(No Model.) 2 Sheets—Sheet 1.

# W. MEEKER.

## BALL BEARING.

No. 576,134. Patented Feb. 2, 1897.

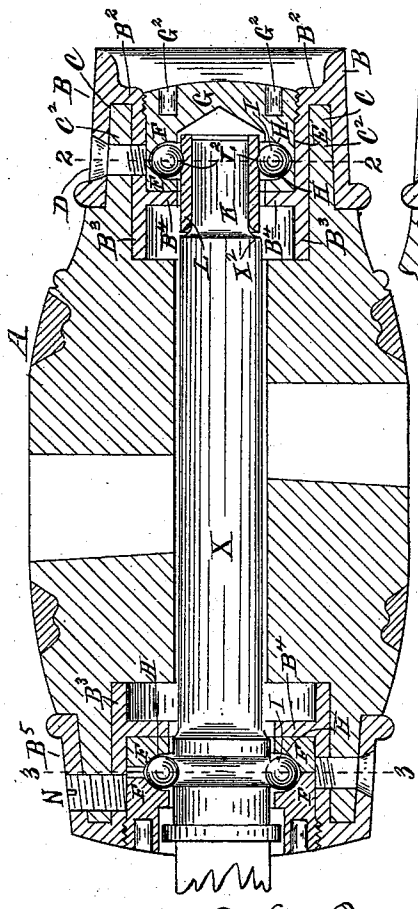

Fig. 1.

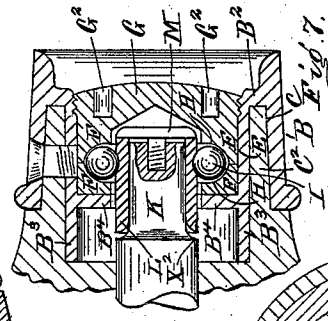

Fig. 7.

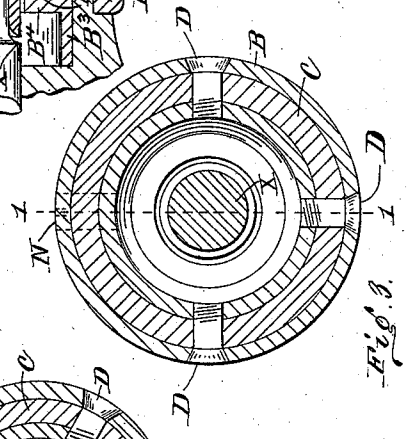

Fig. 3.

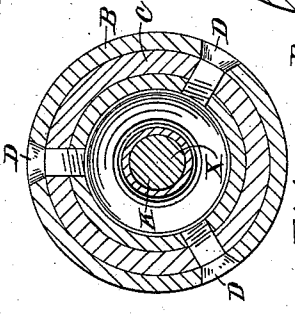

Fig. 2.

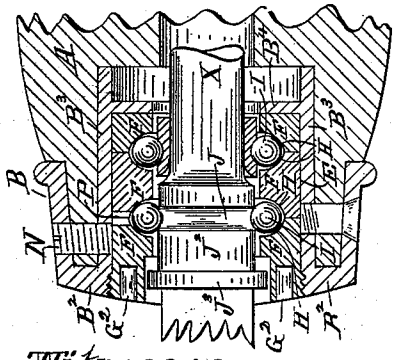

Fig. 5.

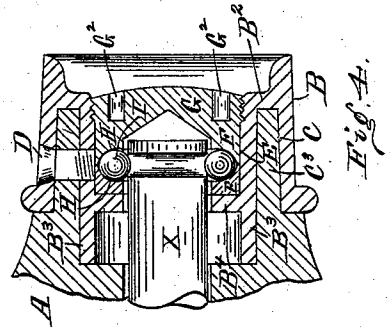

Fig. 4.

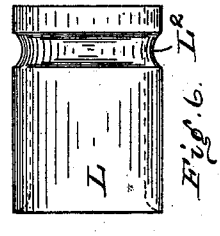

Fig. 6.

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(No Model.) 2 Sheets—Sheet 2.

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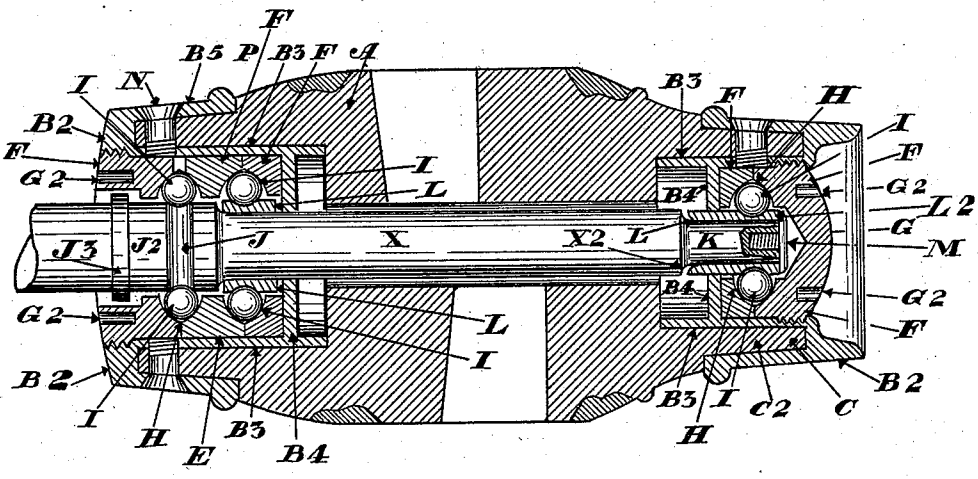
FIG 8

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# UNITED STATES PATENT OFFICE.

WILLIAM MEEKER, OF WASHINGTON COURT-HOUSE, OHIO.

## BALL-BEARING.

SPECIFICATION forming part of Letters Patent No. 576,134, dated February 2, 1897.

Application filed March 7, 1895. Serial No. 540,876. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM MEEKER, a citizen of the United States, and a resident of the city of Washington Court-House, in the county of Fayette and State of Ohio, have invented certain new and useful Improvements in Ball-Bearing Wheels, of which the following is a specification.

The several features of my invention and the various advantages resulting from their use, conjointly or otherwise, will be apparent from the following description and claims.

In the accompanying drawings, making a part of this application, and in which similar letters of reference indicate corresponding parts, Figure 1 is a vertical central longitudinal section of a wheel-hub, illustrating my invention, said section being taken in the plane of the dotted line 1 1 of Fig. 3. Fig. 2 represents a forward transverse vertical section, partly in elevation, taken in the plane of the dotted line 2 2 of Fig. 1. Fig. 3 represents a rear transverse vertical section, partly in elevation, taken in the plane of the dotted line 3 3 of Fig. 1. Figs. 4 and 7 represent in section a front portion of the hub and its accompaniments; and Fig. 5 represents a section of the rear portion of the hub, illustrating modifications of construction, all of these sections being longitudinal and taken in the plane of the dotted line 1 1 of Fig. 3. Fig. 6 represents an enlarged side elevation of the sleeve, which is a feature of my invention. Fig. 8, Sheet 2, is a vertical central longitudinal section of a wheel-hub, illustrating my invention and embodying the mechanisms shown, respectively, in Figs. 5 and 7, the axle and certain other portions, as the balls, &c., being shown in elevation.

A indicates a wooden hub provided with metal point-band B and a butt-band $B^5$. The appearance of the outside of this hub thus provided is the same as the ordinary hub having point and butt bands. The new feature of invention in connection with these bands is that the outer end of each band extends across a portion of the adjacent end of the hub and then extends inwardly, thus forming a substantial box at its end of the hub. The purpose of this box is to hold the bearings and at the same time to avoid cutting away the center of the hub. This cutting away of the center of the wooden hub has hitherto been done in all cases where the box extends through the same.

The wooden hub is turned (or formed) on the outside, the same as any ordinary hub, but is cupped at the end to admit of the inward extension of the band at that end.

The wood of the hub is left larger than the space between the inside and outside portions of the band, and the band is forced over and upon this wood and the latter compressed therein. Thus the bands are held securely upon the wooden portion of the hub. For further explanation of this construction of the wooden hub and end bands I offer the following: Each of the bands B and $B^5$ near its outer end is provided with the inwardly-extending flange $B^2$, and from the inner portion (radially considered) of this flange $B^2$ extends the cylindrical extension or sleeve $B^3$ toward the plane of the spokes. The length of this sleeve $B^3$ is determined by the necessities of the construction of the bearing mechanism, as will be hereinafter fully apparent.

By the aforedescribed construction of the band and sleeve a space C is left between the bands B and $B^5$, respectively, and the sleeve $B^3$, and this space is slightly tapered—viz, increasing in width from the flange $B^2$ toward the spokes.

The wood of the adjacent end of the hub is bored out or cupped, so as to diminish the thickness of the same from within until a thick cylindrical flange or sleeve of wood, as $C^2$, is left. The thickness of this flange is slightly greater than the width of the said space C. The wooden flange $C^2$ of the hub A is then driven into the space C to the flange $B^2$ and compressed and wedged securely in position.

It is to be understood that the flange $B^2$ and sleeve $B^3$ are ordinarily in one piece with their respective adjacent bands B and $B^5$.

To make the connection between each box-sleeve band and the wooden hub doubly secure, so that no unexpected or accidental blow or force can be able to separate them, I employ screws D, (preferably three in number and at equal distances apart around each band.) Each of these screws extends through the band and through the wooden flange $C^2$ and is screwed into the sleeve $B^3$.

Each of the box-sleeves $B^3$ has a broad flat annular interior surface E, presenting an appropriate surface against which the outer surfaces of the complementary rings F F (holding the ball-bearings) rest. A stop or projection $B^4$, extending radially inwardly from the sleeve $B^3$, prevents the rings F F from sliding toward the spoke-center of the hub. At the front end of the hub a cap G, screwed to the outer end of the part B $B^2$ $B^3$, is made integral with the outer one of the pair of rings F and prevents these rings from improperly sliding toward the outer end of the hub to which they are adjacent. The making of the outer ring F integral with the cap not only economizes metal, but also facilitates the withdrawal of the outer ring when occasion demands.

The preferred mode of securing the cap G to the part B $B^2$ $B^3$ is by screwing the same within and to the outer end portion of the sleeve $B^3$, substantially as shown. Suitable means for unscrewing this cap are provided, the preferred means being the recesses $G^2$, adapted to receive a forked wrench, well known in the art of wheel and axle manufacture.

The inner adjacent edge of each pair of rings is cut away in a form bevel or concave, (in cross-section,) these bevel or concave formations extending all the way around, thus providing a groove H, wherein the outer surfaces of the balls I are received.

In regard to the rear circle or series of balls I it will be observed that those surfaces of these balls which are toward the axle X fit and roll in a circumferential groove J in the rear portion of the axle. This rear portion of the axle X is usually enlarged, as indicated by the character $J^2$. The customary annular flange or shoulder $J^3$ is present, fixed to the axle at rear of the rear ring F and, within an extended portion of the latter, screwed into the sleeve $B^3$, substantially as shown, and containing recesses $G^2$ for application of the forked wrench to unscrew this ring F.

I reduce the forward end portion of the axle X substantially as shown and mark this reduced portion K. On this reduced portion K, I locate a sleeve L. This sleeve can slip readily around the axle. In the outer peripheral portion of this sleeve L, I form a groove $L^2$, and it is in this groove that these surfaces of the front series of balls I, which are nearest the axle, fit. The balls roll in this groove. Ordinarily the sleeve will remain stationary with the axle, the balls rolling on the sleeve. A portion of each of the front series of balls being in this groove $L^2$ of the sleeve and another portion being in the groove H H in rings F F, and the latter being stationary with the hub, the sleeve L is held in place on the axle X. Some of the principal objects of this important feature of my invention will appear from the following explanation:

The longitudinal expansion of the metal axle differs in extent from the expansion of the hub. Such will be the case when the hub is altogether of metal and also when the hub is composed in part of metal and in part of wood. In the latter instance the difference in expansion will be greater than in the case of a metallic hub. Conversely, the difference in contraction between the axle and the hub will be in like ratio. This difference in the ratio of contraction and expansion causes in the ball-bearing hubs as heretofore constructed great increase of friction, for the reason that the unequal expansion referred to moves the groove H H out of alinement with groove $L^2$ and causes the balls to bind between the side of one groove and the obliquely-opposite side of the opposing groove. In such event nearly all of the advantages derived from the employment of the balls are neutralized, and frequently the hub binds on the wheel so tightly that the wheel will not revolve, or if it does revolve the axle or hub is cut by the excessive friction. I leave room between the shoulder $X^2$ of the axle and the adjacent end of the sleeve L and also at the other end of this sleeve for the expansions noted.

It should be observed that the hub is held in place on the axle by means of the rear circle of balls at the rear end of the hub.

By unscrewing the annular rear piece (ring) E the axle may be withdrawn, together with the rear circle of balls. The sleeve L and the forward circle of balls around said sleeve will remain in place. Such arrangement is very convenient, as it avoids the necessity of replacing the forward circle of balls in position each time the axle is withdrawn.

The addition of the cap-piece M, (see Fig. 7,) resting, as it does, in close proximity to the forward end of the sleeve L, prevents the axle X from being slipped rearwardly out of place in case the securing-ring F at the rear end of the hub is accidentally loosened or unscrewed; but such cap-piece does not in any way interfere with the longitudinal movement due to expansion or contraction, because said cap-piece M is fixed stationary in the end of the axle X and there is enough room left on either end of the sleeve L to allow it and the axle X sufficient play in relation to each other, substantially as shown. This cap-piece M is not, however, a necessity, but simply a precautionary means, which may or may not be employed, as desired.

As I have before stated, the axle may be withdrawn from the hub or inserted in place therein without disturbing the position of the sleeve L or the front series of balls which roll on it.

For convenience in manipulating the series of balls at the rear end of the hub and for properly locating them after the axle has been inserted in the hub and placed in position I employ a device of an invention secured by Letters Patent No. 534,047, issued to me February 12, 1895, to wit: I provide a suitable screw-stopple, as N, (see Figs. 1 and 5,) screwed through the part B $B^2$ $B^3$ or $B^5$ $B^2$ $B^3$

and reaching the ring F, substantially as shown. An opening P of less diameter than the balls is present in the vicinity of said screw N and between the rings F F when the rings are screwed together. When the rear ring is screwed back and the screw-stopple N is withdrawn, the balls I can be successively dropped through the opening vacated by the screw-stopple and down into the rings and against the axle. Then by advancing the rear ring F toward the spokes the balls are forced into place—viz., into the groove in the axle and into the groove conjointly formed by the rings F F. The screw-stopple can then be replaced. By reversing this operation the balls can be removed, the hub being turned so that the opening of the screw-stopple and the opening P are beneath, instead of above, as shown.

When desired, an additional sleeve L, carrying one or more series of balls, may be located at the rear of the hub in conjunction with the concentric rings F, holding the balls in the hub. Such second sleeve L, carrying one of such series, is shown in Fig. 5. This last arrangement is desirable when two series of balls are to be employed at the rear of the hub, and is obviously preferable to the plans heretofore employed of having the grooves for each of the inner surfaces of each series cut directly into the axle itself.

While I have shown but one series of balls in relation to the sleeve, it will be understood that two or more series of the same can be applied thereto, whether the sleeve be located at the front or rear of the hub.

The number of series of balls working in grooves, as J, in the axle itself at the rear end of the hub may be varied, as desired.

When any preferred means other than a series of balls working in a groove J in the axle itself are employed to hold the axle in place in the hub, then such series may be dispensed with, the sleeve or sleeves L and their rows of balls being, nevertheless, retained.

The combination of the cap G and ring F, formed integral with each other, is of use and applicable not only in connection with a sleeve, as L, on the axle, but also when the balls roll in a groove cut into the axle itself, substantially as shown in Fig. 4.

What I claim as new and of my invention, and desire to secure by Letters Patent, is—

1. In a ball-bearing wheel, the combination of the axle X, having at its rear the groove J, and the circle of balls I fitting therein and the movable rings F, F, and at the forward portion of the axle, the reduced portion K, sleeve L rotatable around the axle and having the groove $L^2$, a circle of balls I entering said groove, the movable rings F, F, of the hub forming a groove, and the cap G thereof, and the inner cap M secured to the axle, substantially as and for the purposes specified.

2. In a ball-bearing wheel, the hub and axle, a sleeve on the front end of the axle and a sleeve on the rear portion of the axle, the sleeves having annular grooves and rotatable around the axle, and a series of balls, one series for each groove, and rings of the hub forming opposing grooves, and means for preventing the axle and hub from slipping longitudinally as respects one another, substantially as and for the purposes specified.

3. In a ball-bearing wheel, the hub, and axle, a sleeve on the front end of the axle and a sleeve on the rear portion of the axle, the sleeves rotatable around the axle and having annular grooves, and series of balls, one series for each groove, and sliding rings carrying opposing grooves, and supported by the hub, and means for preventing the axle and hub from slipping longitudinally as respects each other, substantially as and for the purposes specified.

4. In a ball-bearing wheel, the hub, and axle, a sleeve on the front end of the axle and a sleeve on the rear portion of the axle, the sleeves rotatable around the axle and having annular grooves, and series of balls, one series for each groove, and annular portions of the hub having grooves respectively opposing the grooves of the sleeves, the axle having a fixed groove J, and the hub having a groove H, opposed to groove J, and a series of balls for the latter groove, substantially as and for the purposes specified.

5. In a ball-bearing wheel, the hub, and axle, a sleeve on the front end of the axle and a sleeve on the rear portion of the axle, the sleeves rotatable around the axle and having annular grooves, and series of balls, one series for each groove, and annular portions of the hub forming opposing grooves, and a cap M screwed to the end of the axle just beyond the forward sleeve, substantially as and for the purposes specified.

6. In a ball-bearing wheel, the hub, and axle, a sleeve on the front end of the axle and a sleeve on the rear portion of the axle, the sleeves rotatable around the axle and having annular grooves, and series of balls, one series for each groove, and opposing grooves furnished by the mechanism of the hub, and a cap as M screwed to the end of the axle just beyond the forward sleeve, the axle being provided with groove J, and the adjacent surrounding portion of the hub provided with a groove being opposite to said groove J, substantially as and for the purposes specified.

7. In a ball-bearing wheel, the combination of the axle and certain annular portions of the hub forming a groove H and one of which portions is removable, and the axle having a groove J opposed to the groove H and a series of balls located in the said groove, the rings F, F having the radial opening P, and the stopple-opening through the hub and the stopple N secured therein, substantially as and for the purposes specified.

8. In a ball-bearing wheel, the combination of the axle and certain annular portions of the hub forming a groove H and one of which portions is removable, and the axle having a

groove J opposed to the groove H and a series of balls located in the said groove, the rings F, F, having the radial opening P, and the stopple-opening through the hub and the stopple N secured therein, and sleeve L on the rear portion of the axle in front of the groove J, and a shoulder of the axle tightly embracing the axle so as to be capable of rotating thereon except under extraordinary strain, having a groove therein, and a series of balls in the groove and rolling also in an opposing groove provided in the encircling mechanism of the hub, substantially as and for the purposes specified.

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Attest:
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