G. RENNERFELT.

ELASTIC WHEEL BEARING.

APPLICATION FILED FEB. 4, 1907.

1,005,473. Patented Oct. 10, 1911.

Fig. 1

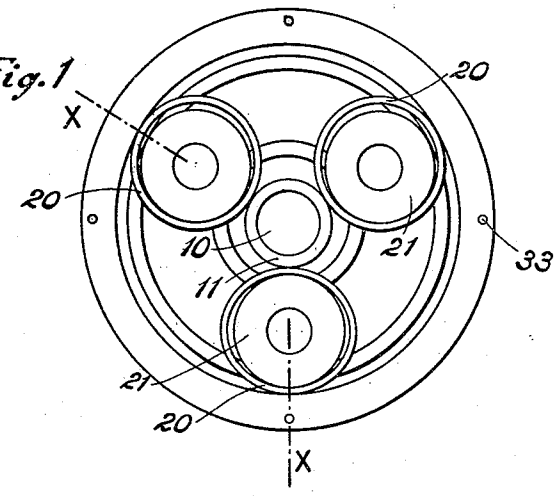


Fig. 2

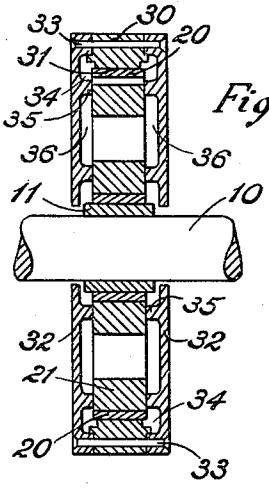


Fig. 5

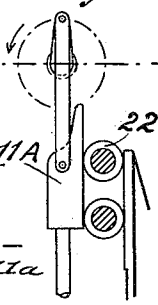


Fig. 6

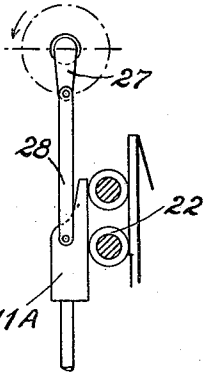


Fig. 3

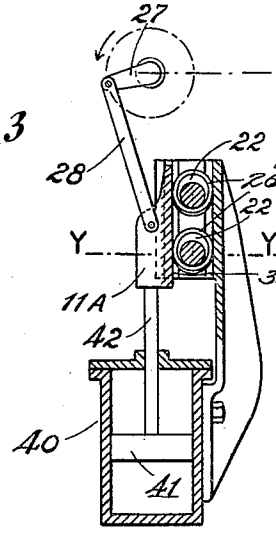


Fig. 8.

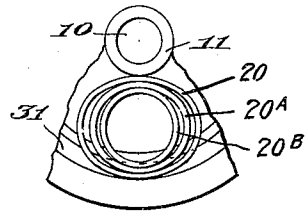


Fig. 4

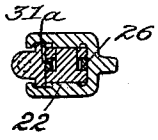
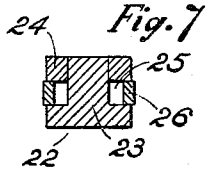


Fig. 7



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GUSTAF RENNERFELT, OF SCRANTON, PENNSYLVANIA.

ELASTIC-WHEEL BEARING.

1,005,473. Specification of Letters Patent. Patented Oct. 10, 1911.

Application filed February 4, 1907. Serial No. 355,592.

To all whom it may concern:

Be it known that I, GUSTAF RENNERFELT, a subject of the King of Sweden, and a resident of the city of Scranton, in the county of Lackawanna and State of Pennsylvania, United States of America, have invented certain new and useful Improvements in Elastic-Wheel Bearings, of which the following is a specification.

My invention relates to improvements in roller or wheel bearings and consists in the construction and arrangement of parts described in the following specification, the novel features whereof are set forth in claims.

Referring to the drawings, Figure 1 is an end elevation of a bearing made according to my invention with one of its side plates removed. Fig. 2 is a sectional side elevation of the same bearing, the section being taken on the broken line X—X of Fig. 1. Fig. 3 is a semidiagrammatic representation, partly in section, of a pump to which my improved bearing is applied with a cross-head a straight track and a frame connecting the track with the pump cylinder. Fig. 4 is a sectional view of one of the bearing rollers shown in Fig. 3, the section being taken on the line Y—Y. Figs. 5 and 6 are diagrammatic representations of some of the parts shown in Fig. 3 illustrating the two extreme positions of the rollers during the operation of the pump. Fig. 7 is a sectional view of one of the rollers shown in Fig. 3. In this case the parts are drawn to a larger scale and the roller is represented in its non-compressed condition. Fig. 8 is an elevation of a portion of a bearing made according to a modification of my invention.

Like characters of reference designate corresponding parts in all of the figures.

10 designates a shaft to which my bearing is applied; 11 designates a bushing, preferably of steel, placed over this shaft and arranged to rotate with it. The bushing may thus be considered as a part of the shaft, or to serve as a member for transmitting pressure from the shaft to the track.

20, 20, 20 designate a plurality of hollow rollers or rings which may be constructed of steel or other desired material. These rollers are constructed of short length as compared with their diameter so that they somewhat resemble wheels.

30 designates a portion of an outer casing which forms a track 31 for these rollers to run upon and which is arranged to support the rollers and the shaft, thus serving as a member for sustaining pressure from the shaft. 32, 32 designate plates which are arranged to be fastened one on each side of the track portion 30 by means of bolts or rivets 33. One of these plates may be formed integrally with the said track portion if desired. These side plates thus form portions of the outer casing which supports the rollers and the shaft. The plates and the track portion are preferably designed and shaped so that they form annular grooves 34, 34 on either side of the track 31. The side plates 32 are preferably formed with ribs or projections 35, 35. A chamber or recess 36 is thus formed between these ribs.

21, 21 designate auxiliary rollers which I sometimes use in conjunction with the hollow rollers 20.

The rollers 20 are hollow so that they are flexible and constitute springs. The diameter of each of said rollers or wheels is somewhat greater than the difference between the inner radius of the track 31 and the outer radius of the bushing 11. When a plurality of these rollers are placed between the bushing and the track they are compressed somewhat so that they become oval in form. This compression is shown in the lower roller in Fig. 1 somewhat exaggerated. In this figure it may be supposed that the pressure from a load on the shaft is directed downward so that when one of the rollers is vertically below the center of the shaft such a roller will sustain all the pressure from said load. The other two rollers will at the same time be temporarily relieved from the pressure. The lower roller is therefore more compressed than the others, but the parts may be so arranged that the effect of this compression will not be sufficient to cause either of the two upper rollers to become loose between the bushing and the track and thus liable to shift their position.

In order to keep the compression of the rollers 20 within proper limits the auxiliary rollers 21 may be used. These are so arranged that they will receive the pressure from the shaft when the outside rollers are compressed to the extent shown in the roller in Fig. 1, when its inner diameter coincides

with the outer diameter of the auxiliary roller 21. The annular grooves 34, 34 are arranged as I have before stated one on each side of the track upon which the rollers 20 travel. They thus serve the purpose of forming receptacles for any dust or grit which may accidentally get inside of this bearing. The side plates 32, 32 serve the purpose of guiding the rollers and holding them in parallelism. When these side plates are made with inwardly projecting ribs 35, 35 as shown, the surface of these ribs may be tooled until they present smooth surfaces parallel to each other at a distance apart but slightly greater than the width of the rollers. This construction minimizes the amount of machine work necessary to be done upon these parts in manufacturing the bearings. The spaces 36, 36 between these ribs may be utilized for the purpose of securing to the bearing a dust-scraper such as is described in my pending application Serial Number 337,389, filed October 4th, 1906.

In many cases where the speed of rotation of the shaft is high it is distinctly preferable to use the rollers 20 alone without the reinforcement of the auxiliary rollers 21, and this construction will give to the bearing a greater amount of elasticity which is beneficial when imperfectly balanced masses are rotated by the shaft at high speeds. It is evident that the auxiliary rollers 21 may also be considered as flexible rollers, and that another roller of similar construction but of smaller diameter than the inner diameter of the rollers 21 could be placed within these rollers 21. In other words, a plurality of concentric hollow rollers can be used instead of the single roller 20, each one of the inner rollers being intended to successively take up the pressure from the shaft as the outer rollers become compressed by this pressure. This construction is illustrated in Fig. 8, in which figure a hollow roller 20^A is placed within the roller 20, and the other hollow roller 20^B is placed within the roller 20^A. I have therefore invented a compound flexible roller which comprises two or more hollow rings placed one within another and separated by a clearance and this I believe is broadly new in the art, and I claim it broadly in combination with the associated parts of a roller bearing.

In some types of machinery it would not be permissible to have such variations in the position of the axis of the shaft relative to the track as may result from the use of the construction illustrated in Figs. 1 and 2 by reason of the variable compression of the rollers. To meet such a case I construct the bearing with inflexible rollers in contact with both the shaft and the track and supported or retained in position by flexible rings. Such a construction is illustrated in Figs. 3, 4 and 7. In these figures 22 designates the rollers which are constructed, as may be clearly seen by an examination of Fig. 7, with a solid core 23 of special shape. A heavy collar 24 is arranged to be fitted over one end of this core and may be securely attached thereto. The two parts together thus form a roller with a central groove 25 in its periphery. A flexible spring roller 26 may be placed within this groove in a manner shown. This ring is somewhat greater in diameter than is the roller 22 and is made of such dimensions that it may be readily compressed between the associated parts of the bearing to which it is to be applied, such, for example, as the cross-head 11^A and the stationary track 31^A. It is evident that the roller shown in Fig. 7 may be used in the bearing shown in Figs. 1 and 2. In Fig. 3 I have shown a pair of such rollers and flexible rings as applied to a bearing for parts which have a rectilinear motion. This bearing is the same as that previously described, differing only in relative dimensions, as it may be considered to have a shaft and a circular track, the diameters of which are of infinite length. As in this case the bearing is arranged for supporting parts which move reciprocally in a straight line, a cross-head 11^A is shown, instead of the bushing 11, as the pressure transmitting member.

The roller bearing which is illustrated in Fig. 3 is especially applicable to and may be used in conjunction with the form of differential gearing sometimes known as Ead's tackle which is described in United States Patent No. 349,123 issued September 14, 1886 to William Roth. For the sake of greater simplicity in the drawing I have illustrated the bearing in combination with a reciprocating pump 40 driven by a crank 27 which comprises a piston 41 and a piston rod 42. This crank 27 is arranged to be rotated in the direction indicated by the arrows by any suitable motive power. The crank 27 is connected to the cross-head 11^A by means of a connecting rod 28, and the piston rod 42 of the pump 40 is connected directly with the cross-head. It may be seen that pressure from the cross-head is always directed toward the rollers, except when the crank 27 occupies the central positions in which it is shown in Figs. 5 and 6. At such points the rollers 22 which have solid cores would have a tendency to become dislocated from their proper positions, but this tendency is overcome by the use of the elastic rings 26 which are compressed between the cross-head and the track and are thereby retained in position.

The roller bearing which I have invented is arranged, as may be seen by referring to the foregoing description, to be entirely free from sliding friction.

Hitherto it has been necessary in roller

bearings or in wheel bearings to provide some means for holding the various rollers in proper positions and to this end some mechanical connection between the rollers has been necessary in order to maintain such of the rollers as are temporarily out of contact with the shaft and its surrounding track in their proper relative positions. Such mechanical connections complicate the construction of the bearing and tend in some degree to retard, by rubbing or sliding friction, the motion of the rollers.

In my present improved type of roller bearing all mechanical connections between the rollers are eliminated and the contact between the rollers, the track and shaft constitutes the sole connection between the rollers, and this contact serves the purpose of keeping the rollers at the proper distance apart. As there is no sliding friction in this bearing, no lubrication is necessary for diminishing the friction.

What I claim is.—

1. In a bearing, a pressure transmitting member, a track, a plurality of flexible hollow rollers, and another flexible roller within each of said flexible hollow rollers.

2. In a bearing, a pressure transmitting member, a track, a flexible roller between the member and the track, and a roller within the flexible roller arranged to limit the compression of said flexible roller.

3. In a bearing, a track, a shaft, a plurality of flexible hollow rollers in contact with the track and with the shaft, another roller within each of said flexible rollers, said inner rollers being arranged to sustain a part of the pressure on the bearing when the flexible rollers are sufficiently compressed by said pressure.

4. In a bearing, a track, a shaft, a plurality of outer flexible hollow rollers compressed between the track and the shaft, another flexible roller within each of said flexible rollers, said inner rollers being arranged to sustain a part of the pressure on the bearing when the outer flexible rollers are sufficiently compressed by said pressure.

5. In a bearing, a track, a shaft, a plurality of outer flexible hollow rollers normally slightly compressed between the track and the shaft, another flexible roller within each of said flexible rollers, said inner rollers being arranged to sustain a part of the pressure on the bearing when the pressure upon the outer flexible rollers causes their compression to exceed the normal.

6. In a bearing, a track, a shaft, a plurality of flexible hollow rollers compressed between the track and the shaft, another flexible roller within each of said flexible rollers, the outside diameter of said inner rollers being less than the inside diameter of the outer flexible hollow rollers, said inner rollers being arranged to sustain a part of the pressure on the bearing when the outer flexible rollers are sufficiently compressed by said pressure.

7. In a bearing, a track, a shaft, a plurality of series of flexible hollow rollers, the outside diameter of each of said rollers in one series being less than the inside diameter of the next adjacent roller, said rollers being arranged to be compressed between the track and the shaft, and arranged to sustain a part of the pressure on the bearing when the outer roller or rollers are sufficiently compressed by said pressure.

8. A roller bearing, comprising a shaft, a track, a roller arranged to sustain pressure between the shaft and the track, plates in close proximity to the ends of the roller and arranged to keep the roller in parallelism with the shaft, and a spring roller surrounding the roller and compressed between the shaft and the track, and arranged to maintain the roller in proper peripheral position.

9. A shaft, a track, a plurality of hollow flexible rollers between the shaft and the track, plates fastened to the track on each side of the rollers, the diameter of each roller being greater than the difference between the radius of the shaft and the radius of the track, and the plates being arranged to hold the rollers in parallelism with the shaft.

10. A shaft, a track, a plurality of hollow rollers between the shaft and the track, said rollers being flexible in their radial direction, the diameters of the rollers being different between the radius of the shaft and the radius of the track, a pair of plates, one of said plates being on each side of the rollers, there being inwardly projecting ribs on the inner surfaces of the plates, said plates forming annular grooves, the plates being attached to the track and arranged to hold the rollers in parallelism.

11. In a roller bearing, the combination of a pressure transmitting member, a pressure sustaining member, a roller interposed between said two members, and a flexible hollow roller surrounding said first roller and compressed between the pressure transmitting member and the pressure sustaining member and arranged to maintain the position of said first roller.

12. In a roller bearing, the combination of a shaft, a track, a roller of smaller diameter than the distance between the shaft and the track, and a flexible hollow roller of greater diameter than the distance between the shaft and the track, said hollow roller surrounding the first roller and arranged to maintain the position of said first roller.

13. In a roller bearing, the combination of a pressure transmitting member, a pressure sustaining member, a roller interposed between said two members, and a flexible hollow roller surrounding the first roller and

compressed between said two members and arranged to transmit a part of the pressure from the pressure transmitting member to the pressure sustaining member, and to maintain the position of the first roller.

14. In a roller bearing, the combination of a pressure transmitting member, a pressure sustaining member, a plurality of rollers interposed between said two members, a plurality of flexible hollow rollers surrounding said first rollers and compressed between said two members, and arranged to transmit a part of the pressure from the pressure transmitting member to the pressure sustaining member and to maintain the position of the first rollers.

15. In a roller bearing, the combination of a shaft, a track, a plurality of rollers of smaller diameter than the distance between the shaft and the track, and a plurality of flexible hollow rollers of greater diameter than the distance between the shaft and the track, said hollow rollers surrounding the first rollers and arranged to maintain the relative position of said first rollers.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAF RENNERFELT.

Witnesses:

A. W. BROADBENT,

FRED H. LINTON.