts, which in turn pass from the end drying cylinders of each tier about a felt drying cylinder, before proceeding to the first drying cylinder in the respective tiers. In order to dry the web, the drying cylinders are heated by steam under pressure. These drying cylinders are of a large diameter and are relatively long, being at least 20 inches long. As a result there is an appreciable change in length of the drying cylinder from the time the drying cylinder, its shaft and its bearings are cold, to the time the cylinder, its shaft and bearing are heated by steam under pressure, supplied to the drying cylinder to dry the web partially wrapped thereabout. Due to the length and necessary large diameter of the drying cylinder together with its shafts, it has been difficult to compensate for these changes in length of the shaft and changes in position of the support bearings therefor.

Summary and objects of the invention

A principal object of the present invention is to remedy the foregoing deficiencies by supporting at least the shaft on a movable bearing movable in accordance with changes in length of the drying cylinder and tied to the support frame structure for the drying cylinders.

A further object of the invention is toprovide a compensating bearing support and bearing for at least one end of a drying cylinder, in which the bearing support is supported on the dryer frame structure, for controlled movement with respect thereto in accordance with expansion and contraction of the drying cylinder.

Still another object of the invention is to improve upon the bearing supports for the drying cylinders for paper machine dryers, by supporting the bearing for the dryer shaft for swinging movement about an axis spaced from the axis of the shaft, and extending transversely thereof.

A further object of the invention is to provide an improved support for the end of a drying cylinder support and drive shaft in the form of a self-aligning bearing supported on a swinging arm, supported on the frame of the dryer structure for movement about an axis extending transversely of the axis of ratation of the dryer cylinder and spaced radially therefrom.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a diagrammatic view in side elevation of a part of a typical dry end section of a paper machine, showing bearing supports for the drying cylinder shafts constructed in accordance with the principles of the present invention; and

FIGURE 2 is an enlarged detailed view with certain parts shown in transverse section, showing certain details of the drive and support for a drying cylinder supported in accordance with the principles of the present invention.

In the embodiment of the invention illustrated in the drawings, I have shown in FIGURE 1 a part of a paper machine dry end section generally designated by reference numeral **10**. The dry end section is shown as including drying cylinders **11, 11** of an upper tier of drying cylinders and a drying cylinder **12** of a lower tier of drying cylinders, staggered with respect to the drying cylinders **11** in the upper tier and having a paper web W partially wrapped about the drying cylinders of the upper and lower tiers of drying cylinders in a serpentine path. The paper web W is wrapped to the drying cylinders by upper and lower felts F, maintained in wrapping engagement with the web by felt rollers **13** disposed between each pair of drying cylinders in the upper and lower tiers thereof.

The upper felt F is shown as being trained from the last drying cylinder **11** upwardly around a series of idlers **14, 14** training the felt about a felt drying cylinder **15** like the drying cylinders **11, 11** and **12**. From the drying cylinder **15** the felt passes to the first drying cylinder of the upper tier of drying cylinders. The lower felt, in a like manner, is trained from the last drying cylinder **12** of the tier of drying cylinders about a felt idler **16** and downward therefrom and about a drying cylinder (not shown) for drying the felt prior to passing of the felt to the first drying cylinder of the lower tier of drying cylinders.

The drying cylinders **11, 11** and **12, 12**, as well as the felt dryer **15** are all supported on a frame structure **17** including a plurality of vertically extending posts **18, 18**, extending upwardly of a foundation for the dryer end section and beams **19, 19** supported at their ends on said posts and extending for the length of the foundation and suitably connected together at their ends. The compensating bearing support for each drying cylinder **11, 12** and **15** is the same, as is the drive and support means for the opposite ends of said drying cylinders, so one compensating bearing support and support and drive only will herein be shown and described in detail.

As shown in FIGURE 2 the drying cylinder **11** has a support and drive shaft **20**, extending from an end thereof and journalled in a gear housing **21** on suitable bearings, herein shown as being roller end thrust bearings **22**. The shaft **20** may be hollow to accommodate steam under pressure to pass therethrough to the interior of the drying cylinder **11** to heat said drying cylinder and drive moisture from the web passing thereabout. The shaft **20** and drying cylinder **11** are driven from suitable gearing contained within the housing **21**, and herein shown as including a helical gear **23**, keyed or otherwise secured thereto. A steam fitting may be connected with the outer end of the shaft **20** to accommodate the supply of steam through said shaft into the interior of the drying cylinder **11**.

The opposite end of the drum **11** has a shaft **25** extend-

ing therefrom coaxial with the shaft **20** and journalled in a compensating bearing support **26**, as will now be described. The shaft **25** is hollow and may have a steam fitting thereon to accommodate the circulation of steam through the shaft **20** into one end of said drum and out from said drum through the shaft **25**. The bearing support **26** is shown as being in the form of a swing arm **27** transversely pivoted to a bearing support box **29** secured to and depending from a beam **19**. As shown in FIGURE 1 the swing arm **27** has a bifurcated upper end portion, the furcations of which extend along each side of the bearing box **29** and are pivotally mounted thereon on a pivot pin **30** extending transversely to the axis of rotation of the shaft **25**. The swing arm **27** extends angularly outwardly of the axis of the pivot pin **30** and extends downwardly therefrom and supports the bearing box **31** at its lower end, with the center thereof offset from the center of the pivot pin **30**, to move upon expansion and contraction of the drum **11** and shaft **25** as the drum is heated from a cold to a hot position. The bearing box **31** forms a support for self-aligning bearing means, herein generally shown as being a sleeve **32** having a spherical bearing surface **33** engageable with a corresponding spherical bearing supported within the bearing box **31**. The bearing sleeve **32** and its support within the bearing box **29** forms a well known form of self-aligning bearing, which may be of any commercial type and is not herein shown and described in detail except insofar as such a bearing accommodates swinging movement of the swing arm **27** about the axes of the pin **30**, upon expansion and contraction of the cylinder **11** and shafts **20** and **25**.

In FIGURE 2 I have shown a dash dot line A intersecting the center of the pin **30** and transverse center of the sleeve **32** of the self-aligning bearing, indicating the position of the transverse center of the sleeve **32** when the drum **11**, the shaft **25** and its bearing sleeve **32** are cold. I have also shown by broken line B the position of the transverse center of the bearing **32** when the drum **11**, the shaft **25** and the bearing sleeve **32** are hot, and indicating the swing of the swing arm **27** from the cold to the hot positions of said swing arm, as steam is supplied to the drying cylinder **11** through the center of the shaft **20** to heat the cylinder, its shaft and bearing.

It should here be noted that the transverse center of the sleeve **32** is offset laterally from a vertical line extending through the center of the pin **30** and intersecting the rotational axis of the shaft **25**. While this may slightly increase the angularity of the shaft **25** and axis of rotation of the drum **11** when hot, it offsets the steam load on the cylinder **11** and takes part of the thrust off of the back bearing **22**.

While I have herein shown and described one form in which the invention may be embodied, it may readily

be understood that various modifications and variations in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In an apparatus for drying fibrous web,

a drying cylinder about which a web is partially wrapped and heated,

a frame,

shaft members extending from opposite ends of the cylinder,

means for passing steam axially through said cylinder, the steam causing axial expansion of the cylinder and also imposing an axial load on the cylinder as it passes therethrough,

a fixed axial thrust bearing mounting one of said shaft members,

a self-aligning bearing mounted on the other of said members,

an elongated swingable arm connected at one end to said self-aligning bearing, and

a pivot pin pivotally mounting the other end of said swingable arm to said frame,

said pivot pin being spaced radially of said self-aligning bearing and having an axis of rotation extending transversely of the aligned axes of said shaft members and said bearings,

said axis of said pivot pin and the transverse axis of said self-aligning bearing being axially offset from one another in a direction along the axis of said cylinder for providing an included angle of less than 90° between the longitudinal axis of said swingable arm and the axes of said cylinder shaft members thereby to intensify the resistance to the axial thrust imposed on said shaft members when the steam load is transmitted to the swingable arm.

2. The apparatus as defined in claim **1** wherein said steam passing means comprises steam passages formed in said shaft members.

References Cited

UNITED STATES PATENTS

1,043,631	11/1912	Schmidt	308—29
2,628,433	2/1953	Ostertag	34—124
2,687,926	8/1954	Gair et al.	308—28
2,914,864	12/1959	Clem	34—121
3,016,273	1/1962	Benoit	308—72

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