Nov. 26, 1957 J. F. KOPCZYNSKI 2,814,206

ULTRA HIGH SPEED BEARINGS

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Fig. 1.

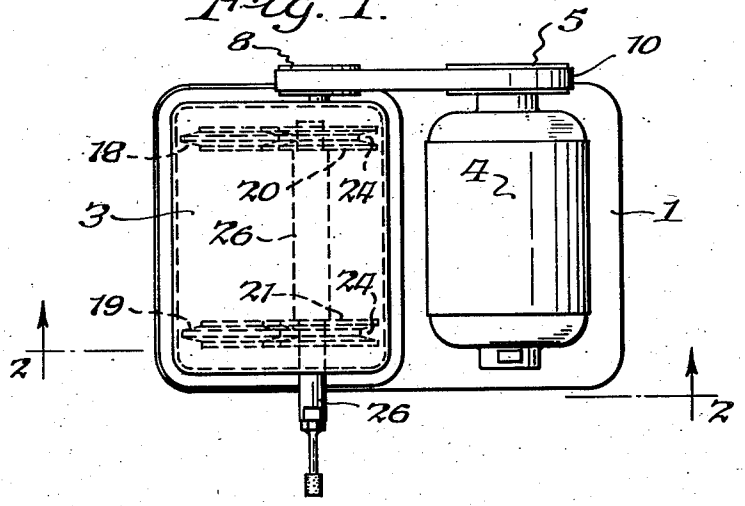
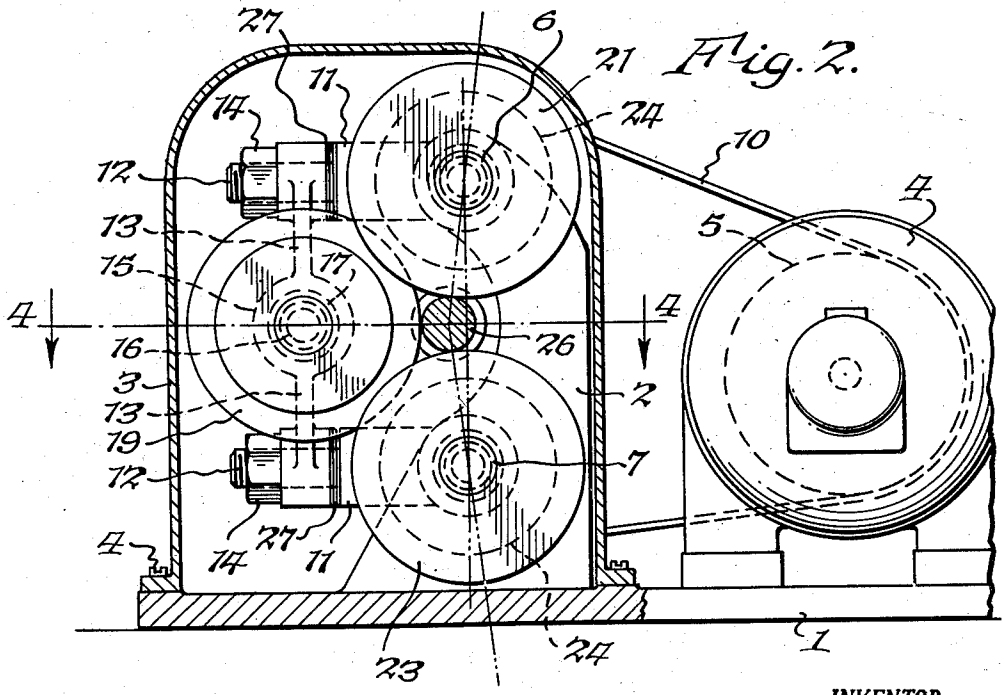


Fig. 2.



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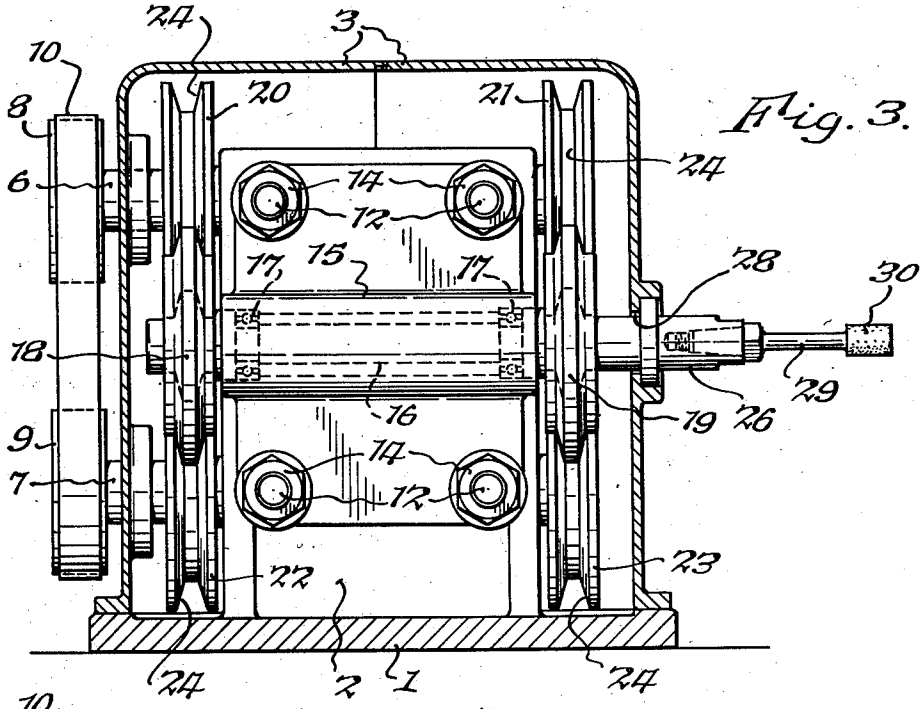


Fig. 3.

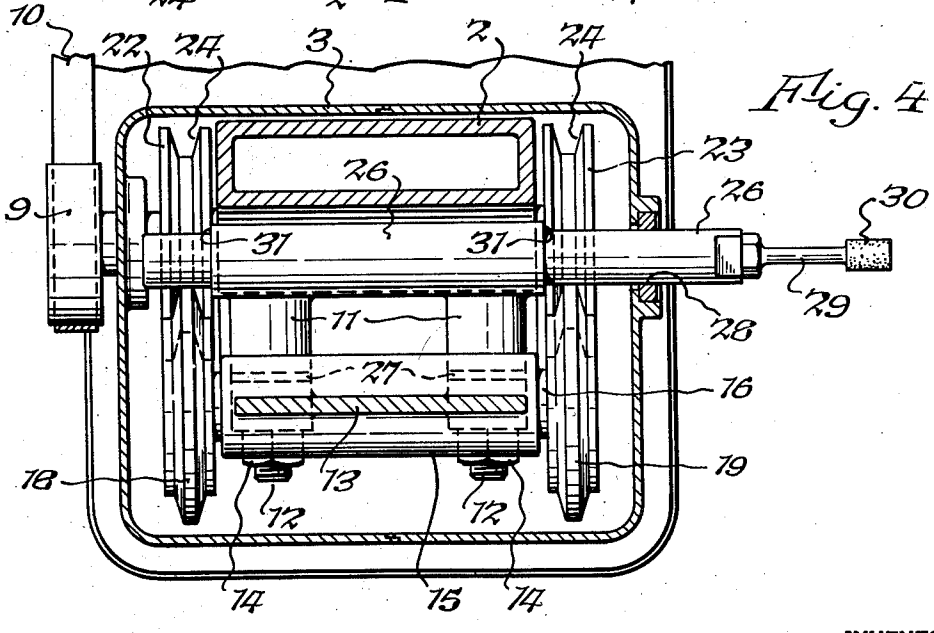


Fig. 4

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2,814,206

Patented Nov. 26, 1957

2,814,206

ULTRA HIGH SPEED BEARINGS

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Application January 24, 1956, Serial No. 561,034

6 Claims. (Cl. 74—209)

This invention relates to a high speed spindle drive, with which a spindle may be operated at ultra high speeds without overheating of bearings.

An object of the invention is to provide an improved mounting for a high speed spindle, by which a spindle, even those of very small diameters, may be given unusually high rotary speeds without overheating of the bearings by which it is supported, which will be relatively simple, practical, compact and durable, and which will provide a relatively high driving pressure on the shaft.

Another object of the invention is to provide a simple, compact unit for mounting and operating a spindle that may be used to detachably mount various objects or tools for high speed rotation, and with which the spindle may be changed and adjustment made for different sizes of spindles.

Other objects and advantages will be apparent from the following description of one embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a top plan of a device constructed in accordance with this invention, and illustrating its use for mounting a small high speed grinding tool;

Fig. 2 is a vertical sectional elevation of the same, the section being taken approximately along the line 2—2 of Fig. 1;

Fig. 3 is a side view of the same, the base and housing being broken away and in section; and

Fig. 4 is a horizontal, sectional plan of the same, the section being taken approximately along the line 4—4 of Fig. 2.

In the illustrated embodiment of the invention, a base 1 is provided with an upright pedestal 2 (see Figs. 2 and 4), which is enclosed in a housing or casing 3 that is removably secured over the pedestal, and to the base, such as by screws 4. Also mounted on the base 1 and outside of the housing 3 is an electric motor 4 which operates a drive pulley 5. Two shafts 6 and 7 are rotatably mounted on the pedestal 2 by suitable anti-friction bearings adjacent the ends of the shafts. These shafts 6 and 7 extend through the housing 3 at one end, the extending end of shaft 6 carrying a pulley 8, and the extending end of shaft 7 carrying a pulley 9 of the same size as pulley 8. A belt 10 runs in succession around or over the pulleys 5, 8 and 9, so that when the motor 4 is operating it will drive the pulleys 8 and 9 and thus rotate the shaft 6 and 7 in the same directions, and at the same speeds.

Extending from a face of the pedestal 2, are four studs or posts 11 (Figs. 2 and 4) which terminate at their outer ends in reduced threaded end portions 12. These studs 11 are arranged in vertical and horizontal alignment, with two of the studs near the top of the pedestal, and the other two near the bottom of the pedestal and aligned horizontally with each other and also vertically below those of the upper end of the pedestal. A web 13 is confined against the shoulders of the posts 11, by having apertures in the web fitted over the posts and confined on

the posts by nuts 14. The web 13 is thin enough so that it may flex somewhat in the space between the upper pair of posts and the lower pair, and approximately midway between these pairs of posts in a vertical direction, this web is provided with an enlargement 15 which serves to rotatably mount a shaft 16 through suitable ball or roller bearings 17 that are provided near the ends of the enlargement. Fixed on the ends of this shaft 16 are wheels 18 and 19, which are disposed at the ends of the pedestal 2.

The shafts 6 and 7 are rotatably mounted in the pedestal by suitable anti-friction bearings similar to the bearings 17. Wheels 20 and 21 (Fig. 3) are fixed on the shaft 6 at the ends of the pedestal, so as to rotate with the shaft, and wheels 22 and 23 are fixed on the shaft 7 to rotate therewith at the ends of the pedestal 2. The wheels 18, 20 and 22 are in side by side alignment with one another, and the wheels 19, 21 and 23 are in sidewise alignment with one another. The wheels 20, 21, 22 and 23 have peripheral grooves 24, and the wheels 18 and 19 have a peripheral cylindrical rib of substantial size or width, that can enter the grooves 24 and telescope somewhat therewith in order to enable a close approach of the wheels 18 and 19 to the other wheels on shafts 6 and 7 which are aligned therewith. This provides a triangle of three wheels at each end of the pedestal, so that a spindle or rod 26 may be clamped between the three wheels of each triangle and rotatably confined in the triangle by the peripheries of the three wheels.

The clamping of the rod 26 between the wheels of a triangle at spaced points along the length of the rod will provide an adequate mounting for the rod 26 which will withstand lateral pressures on the ends of the rod while it is rotating. This rod 26 is preferably and usually quite small in diameter, and since the peripheries of the wheels 18 and 19 can enter the grooves 24 in the wheels on the other shafts that are aligned therewith, the three wheels of each triangle can closely approach and engage and rotatably mount a rod 26 of relatively small diameter. The distance between the peripheries of the wheels 20 and 22 at one end and between the wheels 21 and 23 at the other end of the pedestal is slightly less than the diameter of the spindle or rod 26 to be rotated therein, and therefore, when the rollers 18 and 19 press the rod against the pair of wheels that are above and below the rod, as shown in Fig. 2, a very small pressure on the rod by the wheels 18 and 19 will create a considerably greater pressure or friction on the rod where the top and bottom wheels engage with the rod 26, so as to provide good driving contact for the rod. Shims 27 are provided on each reduced threaded end of the posts 11 between the web 13 and the shoulders on the post 11. By varying the number of shims on each post, one may adjust the web which rotatably supports the third pair of wheels, toward and from the rod 26 and thus accommodate rods of different diameters.

The number of shims is so selected that when the web is confined snugly against the shoulders on the post, the web will have a slight flexing force thereon, that will resiliently urge the wheels 18 and 19 into contact with the rod 26. When the motor 4 is operated, it will act through the belt 10 to rotate the shafts 6 and 7 and, through the wheels mounted on those shafts, will rotate the rod 26. This rod 26 at one end extends through the housing through an opening 28 and at its outer end it has a threaded recess in the end face into which is threaded a spindle 29 carrying on its free end a machine tool, such as a small diameter machine grinder 30. Thus by unscrewing the spindle 29, one may remove the tool 30 and replace it with a fresh one or the tool 30 may be replaced by a small object to be worked upon by some outside machine. The rod 26 has shoulders 31 on its ends which engage against the sides of one or more of the wheels

between which it is confined, and these shoulders limit endwise movement of the rod 26 so that it is never out of place in its mounting between the two triangles of wheels.

It will be understood that various changes in the details and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim:

1. An ultra high speed mounting for a spindle, which comprises a frame, a pair of shafts rotatably mounted on said frame in side by side, but spaced apart and parallel relation, a wheel fixed on each end of each shaft to rotate with its shaft, a plurality of studs carried by said frame intermediate the ends of said shafts in parallel, but spaced apart, relation and extending in directions crosswise of a plane passing through the axes of rotation of said shafts, a member having apertures through which said studs extend for support from the frame, means adjustable on said studs for confining said member on said studs and adjusting said member towards and from said pair of shafts, a bearing carried by said member, a third shaft rotatably mounted in said bearing in said member in a position side by side width, but spaced from and approximately parallel to said shafts of said pair of shafts, and bodily movable with said member toward and from said pair of shafts, a wheel on each end of said third shaft, a driving connection to at least one of said shafts, a rod rotatably confined between the triangle of wheels at each end of said three shafts and having interengagement with at least one of said wheels to prevent substantial endwise movement of said rod as it rotates with said wheels, whereby said rod may be rotated at ultra high speeds without high bearing speeds for said shafts.

2. An ultra high speed mounting for a spindle, which comprises a frame, a pair of shafts rotatably mounted on said frame in side by side, but spaced apart and parallel relation, a wheel fixed on each end of each shaft to rotate with its shaft, a plurality of studs carried by said frame in parallel, but spaced apart, relation and extending in directions crosswise of a plane passing through the axes of rotation of said shafts, a member having apertures through which said studs extend for support from the frame, means for confining said member on said studs and adjusting said member towards and from said pair of shafts, a bearing carried by said member, a third shaft rotatably mounted in said bearing in said member in a position side by side with, but spaced from and approximately parallel to said shafts of said pair of shafts, and bodily movable with said member toward and from said pair of shafts, a wheel on each end of said third shaft, a driving connection to at least one of said pair of shafts, a rod rotatably confined between the triangle of wheels at each end of said three shafts and having interengagement with at least one of said wheels to prevent substantial endwise movement of said rod as it rotates with said wheels, said member between its engagement with said

studs and its said bearing being somewhat flexible and resilient to enable a resilient but yielding pressure to be exerted on said third shaft in a direction toward said pair of shafts, whereby said rod may be rotated at ultra high speeds without high bearing speeds for said shafts.

3. An ultra high speed mounting for a spindle, which comprises a frame, a pair of shafts rotatably mounted on said frame in side by side, but spaced apart and parallel relation, a wheel fixed on each end of each shaft to rotate with its shaft, a plurality of studs carried by said frame in parallel, but spaced apart, relation and extending in directions crosswise of a plane passing through the axes of rotation of said shafts, a member having apertures through which said studs extend for support from the frame, means for confining said member on said studs and adjusting said member towards and from said pair of shafts, a bearing carried by said member, a third shaft rotatably mounted in said bearing in said member in a position side by side with, but spaced from and approximately parallel to said shafts of said pair of shafts, and bodily movable with said member toward and from said pair of shafts, a wheel on each end of said third shaft, a driving connection to at least one of said pair of shafts, a rod rotatably confined between the triangle of wheels at each end of said three shafts and having interengagement with at least one of said wheels to prevent substantial endwise movement of said rod as it rotates with said wheels, whereby said rod may be rotated at ultra high speeds without high bearing speeds for said shafts, the spacing between the peripheries of the adjacent wheels on said pair of shafts being slightly less than the outside diameter of said rod where confined between the wheels whereby with a relatively light pressure on said rod by the wheels on said third shaft, a considerably greater rotary driving pressure may be exerted on said rod.

4. The mounting as set forth in claim 1, and said bearing on said member being located between said studs, with the portion of said member between its portions mounted on said studs and its said bearing being resilient and flexible to provide for a resilient but yieldable pressure of the wheels on said third shaft against said rod.

5. The mounting as set forth in claim 1, and said studs having shoulders thereon against which said member abuts, said confining means being nuts on the free ends of said studs engaging against said member.

6. The mounting as set forth in claim 1, and said studs having shoulders thereon against which said member abuts, said confining means being nuts on the free ends of said studs engaging against said member, and shims on said studs in front of said shoulders to provide for adjustment of said member on said studs toward and from said pair of shafts.

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