Nov. 4, 1941. T. MAKARIUS 2,261,740

NONDEFLECTING CYLINDER STRUCTURE

Filed May 29, 1940 3 Sheets-Sheet 1

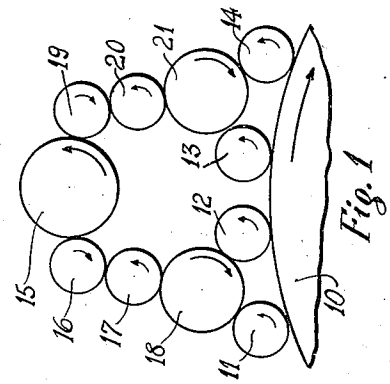


Fig. 1

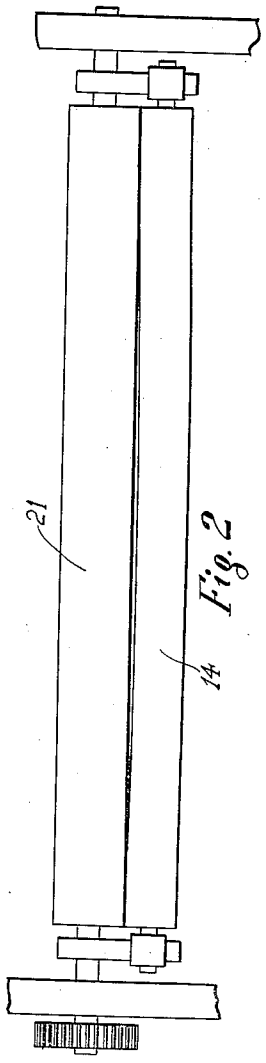


Fig. 2

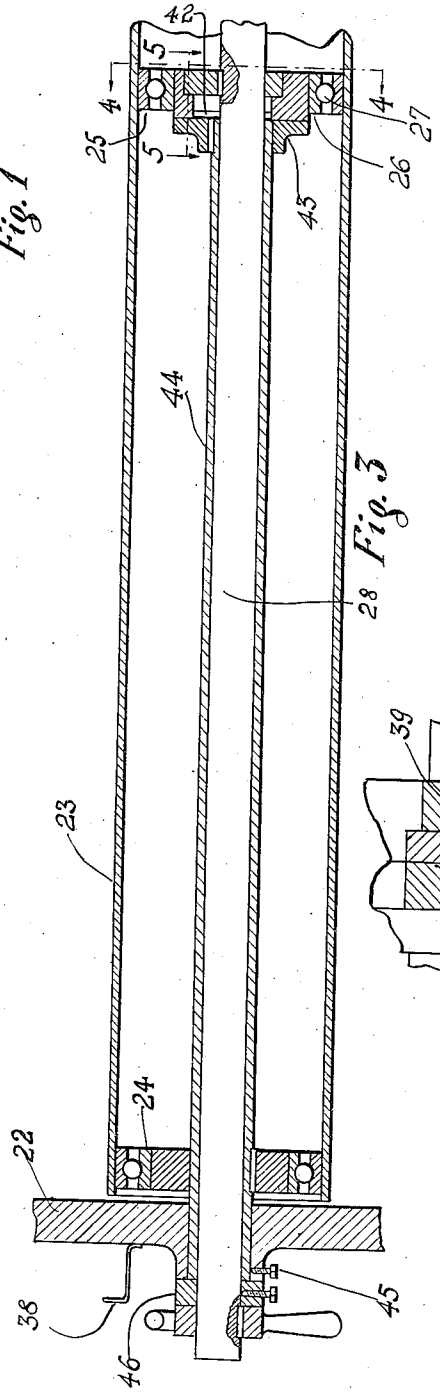


Fig. 3

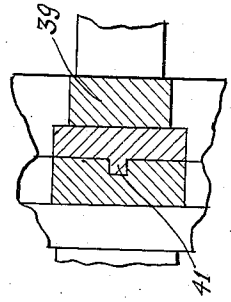


Fig. 5

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NONDEFLECTING CYLINDER STRUCTURE

Filed May 29, 1940 3 Sheets-Sheet 2

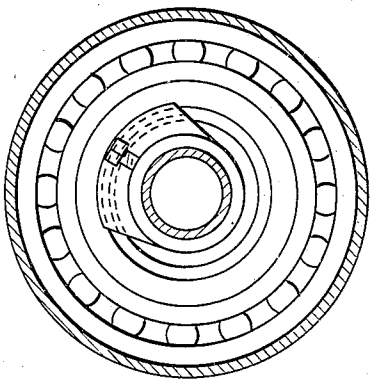


Fig. 11

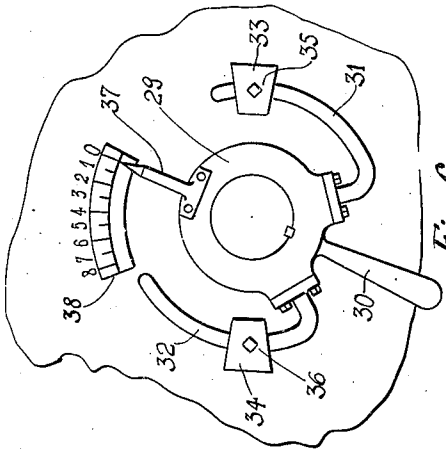


Fig. 6

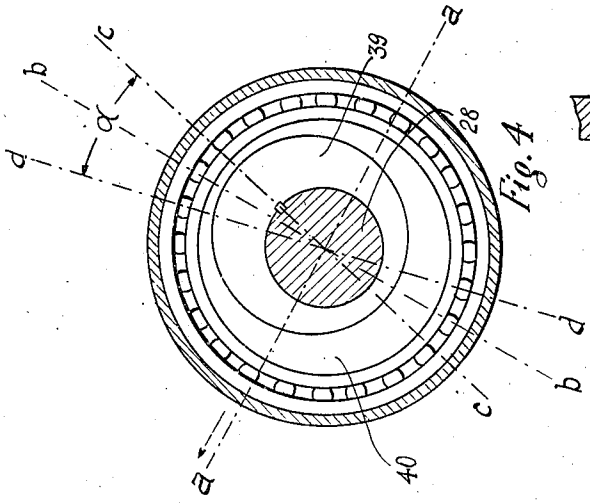


Fig. 4

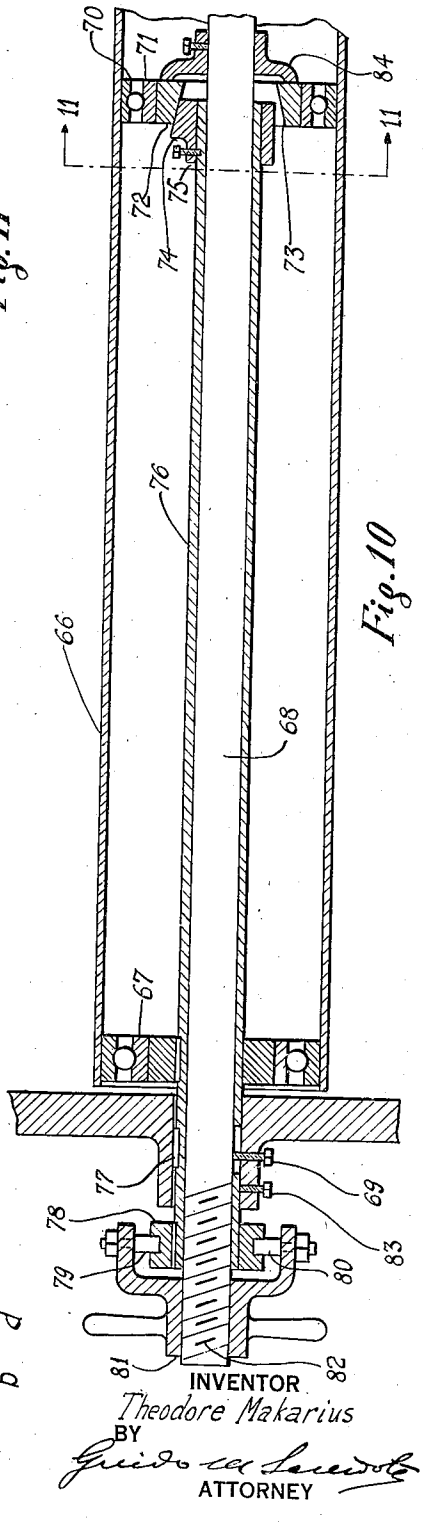


Fig. 10

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Nov. 4, 1941. T. MAKARIUS 2,261,740

NONDEFLECTING CYLINDER STRUCTURE

Filed May 29, 1940 3 Sheets-Sheet 3

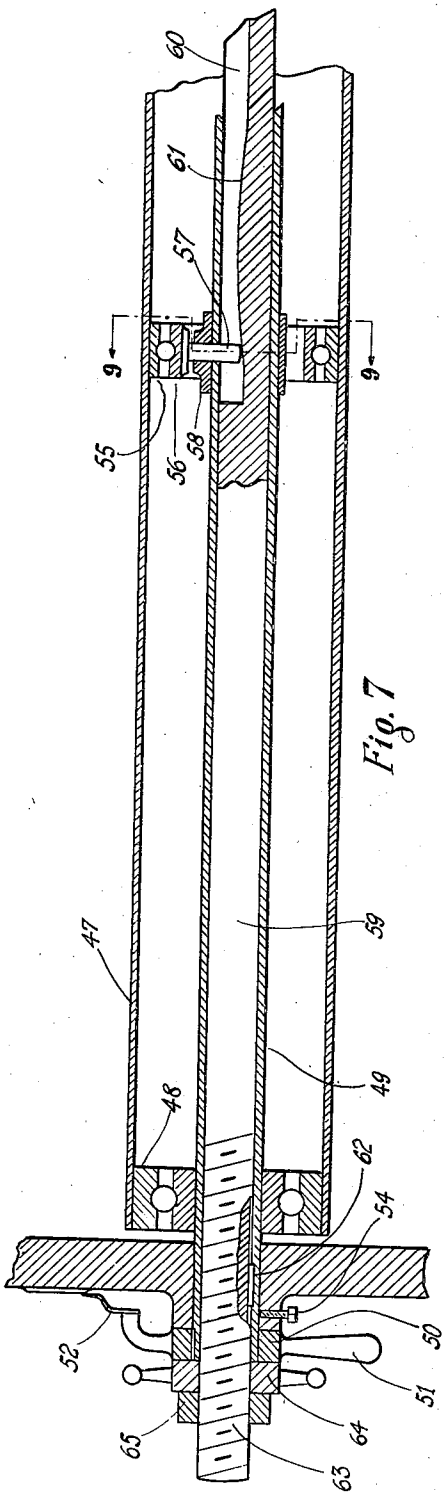


Fig. 7

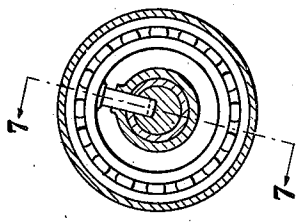


Fig. 9

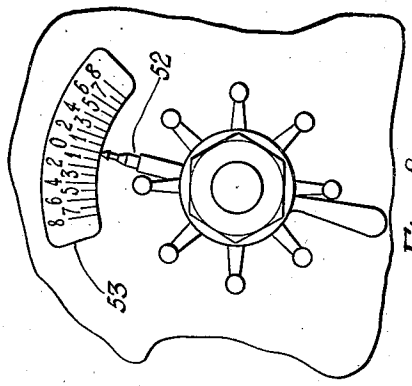


Fig. 8

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2,261,740

UNITED STATES PATENT OFFICE

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NONDEFLECTING CYLINDER STRUCTURE

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Application May 29, 1940, Serial No. 337,897

10 Claims. (Cl. 91—67.8)

This invention relates to cylinder structures, and more particularly refers to improvements in cylindrical machine elements such as rollers or cylinders, especially those of a type suitable for use in printing, lithographic and like machines, and wherever a slender roller or cylinder is subjected to stresses tending to distort or bend it.

For instance, such a condition obtains in connection with some of the inking rollers forming part of the running gear of a lithographic machine, said rollers being frictionally driven at a relatively high speed by another roller, or rollers. Inking and similar rollers are supported by end journals, and are held with a certain limited pressure against the impression cylinder or against an ink distributing roller, or both, with no intermediate support. The frictional driving force exerted against a roller so mounted causes said roller to be deflected along its line of contact with the impression cylinder, the deflection being greatest at the center, unless conditions be such that the deflection cannot take place.

Although the deflection thus caused may be only of the order of a few thousandths of an inch, in the case of an inking roller it constitutes a serious practical difficulty, because uneven inking results, and consequently uneven impression. The tendency in the design of these machines is constantly towards higher speeds, but since higher running speeds tend to intensify the objectionable condition mentioned, it often becomes necessary to reduce the speed in order to produce satisfactory work, thus reducing output instead of increasing it.

The primary object of this invention, accordingly, is to provide a novel and improved method of opposing the deflecting stresses to which a roller or cylinder may be subjected under operating conditions such as I have mentioned, so as to cause said roller or cylinder to preserve its true alignment and a uniform contact with the surface of a roller or cylinder frictionally associated therewith.

Another object is to provide, in connection with a hollow roller or cylinder of relatively small diameter in proportion to its length, a novel and improved method of mounting it by supporting it not only at each end, but also at one or more intermediate points, practically without increasing the weight of its mass in motion.

A further object is to provide a novel and simple method and means for mounting a relatively light weight roller or cylinder of the character indicated, whereby a deflection of said roller or cylinder antagonistic to that occasioned by its normal working conditions may be produced, so as to counterbalance the deflecting stresses and maintain the true alignment of said roller or cylinder.

A still further object is to provide, in connection with a roller or cylinder of the character specified, adjustable means for causing a deflection of said roller or cylinder adapted to exactly counterbalance the deflection produced by the stresses to which the roller or cylinder is subjected under normal working conditions, so as to preserve the true alignment and effective operation of the roller or cylinder.

Other objects and advantages of the present invention will more fully appear as the description proceeds, and will be set forth and claimed in the appended claims.

The invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a schematic illustration of a conventional arrangement of inking rollers in a lithographic press;

Fig. 2 is a plan view of an end inking roller and an ink distributing roller serving the same, illustrating the deflecting action upon the inking roller, due to friction and speed;

Fig. 3 is a fragmentary longitudinal section of a cylinder structure embodying one form of my invention;

Fig. 4 is a cross-sectional view thereof, in an enlarged scale, through line 4—4 of Fig. 3;

Fig. 5 is a fragmentary section of the same through line 5—5 of Fig. 3;

Fig. 6 is a fragmentary side view in elevation of the frame supporting the cylinder, illustrating an arrangement for controlling the adjustment of the deflection thereof;

Fig. 7 is a fragmentary longitudinal section of a cylinder embodying my invention in an alternative form;

Fig. 8 is a fragmentary side view in elevation of the frame supporting the cylinder of Fig. 7, illustrating an arrangement for controlling the adjustment of the deflection thereof;

Fig. 9 is a cross-section of the cylinder through line 9—9 of Fig. 7;

Fig. 10 is a fragmentary longitudinal section of a cylinder embodying my invention in still another alternative form; and

Fig. 11 is a cross-section thereof in an enlarged scale through line 11—11 of Fig. 10.

Referring to Fig. 1, 10 designates the plate cylinder of a lithographic press, 11, 12, 13 and 14 the inking rollers supplying ink to said cylinder, 15 the ink supply cylinder, 16, 17 and 18 a set of

ink distributing rollers supplying ink to the inking rollers 11, 12, and 19, 20 and 21 a similar set of ink distributing rollers supplying ink to inking rollers 13, 14.

The inking rollers are frictionally driven jointly by the plate cylinder and by the ink distributing roller in contact therewith, Assuming that the plate cylinder rotates in a clockwise direction, as the arrow indicates, the inking rollers rotate in a counterclockwise direction and ink distributing rollers 18, 21 rotate in a clockwise direction.

The driving action of ink distributing rollers 18, 21 upon inking rollers 11, 13 tends to force said inking rollers away from contact with said ink distributing rollers, but since the driving action of the plate cylinder upon the same inking rollers tends to force them in the opposite direction a good surface contact between said inking rollers 11, 13, their ink distributing rollers 18, 21 and the plate cylinder is usually maintained.

On the other hand, the action of the plate cylinder upon inking rollers 12, 14 also tends to move said inking rollers away from their ink distributing rollers 18, 21 and as a consequence said inking rollers 12, 14 undergo a certain amount of deflection, which is more pronounced midway of their length, causing uneven distribution of the ink upon said inking rollers. The deflection thus produced is very slight but is sufficient to seriously interfere with the quality of the work; moreover, the higher the speed the greater the deflection so that especially in large presses this condition constitutes a serious bar to the employment of the high speeds which would be desirable for the sake of a high production efficiency.

The manner in which inking roller 14 may be deflected under the conditions mentioned is illustrated in an exaggerated proportion in Fig. 2, where the central portion of said roller is shown entirely out of contact with the surface of the ink distributing roller 21.

In order to correct this difficulty I have conceived the idea of producing in a cylinder operating under conditions similar to those described, a deflection counterbalancing the deflection due to such operating conditions, so that during operation the cylinder remains virtually straight, maintaining a good surface contact with the ink distributing roller, as well as with the plate cylinder. The antagonistic deflection thus produced in the cylinder should be caused to occur in a direction substantially at right angles to a plane passing through the axis of the driving cylinders in contact therewith, so that, for instance, in the case of inking roller 14 the antagonistic deflection of said inking roller should be produced by forcing its middle portion towards a plane passing through the axis of ink distributing roller 21 and the axis of plate cylinder 10.

The antagonistic deflection mentioned can be produced in various manners by applying a force in the proper direction against the inner surface of the cylinder or roller, preferably midway of its length.

One of the arrangements suitable for this purpose is illustrated in Figs. 3 to 6. In the same 22 designates one of the side frames of a printing or lithographic press and 23 designates an inking roller or cylinder, such as 14, supported at each end by a ball bearing such as 24. Midway of its length said cylinder is supported by another ball bearing comprising an outer race 25, an inner race 26, and a circumferential series of balls 27.

Said cylinder is mounted to rotate about a shaft 28 extending between the two side frames of the press, said shaft being normally stationary but being angularly adjustable between two extreme positions by means of an end collar 29, provided with a handle 30 and two circumferential extensions 31, 32, extending through lugs 33, 34, respectively, formed integral with the side frame 22. Said collar and the shaft with it can be fixed at various angular positions by means of set screws 35, 36, a pointer 37 extending from said collar indicating the amount of angular displacement of the shaft from the zero position, as shown in a segmental dial 38, said zero position being the one in which the cylinder or roller is free of deflection and is, therefore, coaxial with the shaft 28 throughout its length when said cylinder is not in motion.

The antagonistic deflection of the cylinder is produced by means of an eccentric 39 fixed on shaft 28 in correspondence of the inner race 26 of the intermediate ball bearing, the action of said eccentric being exerted against the ball bearing and through it the cylinder by means of an eccentric collar 40 interposed between eccentric 39 and said inner race 26.

Assuming that the deflection of the middle part of the cylinder from the position shown in Fig. 4 is to be produced in the direction indicated by the line *a—a*, it follows that the angular displacement of the center of the eccentric 39 causing the deflection of the cylinder in the direction indicated, should take place between two points along a line substantially parallel to said line *a—a*, that is, two points representing the extremes of an angular segment which is symmetrically disposed to the line *b—b* at right angles to the line of displacement *a—a*.

In the position shown the center of the eccentric is, therefore, on the line *c—c* of the angle α, said line corresponding to the position zero given by the pointer 37 upon segmental dial 38.

It is obvious that if shaft 28 is angularly displaced so as to move the center of the eccentric from the line *c—c* to the line *d—d*, representing the other extreme of the angle α, the eccentric collar 40 will cause the ball bearing and with it the middle portion of the cylinder to be displaced in the direction *a—a*, provided said collar 40 is restrained from following the angular displacement of shaft 28 and eccentric 39. It will be understood that since the deformation of the cylinder to be produced in order to counteract its deflection is only of the order of a few thousandths of an inch, the angle α representing the limit of angular displacement of the eccentric is exceedingly small, so that the displacement of its center may be held to take place along a substantially straight line.

In order to compel the eccentric collar 40 to move in the direction of line *a—a*, said collar is provided with two radially directed ridges or projections, such as 41, in alignment with each other, said ridges or projections being slidable in corresponding diametrically opposite radially extending grooves 42, provided in the disk 43 fixed on a sleeve 44, surrounding shaft 28, said sleeve being fixed in the proper position where its grooves 42 are directed along the line of deflection *a—a* by means of a set screw 45, or in any other suitable manner.

Such an arrangement makes it possible to adjust sleeve 44 to the proper angular position and then to permanently maintain it in said position.

Shaft 28 is restrained against axial displacement in any suitable manner, for instance, by means of a set collar 46, at each end thereof.

By angularly displacing said shaft by means of collar 29 from the position zero to any other position on the dial 38, the middle portion of the cylinder can be gradually deflected from zero to a maximum in a direction directly opposite to that in which said cylinder tends to be deflected by the action of the driving cylinders or rollers, as will be understood, so that when the machine is in operation the cylinder will maintain its correct alignment and a good surface contact with the other cylinders or rollers.

In the arrangement shown in Figs. 7 to 9, the cylinder 47 is rotatably mounted by means of end ball bearings 48 upon a hollow shaft 49. Said shaft 49 may be adjusted to different angular positions by means of collar 50, provided with a handle 51 and a pointer 52, indicating the angular position of the shaft upon a segmental dial 53. Once the shaft has been adjusted to the proper angular position it is fixed in said position by means of a set screw 54, by proper angular position being meant the position in which the deflection of the cylinder will take place in the proper direction. It is, therefore, to be understood that where the operative conditions are always the same and the cylinder is subjected to deflecting stresses always in the same direction, the shaft 49 can be fixed in the proper position once and for all and no adjusting or indicating means will be required.

Also in this case the cylinder is supported midway of its length by a ball bearing comprising an outer race 55, and an inner race 56, said inner race being provided with an inwardly extending radially directed stem 57, guided for radial displacement with respect to shaft 49 by said shaft and a collar 58 mounted on said shaft.

The outward radial displacement of said stem and with it of the ball bearing and middle portion of the cylinder may be produced by means of an axially adjustable bar 59, extending through hollow shaft 49, said bar having a longitudinal groove 60 within which stem 57 projects, the end of said stem 57 bearing against the bottom of said groove which has a cam-acting outline, as indicated at 61.

Said bar 59 is slidably keyed to the shaft 49, as shown at 62, so that it cannot rotate with respect to said shaft although it can be axially displaced with respect thereto.

In order to produce the axial displacement of said bar 59 its ends are threaded, as shown at 63, and are engaged by a nut such as 64 and a check nut such as 65.

It will be understood that by releasing the check nuts and operating nuts 64, bar 59 can be caused to move in one or the other direction, so as to produce a greater or lesser deflection of the cylinder.

Still another arrangement is shown in Figs. 10 and 11, in which the cylinder 66 is mounted on end ball bearings 67 to rotate about stationary shaft 68, which is retained in position by means of a set screw 69.

Midway of its length, the cylinder is supported by a ball bearing 70, the inner race 71 of which is provided with a bushing 72 having a central opening 73, the surface of which is conical. The outer deflecting movement of said bushing can be caused by a segmental portion 74 of a collar 75 fixed on a sleeve 76, said segmental portion 74 having a slanting surface adapted to bear against the conical surface of opening 73, in bushing 72, and to cause more or less transversal displacement thereof with respect to shaft 68 of longitudinal displacement of said sleeve 76.

Said sleeve 76 is fixed in the proper angular position by a key 77 which permits axial adjustment of said sleeve. Said axial adjustment is produced by means of a collar 78 fixed to the end of said sleeve, said collar having an annular groove engaged by two pins 79, 80, inwardly extending from a forked nut 81, mounted on a threaded end 82 of shaft 68.

Sleeve 76 is normally restrained against axial displacement by a set screw 83 but it will be understood that by releasing said set screw and turning nut 81, said sleeve may be caused to move in one or the other direction so as to produce by cam action the transversal displacement of the ball bearing and with it of the central portion of the cylinder.

The thrust thus exerted against bushing 72 is preferably taken up in some suitable manner, for instance, by means of a flanged collar 84 fixed on shaft 68.

From the foregoing it will be seen that by virtue of my invention I actually produce in the cylinder a deflection of such a value and in such a direction that the action of the stresses to which the cylinder will be subjected when in operation will neutralize it, restoring and maintaining the correct alignment of the cylinder as well as its surface contact during the operative periods.

It is obvious that it is within the scope of my invention to produce the deflection of the cylinder by applying pressure against its external surface; however, in the case of cylinders, such as inking cylinders, for instance, the object of which is to distribute a liquid or semi-liquid upon a surface in contact therewith, it is preferable to apply the pressure internally in order to avoid interference with an even distribution of such liquid or semi-liquid.

The constructional details of my invention may vary from those shown without departing from the inventive idea. The drawings should, therefore, be understood as being intended for illustrative purposes only and not in a limiting sense.

I, accordingly, reserve the right to carry my invention into practice in all those ways and manners which may enter, fairly, into the scope of the appended claims.

I claim:

1. In a cylinder structure comprising a hollow cylinder rotatably mounted between two end supports and subjected to stresses tending to deflect said cylinder in a given direction, mechanical means housed within said cylinder, adapted to press against the inner surface of said cylinder, so as to produce in said cylinder an actual deflection in the opposite direction, substantially equivalent in value to that due to said stresses, thereby neutralizing the latter and maintaining said cylinder in its correct alignment.

2. In a cylinder structure comprising a hollow cylinder rotatably mounted between two end supports and subjected to stresses tending to deflect said cylinder in a given direction, mechanical means housed within said cylinder, adapted to press against the inner surface of said cylinder, so as to produce in said cylinder an actual deflection in the opposite direction, substantially equivalent in value to that due to said stresses, thereby neutralizing the latter and maintaining said cylinder in its correct alignment, and means controlling said deflecting

means to vary the amount of deflection thereby produced in said cylinder.

3. In a cylinder structure comprising a hollow cylinder rotatably mounted between two end supports and subjected to stresses tending to deflect said cylinder in a given direction, an intermediate bearing within said cylinder, and means to displace said bearing transversely of the axis of said cylinder, to produce in said cylinder an actual deflection in the opposite direction, substantially equivalent in value to that due to said stresses, thereby neutralizing the latter and maintaining said cylinder in its correct alignment.

4. In a cylinder structure comprising a hollow cylinder rotatably mounted between two end supports and subjected to stresses tending to deflect said cylinder in a given direction, an intermediate bearing within said cylinder, and adjustable cam-acting means adapted to displace said bearing transversely of the axis of said cylinder, to produce in said cylinder an actual deflection in the opposite direction, substantially equivalent in value to that due to said stresses, thereby neutralizing the matter and maintaining said cylinder in its correct alignment.

5. A cylinder structure comprising a stationary shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, an eccentric fixed on said shaft, an eccentric collar interposed between said eccentric and the inner race of said bearing, means restraining said collar against rotation while permitting translatory movement thereof in a given direction transversely of said axis, and means controlling the angular position of said shaft.

6. A cylinder structure comprising a stationary shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, an eccentric fixed on said shaft, an eccentric collar interposed between said eccentric and the inner race of said bearing, said collar having at one side a projection extending along a diameter passing through the axis of its outer circumference, a sleeve surrounding said shaft, a flanged collar at the inner end of said sleeve abutting against said eccentric collar, said flanged collar having a diametrically extending guideway interlocking with said projection, means for fixing said sleeve in a given angular position, and means independently controlling the angular position of said shaft.

7. A cylinder structure comprising a stationary shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, and cam-acting means adapted to cause translatory movement of said bearing in a given direction at right angles to the axis of said shaft.

8. A cylinder structure comprising a normally stationary hollow shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, said inner race being provided with a radial inwardly extending stem projecting through said shaft, and a longitudinally adjustable bar extending through said shaft, said bar having a cam-acting surface bearing against said stem, adapted to cause outward movement thereof when said bar is longitudinally displaced from its normal position.

9. A cylinder structure comprising a normally stationary hollow shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, said inner race being provided with a radial inwardly extending stem projecting through said shaft, a longitudinally adjustable bar extending through said shaft, said bar having a cam-acting surface bearing against said stem, adapted to cause outward movement thereof when said bar is longitudinally displaced from its normal position, and means controlling the longitudinal displacement of said bar.

10. A cylinder structure comprising a stationary shaft, a hollow cylinder supported at each end to rotate about the axis of said shaft, a bearing having an inner and an outer race mounted at an intermediate point within said cylinder, an annular member integral with said inner race, having a conical central opening, a longitudinally adjustable sleeve surrounding said shaft bearing at its inner end a collar having a truncoconical portion adapted to bear against the surface of said central opening, means retaining said sleeve in a predetermined angular position, and means controlling the longitudinal displacement of said sleeve.

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