J. H. MODLER.

ANTIFRICTION BEARING.

APPLICATION FILED JAN. 4, 1913.

1,196,264.

Patented Aug. 29, 1916.

3 SHEETS—SHEET 1.

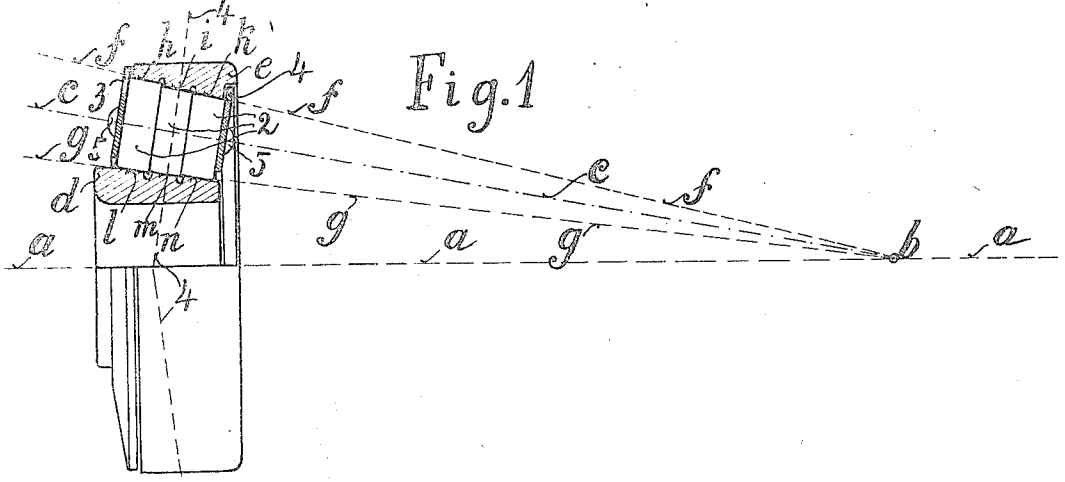


Fig. 1

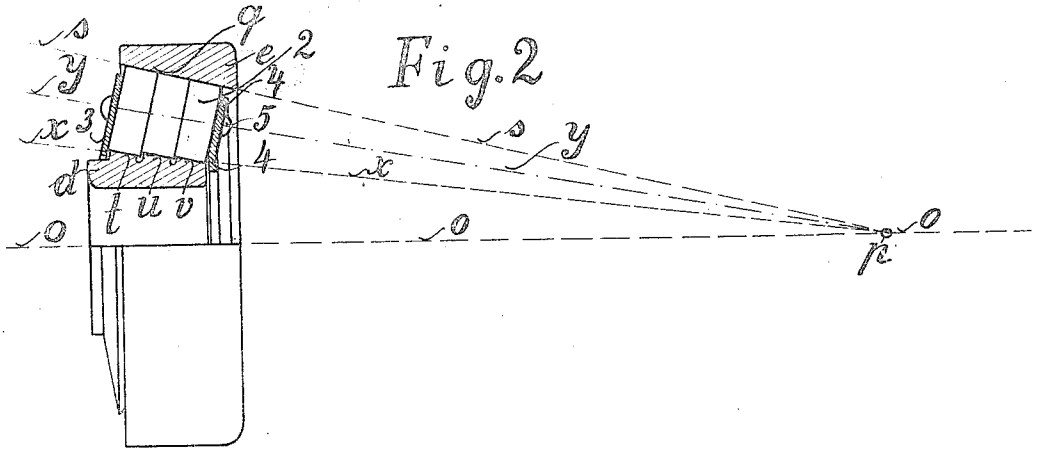


Fig. 2

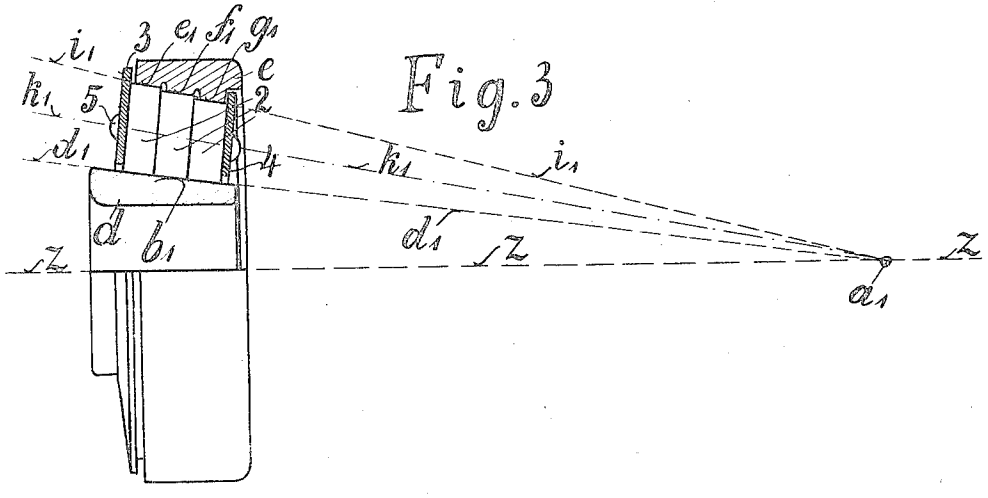


Fig. 3

Witnesses:
Marie J. Wainright
Jacob Lichtenstein

Inventor
John H. Modler
By his Attorney
A. F. Bourne

J. H. MODLER.

ANTIFRICTION BEARING.

APPLICATION FILED JAN. 4, 1913.

1,196,264.

Patented Aug. 29, 1916.

3 SHEETS—SHEET 2.

Fig. 4b

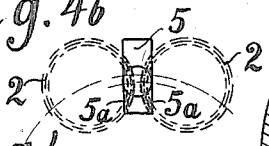


Fig. 4a

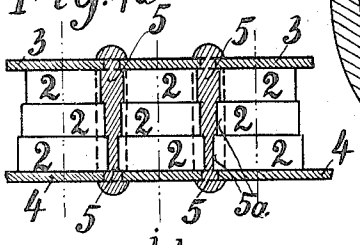
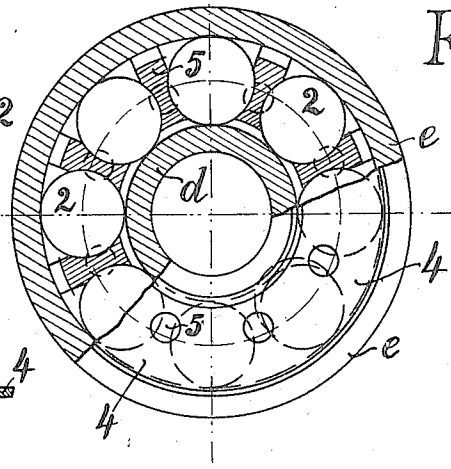


Fig. 4



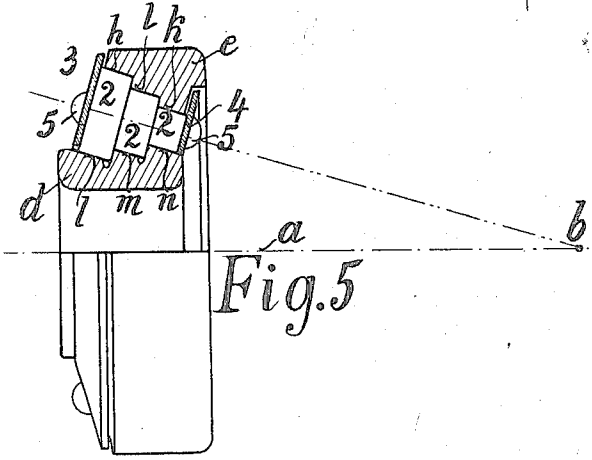


Fig. 5

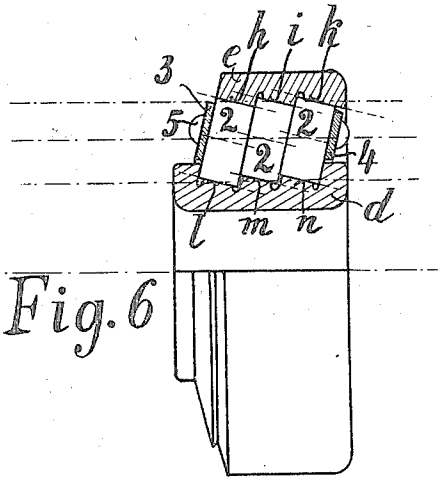


Fig. 6

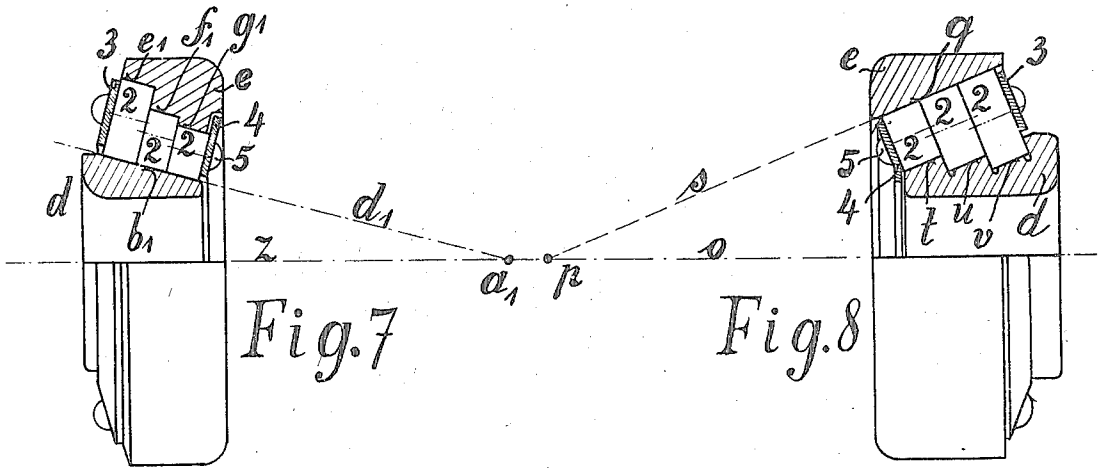


Fig. 7

Fig. 8

Witnesses:

Marie F. Wainright

Jacob Lichtenstein

Inventor

John H. Modler

By his Attorney F. F. Bourne

J. H. MODLER.

ANTIFRICTION BEARING.

APPLICATION FILED JAN. 4, 1913.

1,196,264.

Patented Aug. 29, 1916.

3 SHEETS—SHEET 3.

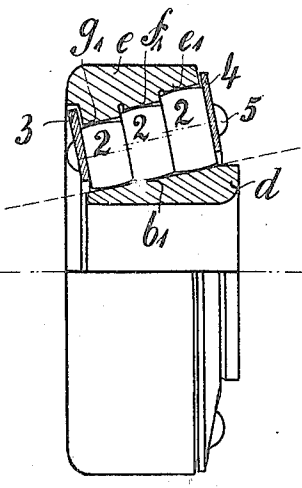


Fig. 9

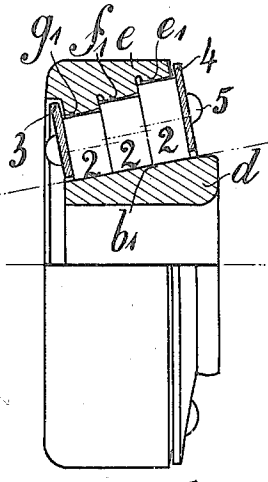


Fig. 10

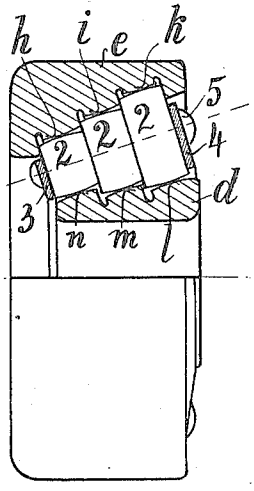


Fig. 11

Witnesses:

Mazie F. Wainright

Jacob Lichtenstein

Inventor

John H. Modler

By his Attorney

T. F. Bourne

UNITED STATES PATENT OFFICE.

JOHN H. MODLER, OF SCHWEINFURT-ON-THE-MAIN, GERMANY.

ANTIFRICTION-BEARING.

1,196,264. Specification of Letters Patent. Patented Aug. 29, 1916.

Application filed January 4, 1913. Serial No. 740,116.

To all whom it may concern:

Be it known that I, JOHN H. MODLER, a subject of the Emperor of Germany, and resident of Schweinfurt-on-the-Main, Germany, have invented certain new and useful Improvements in Antifriction-Bearings, of which the following is a specification.

The object of my invention is to provide a roller bearing having inner and outer members each provided with annular raceways between which are located a plurality of sets of rollers, the rollers of each set having their working surfaces in different but parallel planes between the corresponding raceways, and means to retain said sets of rollers in operative position between said members.

In a preferred embodiment of my invention, the working surfaces of the rollers are graduated in such a way that they are touched by converging lines that meet at one point in the line of the axis or in the center line of the bearing, the corresponding raceways of said members being correspondingly arranged in said line.

My invention further comprises novel details of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings forming part hereof, wherein,

Figure 1 is a partly sectional side elevation of a roller bearing embodying my invention, showing the raceways of the inner and outer members arranged symmetrically, and the rollers correspondingly arranged; Figs. 2 and 3 are similar views illustrating modified arrangements of the raceways and the working rollers; Fig. 4 is a side view partly in section on the line 4, 4, in Fig. 1; Fig. 4ª is a detail of a portion of the retainer for the rollers; Fig. 4ᵇ is a sectional detail of Fig. 4ª; Fig. 5 is a partly sectional side view of a modified form of roller bearing, in which the rollers are graduated in diameter and concentrically disposed, but the surfaces of the sets of rollers are not touched by the same lines that touch the same point in the center line of the bearing; Fig. 6 is a sectional detail of a modified form of bearing wherein the surfaces of the rollers and the corresponding raceways are in parallel lines, but the rollers are not concentrically disposed; Figs. 7 and 8 are sectional detail views of modified forms of Fig. 6; Fig. 9 is a sectional detail view illustrating the bearing provided with rollers having curved working surfaces and the raceways having plane surfaces; Fig. 10 is a similar view illustrating a bearing wherein the rollers have cylindrical surfaces and the opposed raceways have curved and plane surfaces respectively, and Fig. 11 is a similar view illustrating the rollers and raceways having curved surfaces.

Similar numerals of reference indicate corresponding parts in the several views.

In the form of the bearing shown in Figs. 1 and 4, the inner and outer members or rings *d* and *e* are respectively provided with opposed similarly disposed raceways for the interposed sets of rollers 2. The rollers are shown in sets in cylindrical form, and the raceways *l*, *m*, *n*, of the inner member *d* and the raceways *h*, *i*, *k*, of the outer member *e* are parallel to the axes of the respective sets of rollers. The diameters of the rollers of each set of rollers vary from the rollers of the other sets, and the raceways are arranged in such a way that the converging lines *f*, *g*, meeting at the point *b* in the line of the axis *a* of the bearing, touch the raceways, *h*, *i*, *k*, and *l*, *m*, *n*, respectively, at some point. In all the views of the drawings I have shown three sets of rollers, and corresponding raceways for such rollers, although it will be understood that any desired number of sets of rollers may be provided, with a corresponding number of raceways. The rollers 2 are maintained in proper working relation by a suitable retainer or cage, which, in the examples illustrated, comprises suitably shaped rings 3, 4, connected together by separators 5, between which parts of the retainer the several sets of rollers are located to freely rotate. The separators 5 may be in the form of suitably shaped blocks, preferably having curved surfaces at 5ª (Fig. 4ª) corresponding to the opposed rollers, having their end portions passing through the rings 3, 4, and riveted firmly thereto, or such separators may be journaled in the rings 3, 4, if desired.

In Fig. 1 it will be seen that while the rollers are of graduated diameter and have cylindrical surfaces, they are symmetrically arranged between the opposed pairs of raceways *k*, *n*, *i*, *m*, and *h*, *l*, which are located concentrically with respect to one another, but correspondingly touched by the respective lines *f*, *g*.

In Fig. 2 the outer member *e* has a single

plane raceway q against which the outer surfaces of the rollers of each set bear, and the inner member d has graduated raceways t, u, v, such raceways being concentrically disposed with respect to the axial lines of the rollers, while the raceways t, u, v, are respectively parallel to the raceway q, and are thus so graduated that the line x which meets the axial or center line o of the bearing at the point p, touches said raceways, and the line s which meets line o at the point p lies in the raceway q, the line y touching the axes of the rollers and meeting the point p of line o.

In Fig. 3 the relative arrangement of parts shown in Fig. 2 is reversed, that is to say, the outer member e is provided with graduated raceways e', f', g', and the inner member d is provided with the plane raceway b', the rollers 2 being correspondingly graduated to engage said raceways as shown, the raceways e', f', g', being each parallel to the raceway b'. In this form of bearing the raceways e', f', g', touch the line i that meets the axial or center line z of the bearing at the point a', and the line d', which lies in the raceway b', meets line z at the same point a', the line k' which touches the axes of the rollers also meeting the point a'.

In the examples of the bearing illustrated in Figs. 1 and 3 wear of the bearing may be taken up by moving the inner member d inwardly, while in the example illustrated in Fig. 2 wear of the bearing may be taken up by moving the inner member d together with the rollers inwardly, with respect to the outer member.

In the example illustrated in Fig. 5, the relative arrangement of the parts is substantially the same as that shown in Fig. 1, but the raceways h, i, k, do not all touch a line meeting at a point b with the axis or center line a of the bearing, and likewise the raceways l, m, n, do not touch a line meeting at said point with the line a.

In Fig. 6 the rollers are of the same diameter and the surfaces of all the rollers of each set lie in parallel planes, the raceways h, l, i, m, and k, n, being correspondingly arranged, but the axes of the rollers of each set are not concentric, and lines parallel with the surfaces of the rollers are also parallel with the axes of the rollers, but none of the roller surfaces or raceways are in the same line.

In Fig. 7 the relative arrangement of the members d, e, and the raceways are substantially similar to that shown in Fig. 3, excepting that the rollers are so proportioned and graduated that their axes do not meet the axial line z of the bearing at the point a' where the line d' from the raceway b' meets the line z, and the raceways e', f', g', are parallel and graduated in distances from the raceway b', so that the raceways e', f', g', are not all touched by a line meeting the line z at the point a'.

In Fig. 8 the arrangement of the bearing is generally similar to that shown in Fig. 7 but reversed in relative arrangement, and corresponds substantially in arrangement to that shown in Fig. 2, except that the axes of the rollers do not touch the axial line o of the bearing at the point p where the line s, which touches the raceway q, meets the line o, and the raceways t, u, v, are parallel and graduated in distances from the raceway q, so that the raceways t, u, v, are not all touched by a line meeting the line o at the point p.

While I have described the rollers as cylindrical and the raceways as having corresponding plane surfaces, to coact with such rollers, it is not essential that the rollers and raceways have absolutely cylindrical surfaces, as the rollers or the raceways, or both, may have curved surfaces, such as outwardly curved or convex surfaces, as illustrated in Figs. 9, 10 and 11.

In Fig. 9 the rollers 2 are shown provided with outwardly curved or convex surfaces adapted to bear against raceways having cylindrical or plane surfaces, the arrangement of parts other than above in Fig. 9 corresponding substantially to Fig. 7, although the arrangement of the curved and plane surfaces of the rollers and raceways may apply to either of the figures.

In Fig. 10 the rollers and raceways are arranged relatively the same as in Fig. 9, except that the rollers are cylindrical and the raceways e', f', g', have curved convex surfaces, and the raceway b' is cone-like.

The relative arrangement of the parts shown in Fig. 11 is generally substantially the same as in Fig. 5, except that the rollers and the raceways have outwardly curved or convex surfaces.

According to my improvements, by having a plurality of series of rollers, each series comprising a plurality of rollers, said rollers and raceways being graduated in diameter, and having their surfaces touching lines that meet a common point with the axes of the respective series of rollers in a line passing through the axis of the bearing, or by having the surfaces of the rollers and raceways in parallel lines with the opposite sides of the same the rollers not touching or coinciding with the same lines, either parallel with or at an angle to the axes of the rollers, the disadvantage of conical rollers bearing against opposed conically disposed surfaces, tending to act in a wedge-like manner due to end thrusts of the members of the bearing, is obviated, but, by the arrangements set forth herein, the advantages of a conical bearing having anti-friction rollers is attained, with graduated rollers having surfaces which do not, in conjunction with

the corresponding raceways, act at any time in a wedge-like manner, whether the surface be cylindrical or convex. Furthermore, the sliding tendency of conical rollers to get out of alinement, frequently caused by the varying diameters of rollers and raceways creating considerable friction and strain on the retainer or cage, is largely obviated. Friction between the raceways and rollers is reduced, since the rollers may be made as narrow as desired, and each roller, located between correspondingly narrow raceways, the surfaces of which correspond in parallelism with the surfaces of the rollers coacting therewith, do not tend to rotatively control other rollers of the same set, so that twisting or cramping of relatively long cone-like rollers between correspondingly disposed raceways, is overcome, by having the surfaces of each roller and its opposed raceways parallel.

Having now described my invention what I claim is:—

1. An anti-friction bearing having inner and outer members, and a plurality of sets of rollers between said members having their surfaces inclining toward the axis of the bearing in graduated parallel lines, said members having raceways coacting with said rollers and inclining toward said axis, one line drawn from a common point in said axis passing through each one of the raceway surfaces correspondingly on opposite sides of said rollers.

2. An anti-friction bearing having inner and outer members and a plurality of sets of rollers between said members, each set of rollers having diameters differing from the other sets, the axis of the rollers of each set coinciding, the surfaces of said rollers lying in parallel lines, said members having raceways coacting with said rollers.

3. An anti-friction bearing having inner and outer members, and a plurality of sets of rollers between said members, each set of rollers having diameters differing from the other sets, the axes of the rollers of each set coinciding, the surfaces of said rollers lying in parallel lines, said members having raceways coacting with said rollers, the surfaces of said raceways lying in lines corresponding with the first named lines.

4. An anti-friction bearing having inner and outer members, and a plurality of sets of rollers between said members, each set of rollers having diameters differing from the other sets, the axes of the rollers of each set being in a line that coincides at a point with the axis of said members, said members having raceways corresponding in distances apart substantially to the diameters of corresponding rollers of said sets, said raceways being parallel with the axis of the corresponding rollers.

5. An anti-friction bearing having inner and outer members, and a plurality of sets of rollers between said members, each set of rollers having diameters differing from the other sets, the axes of the rollers of each set being in a line that coincides at one point with the axis of said members, said members having raceways corresponding in distances apart substantially to the diameters of corresponding rollers of said sets, said raceways being parallel with the axes of the corresponding rollers, said raceways crossing lines meeting at the same point met by lines passing through the axes of the rollers and the axis of said members.

6. An anti-friction bearing comprising inner and outer members having a plurality of opposed raceways, the distances between said opposed raceways varying, the surfaces of said raceways crossing lines that meet at the same point in the line of the axis of said members, certain of said surfaces lying on opposite sides of one of said lines, and sets of rollers between said raceways, the axes of said sets of rollers being in a line meeting said point.

7. An anti-friction bearing comprising inner and outer members having a plurality of opposed raceways, the distances between said opposed raceways varying, the surfaces of said raceways respectively lying in parallel lines, one line drawn from a common point in the axis of said members passing through each one of the corresponding raceway surfaces and sets of rollers between said raceways.

8. An anti-friction bearing comprising inner and outer members having opposed raceways of different diameters, opposing raceways having parallel faces, the distances between said opposed raceways varying, and sets of cylindrical rollers of different diameters between said raceways one line drawn from a common point in the axis of the members passing through each one of the raceway surfaces correspondingly on opposite sides of said rollers, the axes of the rollers meeting said point.

9. An anti-friction bearing comprising inner and outer members having opposed raceways of different diameters, and sets of rollers of different diameters between said raceways, one of said members being engaged by all the rollers, and the other member having a plurality of graduated raceways each of which is engaged by one set of rollers, one line drawn from a common point in the axis of said members passing through each one of the raceway surfaces correspondingly on opposite sides of said rollers.

10. An anti-friction bearing comprising inner and outer members having opposed parallel-lying raceways, and sets of cylindrical rollers between said raceways, each set comprising a plurality of rollers having diameters differing from the diameters of

the rollers of the other sets, one line drawn from a common point in the axis of said members passing through each one of the raceway surfaces correspondingly on opposite sides of said rollers.

11. An anti-friction bearing having inner and outer members provided with a plurality of opposed raceways having their surfaces crossing one line that passes from a common point in the line of the axis of the members correspondingly on opposite sides, and rollers interposed between said raceways and having their axes parallel to the said raceways.

12. An anti-friction bearing comprising inner and outer members provided with opposed raceways, the raceway of one of said members meeting a line that passes from a point in the line of the axis of said members, the other of said members having a plurality of raceways each of which crosses a line passing from said point, and sets of rollers between said raceways.

Signed at New York city, in the county of New York, and State of New York, this 3rd day of January A. D. 1913.

JOHN H. MODLER.

Witnesses:

T. F. BOURNE,

MARIE F. WAINRIGHT.