March 5, 1929. F. J. OAKES ET AL 1,704,205

JOURNAL MECHANISM

Filed Jan. 8, 1927 5 Sheets-Sheet 1

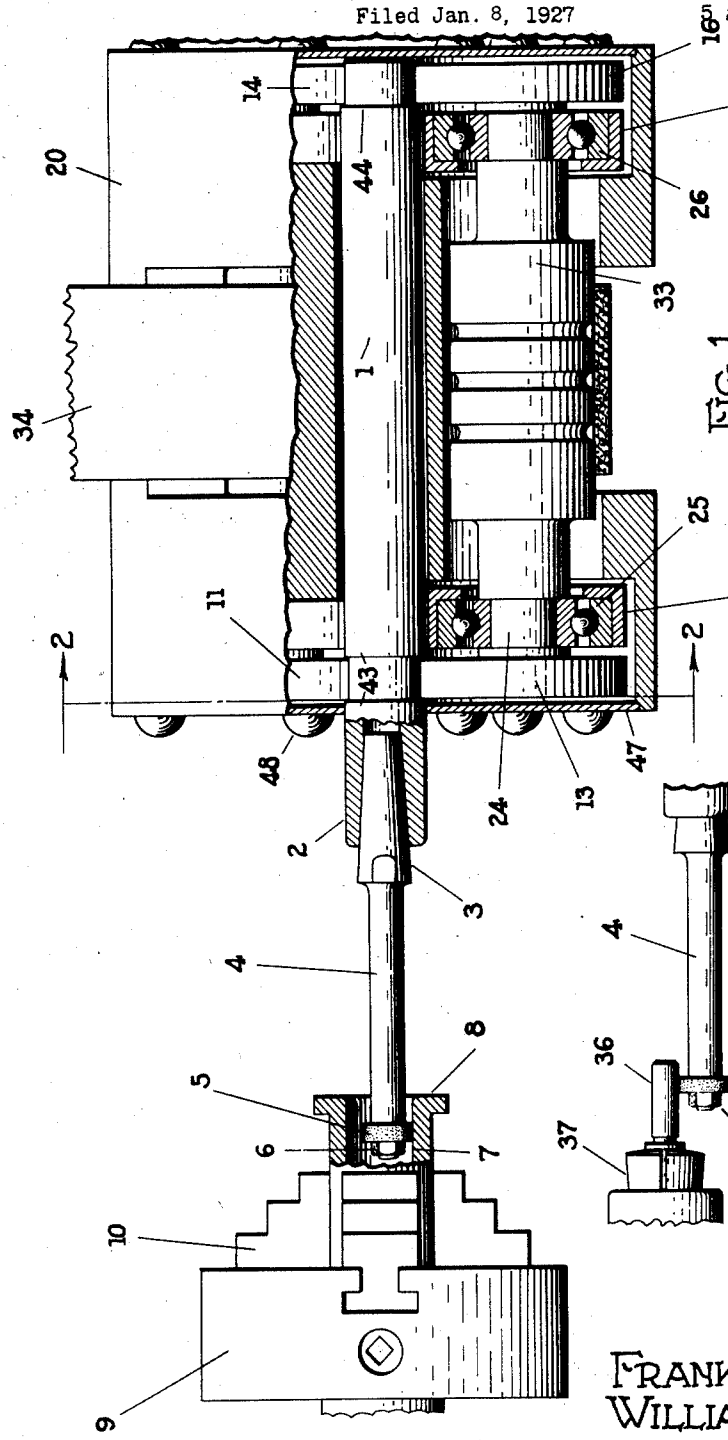


FIG. 1

FIG. 6

Inventors
FRANK J. OAKES
WILLIAM F. BRANDT
By Owen F. Spencer
Attorney

March 5, 1929. F. J. OAKES ET AL 1,704,205

JOURNAL MECHANISM

Filed Jan. 8, 1927 5 Sheets-Sheet 2

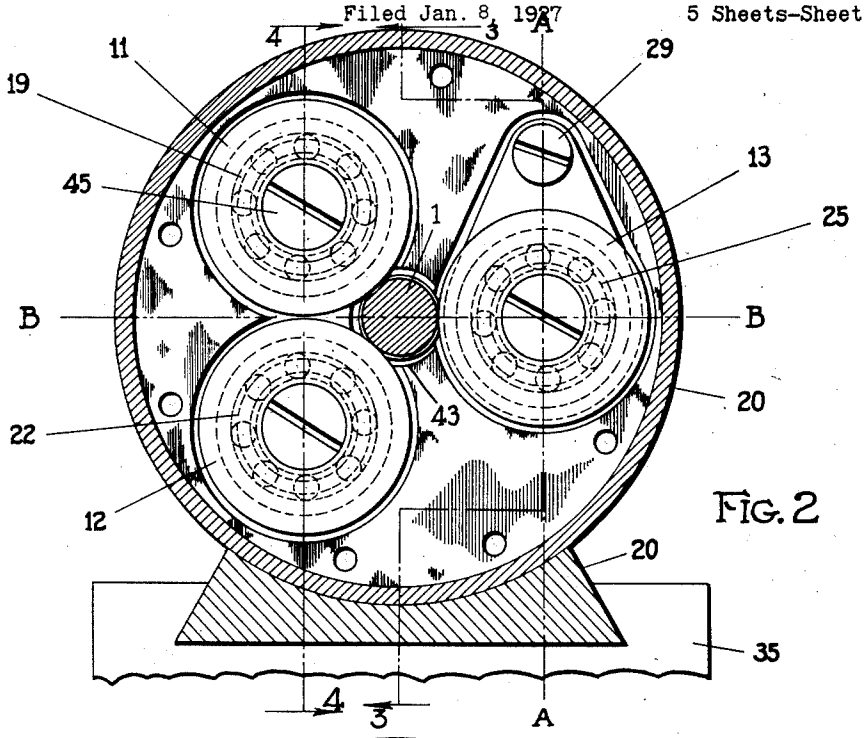


FIG. 2

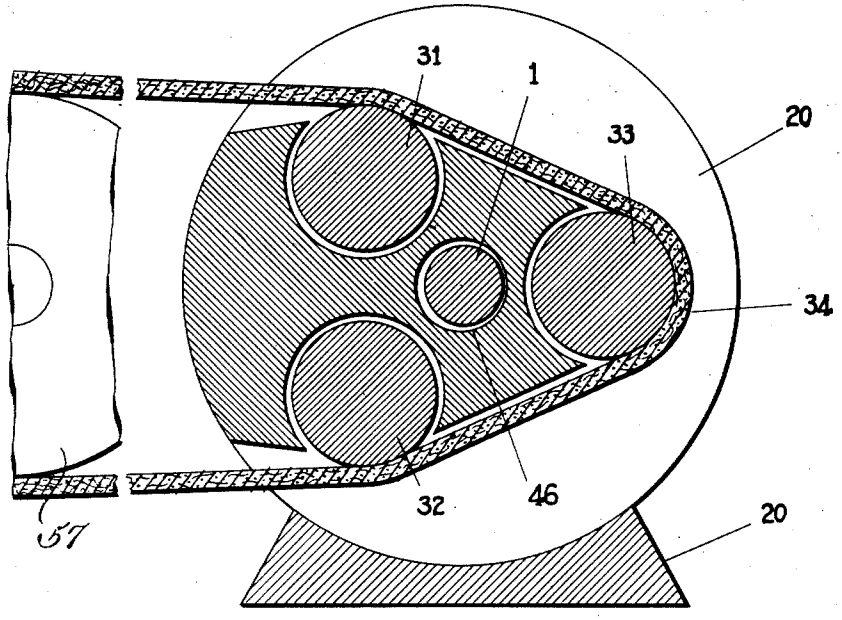


FIG. 5

Inventors

FRANK J. OAKES

WILLIAM F. BRANDT.

By Owen H. Spencer

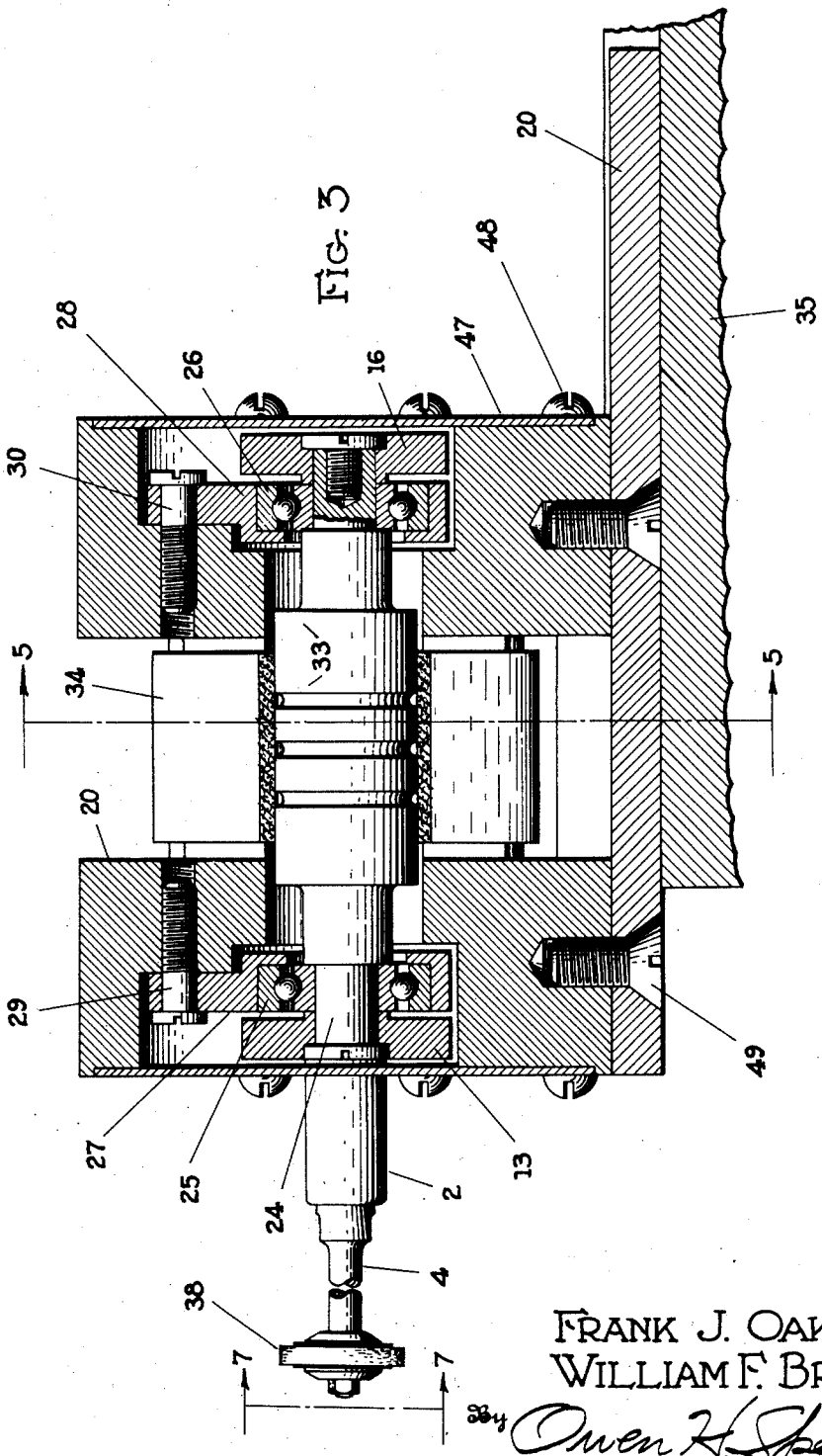
Attorney

March 5, 1929. F. J. OAKES ET AL 1,704,205

JOURNAL MECHANISM

Filed Jan. 8, 1927 5 Sheets-Sheet 3

FIG. 3



Inventors

FRANK J. OAKES

WILLIAM F. BRANDT

By Owen H. Spencer

Attorney

March 5, 1929. F. J. OAKES ET AL 1,704,205

JOURNAL MECHANISM

Filed Jan. 8, 1927 5 Sheets-Sheet 4

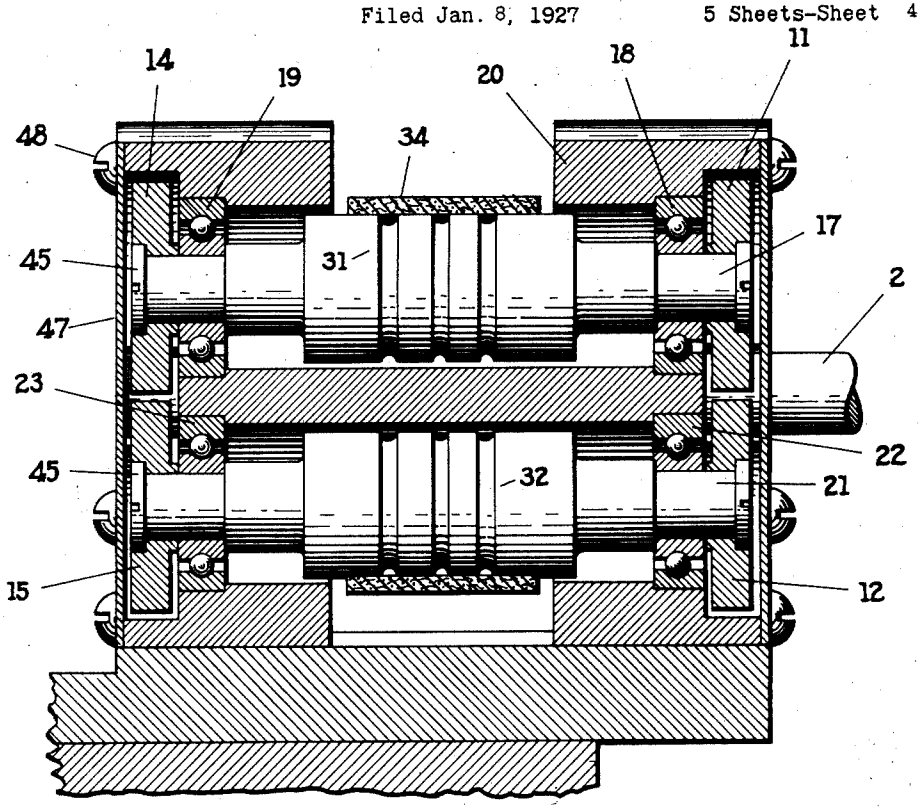


FIG. 4

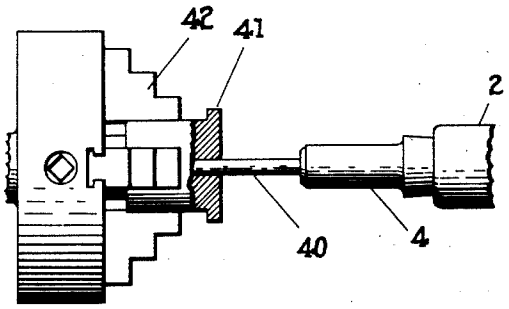


FIG. 8

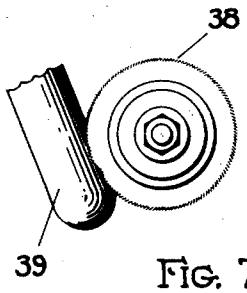


FIG. 7

Inventors

FRANK J. OAKES

WILLIAM F. BRANDT

By Owen H. Spencer

Attorney

March 5, 1929. F. J. OAKES ET AL 1,704,205

JOURNAL MECHANISM

Filed Jan. 8, 1927 5 Sheets-Sheet 5

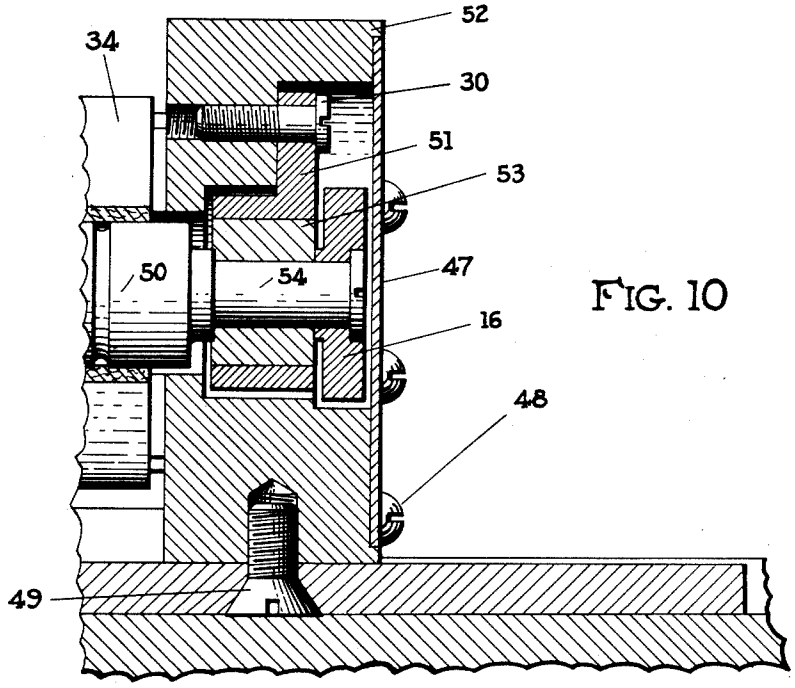


FIG. 10

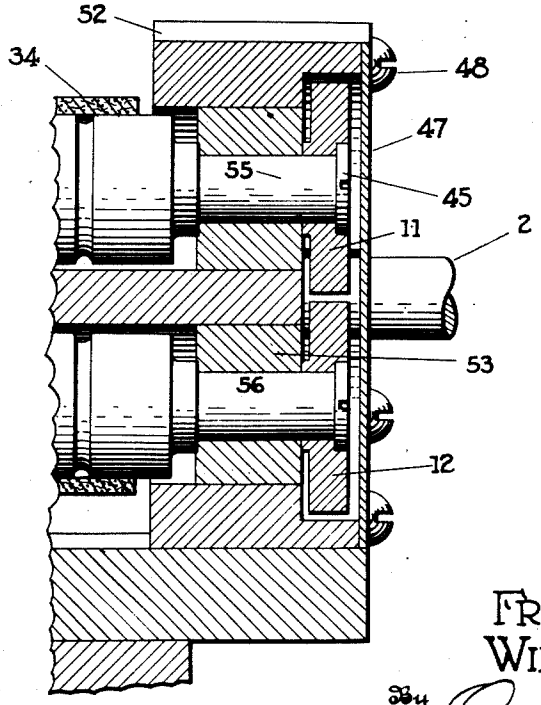


FIG. 9

Inventors
FRANK J. OAKES.
WILLIAM F. BRANDT.
By Owen F. Spencer
Attorney

Patented Mar. 5, 1929. 1,704,205

UNITED STATES PATENT OFFICE.

FRANK J. OAKES AND WILLIAM F. BRANDT, OF INDIANAPOLIS, INDIANA; SAID BRANDT ASSIGNOR TO SAID OAKES.

JOURNAL MECHANISM.

Application filed January 8, 1927. Serial No. 159,924.

This invention relates to machinery bearings as required by shafts intended to be revolved at a very high number of revolutions per minute, and more particularly to mechanisms where great speed and precision is required, and consists substantially in the construction, combination and arrangement of parts hereinafter set forth and pointed out more particularly in the claims.

An object of the invention is to provide a journal means in which shafting may be supported and efficiently revolved at a substantially higher working rate than has heretofore been considered practical, although greatly desired for certain purposes.

It is a primary object of the invention to provide a shaft journal means by which machinery shafting may be pivoted and revolved at excessively high speeds, with great accuracy and rigidity, and also to provide take up means which automatically adjusts for wear.

It is also an object to provide a journal of this class which not only serves as a pivot means but as a propelling means for the parts thus pivoted.

To transmit power to such pivot means, for driving same in propelling the parts so pivoted, it is a further object to provide a plurality of pulleys about such part, said pulleys being communicated with said pivot means, and having a driving belt means tangent to all of same, whereby the corresponding plurality of contact points on said belt means will together give ample frictional contact.

It is a still further object to provide a novel combination and arrangement of the journal and driving parts, by which the tautness of the driving belt thus used, will automatically actuate aforesaid wear take up means of such journal.

The above and other objects are attained by the structure illustrated in the accompanying drawings, in which Figure 1 is a fragmentary sectional plan view of the invention as used to journal a grinding wheel means in conjunction with an internal grinding mechanism; Fig. 2 is a cross sectional view taken in the proximity of line 2—2 of Fig. 1; Fig. 3 is a broadside sectional view taken in the proximity of line 3—3 of Fig. 2, and is a view of the same mechanism except that a polishing wheel is substituted for the grinding wheel shown in Fig. 1; Fig. 4 is a fragmentary sectional side view taken in the proximity of line 4—4 of Fig. 2; Fig. 5 is a cross sectional view taken in the proximity of line 5—5 of Fig. 3; Fig. 6 is a fragmentary detailed plan as seen from the same viewpoint as Fig. 1, and how the invention may be used in connection with external grinding mechanisms; Fig. 7 is a fragmentary end view taken in the proximity of line 7—7 of Fig. 3 and shows the polishing wheel means shown journalled by the invention in Fig. 3; Fig. 8 is a fragmentary sectional plan view illustrating the use of the invention as used in lapping, as understood in the realm of tool and die making; Fig. 9 is a fragmentary sectional view as seen from the same viewpoint as Fig. 1, for indicating the manner of using the invention with plain bushing type bearings; and Fig. 10 is shown for the same purpose, being a fragmentary sectional view as seen from the same viewpoint as Fig. 3.

Similar characters of reference designate similar parts thruout the different views. Referring to Figure 1, the numeral 1 designates a shaft having a sleeve end 2 in which the taper shank 3 of the grinding wheel arbor 4 is co-axially engaged. The miniature grinding wheel 5 is secured on the end of the arbor 4 by the nut means 6 in conventional manner. Said grinding wheel is shown in grinding tangency with the interior cylindrical surface 7 of the work 8, which is a typical drill jig bushing, and which is being thus accurately ground to a desired inside diameter, as will be understood by those familiar with the art. The numeral 9 designates an ordinary grinding machine chuck, the jaws 10 of which grip the work 8. It will be well understood by those familiar with grinding operations of this nature that while the grinding wheel 5 is thus rotated against said work at a desirably high rate of speed, that said chuck is also rotated at a much slower speed by the usual grinding machine gearing (not shown).

Referring to Fig. 2, the shaft 1 is shown sectionally and in tangency with the three idler rollers 11, 12 and 13, which are distributed about same in orbit arrangement, it being understood that the other end of said shaft is likewise disposed in tangency with the idler rollers 14, 15 and 16, as indicated in Fig. 1 and Fig. 4.

It will be obvious that the three rollers 11, 12 and 13, being thus disposed about the sleeve end 2 of the shaft 1, so as to embrace

same at different points of contact, confine and axially determine the working position of same, the rollers 14, 15 and 16, likewise restrict the other end of said shaft and form a pivotal support, by which arrangement a complete journal for said shaft is maintained.

Referring to Fig. 4, it will be seen that the rollers 14 and 11 are co-axially mounted on the different ends of the spindle 17 adjacent its ordinary ball bearings 19 and 18 which are conventionally supported within the frame 20. Likewise, the rollers 15 and 12 are co-axially mounted on the spindle 21, adjacent its ball bearings 23 and 22, which are also conventionally supported in the frame 20.

Referring more particularly to Fig. 3, it will be obvious that the rollers 13 and 16 are also co-axially mounted on the different ends of the spindle 24, adjacent its ball bearings 25 and 26, which are supported within the oscillatable arms 27 and 28, respectively, said arms being free to swing on their pivotal screws 29 and 30, respectively, and thus guide roller 13 and 16 toward said shaft.

By referring especially to Fig. 2, it will be seen that a plane indicated by line A—A passing thru the axes of the pivoted screws 29 and 30, and the spindle 24, will traverse another plane indicated by line B—B passing thru the axes of the shaft 1 and of the spindle 24, at approximately right angles. By this geometrical arrangement it will be understood that the rollers 13 and 16 with the spindle 24, may be swung toward or away from the shaft 1, by correspondingly swinging the arms 27 and 28 on the pivot screws 29 and 30; and the shaft 1 being confined at one end between the roller 13 and the rollers 11 and 12; and at the other end between the roller 16 and the rollers 14 and 15, may be thus kept snugly retained in contact with all of said rollers, regardless of wear, or may be released for disassembling, as desired. By this arrangement, rotation of said shaft may be caused by rotation of any or all of the spindles 17, 21 and 24, and said shaft may be thus driven by the aforesaid rollers, as well as journalled thereby.

It is understood that in carrying the rollers 13 and 16, the arms 27 and 28, the main object is that of complying with the required distance between the roller 13 and the rollers 11 and 12, as well as the distance between the roller 16 and the rollers 14 and 15, to keep said shaft crowded into the interception of the rollers 11 and 12, and of the rollers 14 and 15, without allowing bearing play, and at the same time without frictional binding or breakage. By this achievement, wear resulting either in the ball bearings 25, 26, 18, 19, 22 or 23, or on the peripheries of the aforementioned rollers or of the shaft 1, may be instantly and at all times, taken up by the swinging of the rollers 13 and 16 toward said shaft on the arms 27 and 28, an amount compensating for the total wear of the different parts affected. It will therefore be understood that when the possible and excessive speeds are attained, that said shaft is at all times durably journalled and by its relation with the aforesaid rollers, there is substantially no frictional slippage against same, or any other surfaces; and as said rollers are preferably about three times the diameter of said shaft, the spindles 17, 21 and 24 will be rotated at only about one-third the number of revolutions per minute, as the shaft 1. Therefore, any ordinary ball or other bearings used to journal said spindles will not be worked at a speed greater than about a third the speed of the shaft 1. This is very important, due to the fact that manufacturers of ball, roller and other bearings, have, by extensive experience, been able to inform the purchasers thereof, as to the safe maximum working capacity in revolutions per minute, to avoid self destruction due to intolerant degree of centrifugal force, which would cause the bearing material to break up, and to the unpermittable surface speeds, which cause heating and wear. If, for example, the aforesaid ball bearings were recommended for use in speeds up to 35,000 revolutions per minute, the shaft 1 could be driven at 100,000 revolutions per minute, without overworking said ball bearings.

The pulleys 31, 32 and 33 are formed on the spindles 17, 21 and 24, respectively, between the aforementioned respective ball bearings thereof, and by referring to Fig. 5, it will be seen that the central portion of the frame 20 is left somewhat vacant to expose the outer cylindrical portions of said pulleys, by which arrangement the driving belt 34 is threaded about onto working tangency with all of said pulleys. Said spindles are thus driven by said belt and all of said spindles thus serve to drive the shaft 1 thru the aforesaid rollers, by which arrangement it is made convenient to gear up the speed of the shaft 1 to a desirable high rate, due to the fact that the pulleys 31, 32 and 33 are of less diameter than the aforesaid rollers, the shaft 1 being considerably less in diameter than same.

It is a very important feature of this invention that the ordinary tautness of the belt 34 tends constantly to shift the rollers 13 and 16 with the spindle 24, on the arms 27 and 28 toward the shaft 1, thus automatically taking up for any wear on the different working parts, as soon as such wear occurs, and the shaft 1 is thereby always kept rigidly but freely pivoted.

It is also understood, as neither the shaft 1 nor said rollers can be produced exactly round, due to imperfection in manufacture etc. that the rollers 13 and 16 will accordingly be shifted toward and away from said shaft during each revolution of said shaft or roll-

ers, or both, to minutely compensate for such imperfections, during which the belt 34 yields and contracts accordingly.

Aside from the very high rate of speed made possible by a shaft journalled in the aforesaid manner, it will also be understood that a very high degree of efficiency is reached with very little wear, as the different characteristics of the arrangement affords operation without the overworking of any individual part or member, and with substantially no frictional resistance.

While grinding the work 8, as before mentioned, it is understood that the grinding wheel 5 is fed back and forth lengthwise in said work, by correspondingly feeding the frame 20 back and forth with the grinding machine head 35, to which it is gibbed. The means for thus manipulating said head 5 is not shown, but such means are a conventional part of the grinding machine proper.

In Fig. 6, the grinding wheel 5 being also pivoted as above mentioned, is used also whenever desired to grind the external cylindrical surfaces of work 36, which may be conveniently held in a typical grinding machine collet 37, usually considered a standard part of grinding machine equipment.

Fig. 7 illustrates the use of the polishing wheel 38 which may be used instead of the grinding wheel 5, when it is desired to polish such work as 39.

The shaft 1 may be used to drive a lapping tool 40, as shown in Fig. 8, which is substituted in the shaft 2 in place of the grinding wheel arbor 4, said tool being used as shown in lapping out a small hole in the work 41, which is conveniently supported in the chuck 42.

As shown in Fig. 1 and Fig. 2, the shaft 1 is provided with shoulders 43 which together straddle the adjacent periphery portion of the rollers 11, 12 and 13. In like manner, the shoulder 44 overlaps the inner adjacent periphery portion of the rollers 14, 15 and 16. These shoulders 43 and 44 are provided to retain shaft 1 in place, endways, to impart longitiudinal working thrusts of same to said rollers. This feature is not only useful in taking the working end thrusts of horizontal shafting so journaled, but also serves to prevent the shaft 1 from falling out of place when the apparatus as a whole is operated at a more vertical or angular position, which may be desirable.

It is understood that conventional roller or bushing bearings may be substituted for the ball bearings 18, 19, 22, 23, 25 and 26 shown in Fig. 4 and Fig. 3. The bearing for journalling the spindles 17, 21 or 24 is merely a matter of selection and is well within the realm of the subordinate.

The aforesaid rollers are conveniently retained in place on their respective spindles, by screw means 45.

A clearance hole 46 is provided thru the frame 20 for the shaft 1, and said shaft has no contact with the frames 20 or 52.

Removable plates 47, are secured to the ends of the frames 20 and 52 by the screw means 48 to conceal and protect the aforesaid rollers, bearings, shaft, etc.

The frames 20 and 52 are conveniently constructed of upper and lower section which are secured together by means of the screws 49.

Referring to Fig. 2, the ball bearings 19, 22 and 25 are indicated by dotted lines, the more important parts of said view being shown in solid lines.

Referring to Fig. 9, the spindles 55 and 56 substituted for the spindles 17 and 21 are adapted to be journalled by the relatively fixed plain bushing type bearings 53. These bearings are fitted to the frame 52, which is substituted for the frame 20. The spindle 54 shown in Fig. 10 is substituted for the spindle 24 being adapted to be journaled by the plain bushing bearings 53, and the arms 51 being also substituted for the arms 28 are adapted to carry the relatively fixed bushing bearings 53. As these two Figures 9 and 10 illustrate the manner of using plain bearings instead of ball bearings, in carrying the invention into effect, it is thought only to be a matter of mechanical skill to use any of the other well known bearing means instead of the ball bearings shown in the other figures, it being understood that the invention is in no way restricted to the particular style of journaling the spindles 17, 21 and 24.

Referring to Figure 5 the pulley 57 serves as an external driving means for the belt 34 which surrounds same in conventional manner.

While we have illustrated in a general way, certain instrumentalities which may be employed in carrying our invention into effect, it is evident that many modifications may be made in the various details without departing from the scope of the appended claims, it being understood that our invention is not restricted to particular forms, herein described.

We claim as our invention:

1. A journal mechanism comprising two roller means pivotally supported with their peripheries adjacent; a shaft means lodged in the intercalation of said roller means in working relation therewith; another roller means adapted to roll against said shaft means on the opposite side thereof from said intercalation, serving to confine said shaft means in working relation with all of said roller means for thus pivoting said shaft means; a shiftable means serving to pivot said other roller means and carry same toward said shaft means; and different pulley means connected with different ones of said roller means, a belt means surrounding said pulley means in common, said belt means serving as a yieldable means to hold said

shiftable means toward said shaft and thereby keep said other roller means in contact with said shaft means and crowd same into working relation with the first mentioned roller means.

2. A journal mechanism comprising two roller means pivotally supported; a shaft means lodged in the intercalation of said roller means in working relation therewith; another roller means adapted to roll against said shaft means on the opposite side thereof from said intercalation, serving to confine said shaft means in working relation with all of said roller means for thus pivoting said shaft means; a movable means serving to pivot said other roller means and carry same toward said shaft means; pulley means connected co-axially with said other roller means, serving to rotate said shaft means; and a machinery belt threaded over all for of said pulley means in working relation, revolving said shaft means, said belt serving as a yieldable means to hold said movable means toward said shaft and thereby keep said other roller means in contact with said shaft, and crowd same into working relation with the first mentioned roller means.

3. A journal mechanism comprising different roller means pivotally supported with their peripheries adjacent; a shaft means lodged in the intercalation of said roller means in working relation therewith; another roller means adapted to roll against said shaft means on the opposite side thereof from said intercalation, serving to confine said shaft means in working relation with all of said rollers for thus pivoting said shaft means; a swinging means serving to pivot said other roller means, and guide same toward said shaft means, when held in the direction thereof; pulley means connected co-axially with said other roller means; and conventional machinery belt means engaging said pulley means, and extending approximately in the direction of said shaft means, serving to rotate said pulley means, and at the same time hold said other roller means in frictional relation with said shaft, and said shaft in frictional relation with the first mentioned roller means, by its working tautness.

4. A journal mechanism comprising two roller means; a shaft means lodged in the intercalation of said roller means in working relation therewith; another roller means adapted to roll against said shaft means on the opposite side thereof from said intercalation, serving to confine said shaft in working relation with all of said roller means for thus pivoting said shaft means; a shiftable means serving to pivot said other roller means and carry same toward said shaft means; a pulley means secured co-axially to each of said roller means; a conventional machinery belt threaded over all of said pulley means in working relation, for revolving said shaft means, such belt serving to hold said shiftable means toward said shaft means by its working tautness; and a guide means serving to guide said shiftable means for directing said other roller means toward said shaft means.

5. A journal mechanism comprising different roller means pivotally supported with their peripheries adjacent; a shaft means lodged in the intercalation of said roller means in working relation therewith; another roller means adapted to roll against said shaft means on the opposite side thereof from said intercalation, serving to confine said shaft means in working relation with all of said roller means, for thus pivoting said shaft means; a shiftable means serving to pivot said other roller means and carry same toward said shaft means; a pulley means mounted co-axially on each of said roller means; and a machinery belt threaded over all of said pulley means in working relation, for revolving said shaft means, said belt tending to hold said shiftable means toward said shaft means by its working tautness.

6. A journal mechanism comprising a roller means; a shaft means in rolling contact with same; another roller means adapted to roll against said shaft means on substantially the opposite side thereof from the first roller means, serving to confine said shaft in rolling relation, for thus pivoting same; pivot means serving to pivot the different roller means independently; a hinged connection between said pivot means; pulley means connected with each of said roller means; and a machinery belt surrounding all of said pulley means in working relation, for revolving said shaft means, said belt serving to hold said roller means toward said shaft means by its working tautness.

7. A journal mechanism comprising a roller means; a shaft means in rolling contact with same; another roller means adapted to roll against said shaft means on substantially the opposite side thereof from the first roller means, serving to confine said shaft means in rolling relation, for thus pivoting same; pulley means connected with each of said roller means; independent pivot means serving to pivot said roller means independently, said pivot means being relatively movable toward and from each other, said pivot means having clearance to expose the outward portions of said pulley means; and a machinery belt surrounding all of said pulley means in working relation, for revolving said shaft means, the tension of said machinery belt, bringing the different pivot means more nearly together.

8. A journal mechanism comprising a shaft, pulley means consisting of a plurality of rollers arranged around said shaft for supporting and driving the shaft, one of said rollers being adjustable laterally, and an oblong flexible means passing around said mov-

able roller and contacting with the other rollers, the area of contact between the flexible means and the movable roller being greater than the area of contact with the remainder of the rollers, said flexible means driving all of said rollers, the tension of said flexible means retaining the adjustable roller in frictional contact with said shaft and said shaft in frictional engagement with the remainder of said rollers, that portion of the flexible means between the movable roller and the stationary rollers extending in an approximately straight uncurving line between said areas of contact.

9. A journal mechanism comprising a shaft, a plurality of pairs of rollers arranged around said shaft for supporting and driving said shaft, one pair of said rollers being adjustable laterally, a pulley associated with each pair of rollers, and a single belt for engaging said pulleys and driving said rollers, the tension of said belt retaining said adjustable rollers against said shaft and said shaft against the remaining pairs of rollers.

10. A journal mechanism comprising a shaft, a pulley means consisting of pairs of rollers arranged in substantially tri-angular formation around said shaft, one pair of said rollers being adjustable laterally, means for holding said shaft against longitudinal movement with respect to said rollers, and a flexible belt for driving all of said rollers directly, the tension of said belt acting to hold the adjustable rollers in engagement with said shaft and said shaft against the remainder of said rollers.

11. A journal mechanism comprising a shaft, a plurality of spindles paralleling said shaft, one of said spindles being adjustable laterally, a pair of rollers on each of said spindles, bearings for the respective ends of said spindles, a pulley on each spindle, and a single belt engaging all of said pulleys for driving said spindles, the tension of said belt forcing rollers on the adjustable spindle against said shaft and said shaft against the remainder of said rollers.

12. A journal mechanism comprising a shaft, a pulley means consisting of a plurality of roller means arranged around said shaft, a pair of pivoted arms supporting one of said roller means, whereby said last roller means may be adjusted laterally, means for holding said shaft against longitudinal movement independently of said roller means, and a single flexible belt for driving all of said roller means in direct contact therewith, the tension of said belt forcing the adjustable roller means against said shaft and the shaft against the remainder of said roller means.

13. A journal mechanism comprising a shaft, a pulley means consisting of a plurality of rollers arranged around said shaft for supporting and driving the shaft, one of said rollers being adjustable laterally, and an oblong belt for driving all of said rollers, the tension of said belt retaining the adjustable roller in frictional contact with said shaft and said shaft in frictional engagement with the remainder of said rollers, said rollers serving as a pulley means for said belt and providing the sole contacting support therefor.

In testimony whereof, we have hereunto set our hands on this the 31st day of December, A. D. 1926.

FRANK J. OAKES.
WM. F. BRANDT.