No. 721,400. PATENTED FEB. 24, 1903.

Z. R. TUCKER.

GRINDING MACHINE.

APPLICATION FILED FEB. 7, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

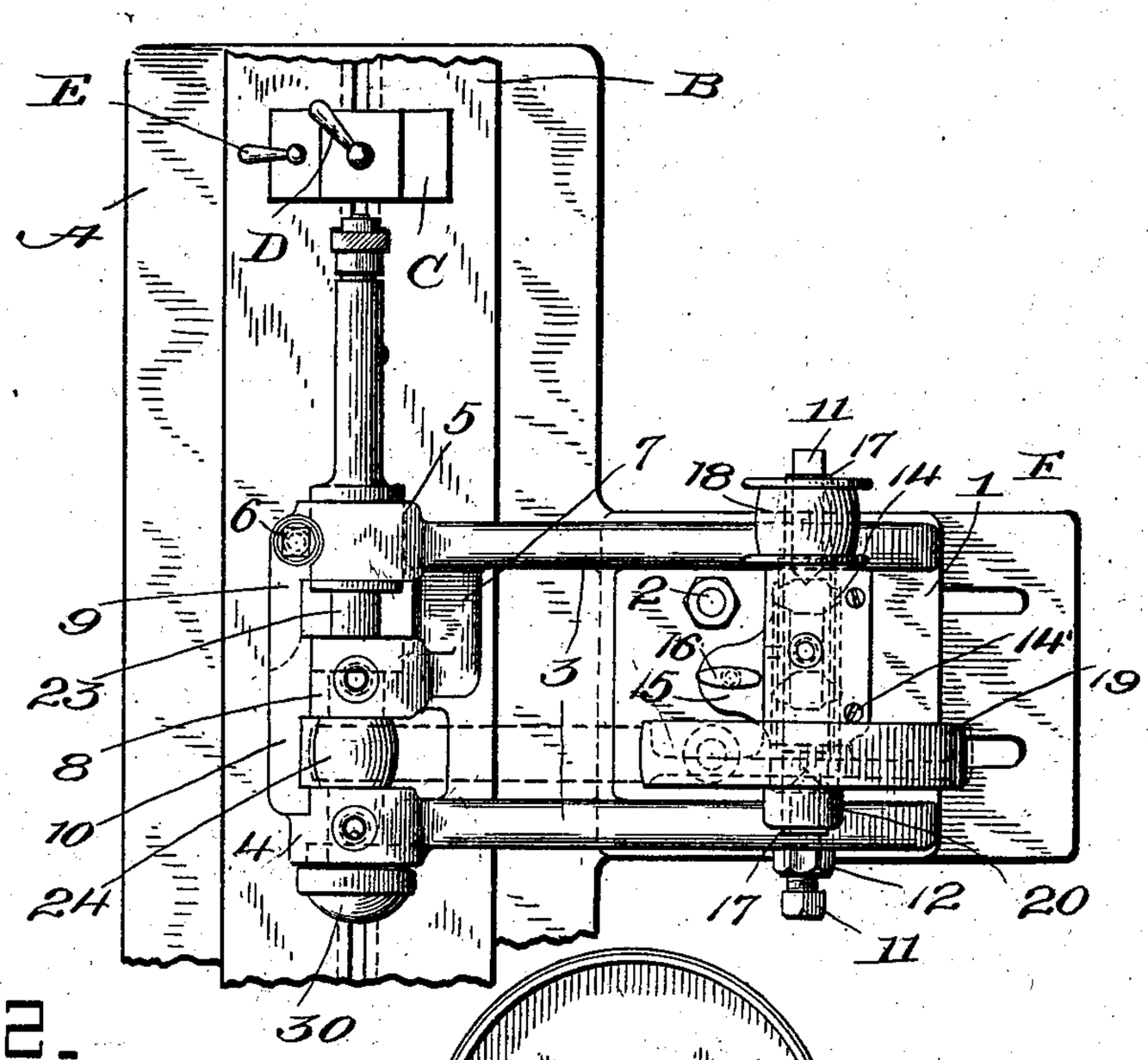


Fig. 2.

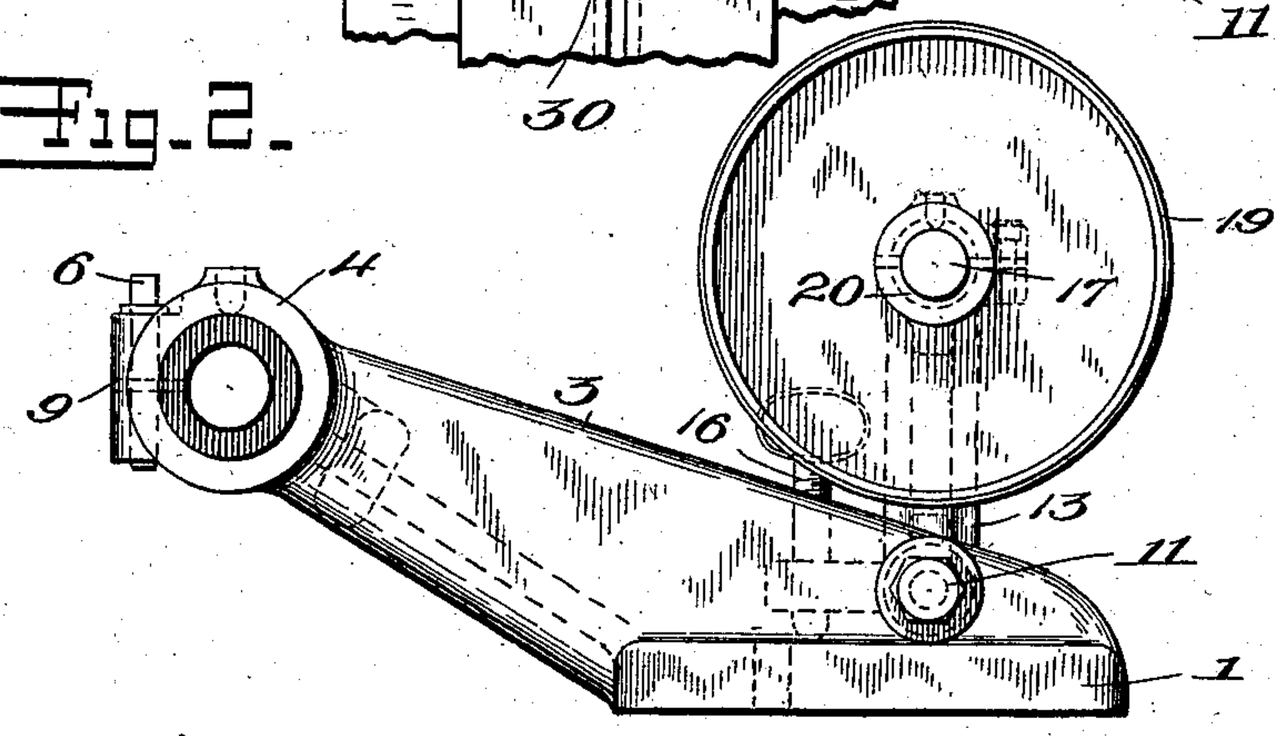
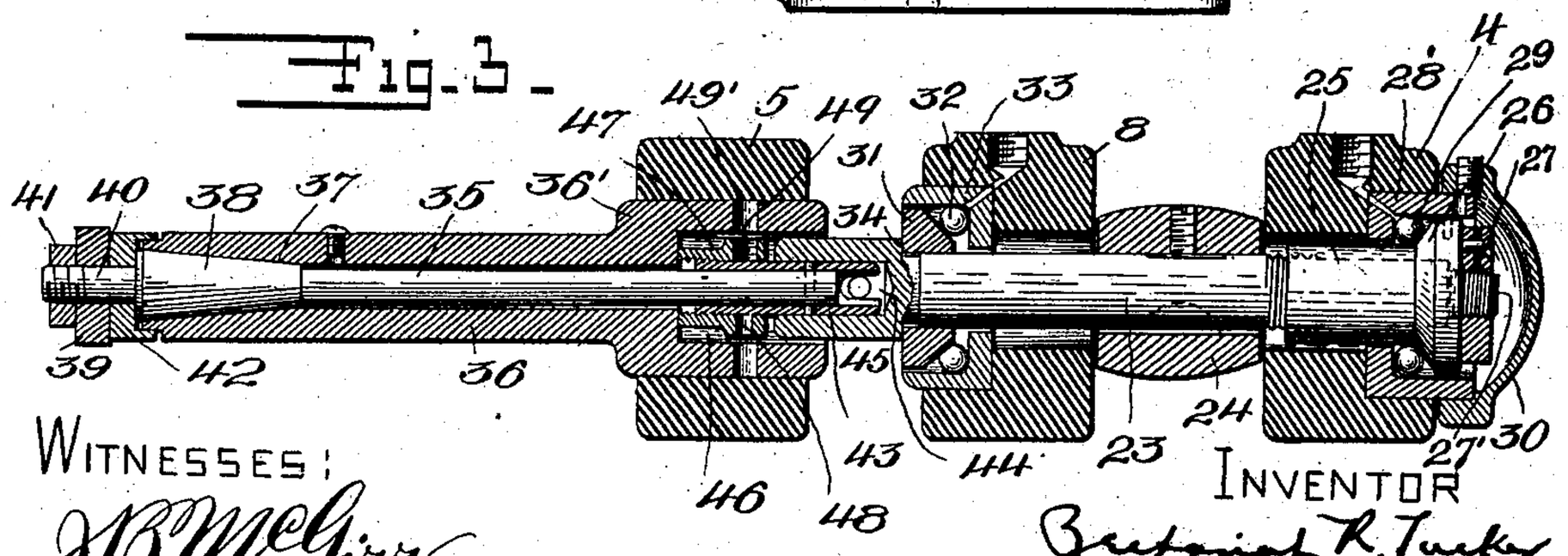


Fig. 3.



WITNESSES:

J. B. McGirr.

Isabelle C. Delaney.

INVENTOR

Zacharias R. Tucker

by

Duell Mayrath & Wright

Attorneys

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 5.

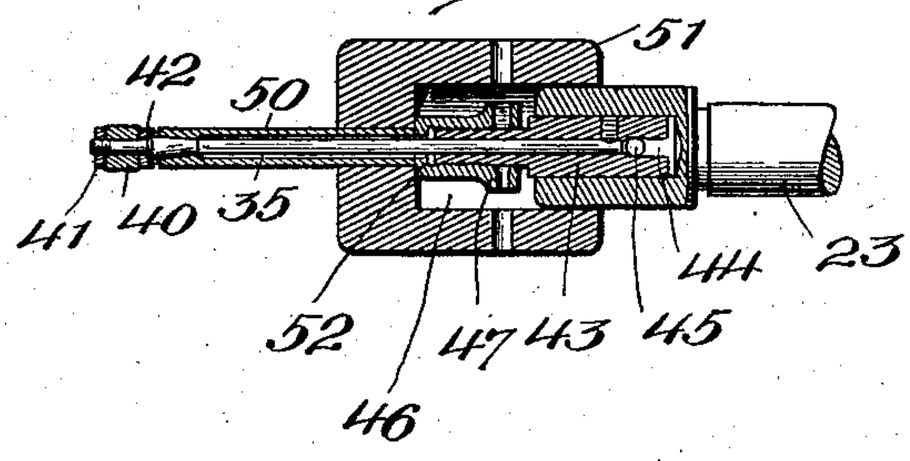
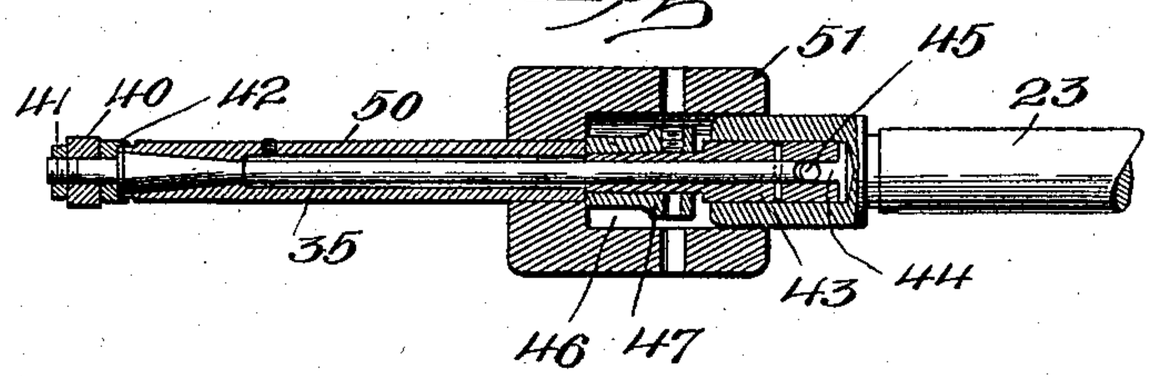


Fig. 4.



Witnesses:
Allan Foose
Isabella E. Delaney

Inventor:
Gretonius K. Tucker
by
Duell Mcgrath & Warfield
Attorneys.

UNITED STATES PATENT OFFICE.

ZECHARIAH RHODES TUCKER, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO UNIVERSAL MACHINE COMPANY, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 721,400, dated February 24, 1903.

Application filed February 7, 1902. Serial No. 92,994. (No model.)

To all whom it may concern:

Be it known that I, ZECHARIAH RHODES TUCKER, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to grinding-machines, and more specifically to the construction of a fixture adapted to be used as a substitute for the usual wheel-head of a grinding-machine.

The objects of the invention are to provide a new and improved tool especially adapted for certain classes of work and a mounting whereby such tool can be readily positioned and properly supported for efficient work.

Heretofore when it has been desired to provide a grinding-machine with a tool adapted for special classes of work—as, for instance, internal grinding—it has been customary to mount a tool-carrying fixture on the bed of the machine and belt the pulley thereof to a pulley on the wheel-head normally used. In order to do efficient work under these circumstances, it is necessary that the attendant should exercise great care in adjusting the fixture, so that the pulleys may be properly alined. This consumes valuable time, and even if properly alined at first the various parts are easily disarranged. This and other disadvantages which are inherent in constructions known in the art are obviated by the present construction, which provides a self-contained fixture to be substituted bodily for the wheel-head, so that there are no parts to be alined and none likely to get out of order, thereby providing a saving in time and an increase in efficiency.

The invention accordingly consists in the features of construction and combinations of elements, which will be hereinafter more fully set forth and the novel features thereof specifically pointed out in the claims at the end of this specification.

In the accompanying drawings, which illustrate a preferred embodiment of the invention, Figure 1 is a top plan view showing diagrammatically a part of the base of a machine and an internal-grinding fixture and tool constructed in accordance with my invention in position thereon. Fig. 2 is a side elevation of the fixture detached, with the pulley-spindle removed. Fig. 3 is a longitudinal sectional view of the pulley-spindle, the detachable tool-spindle, and the bearings therefor. Figs. 4 and 5 are sectional views of modified forms of detachable tool-spindles.

In Fig. 1 of the drawings, A represents diagrammatically a base or frame upon which is mounted, preferably so as to be reciprocable therealong, a carriage B. To this carriage is clamped a chuck C, which may be of any desired construction, shown as having a clamp D for securing the work and a clamp E for securing the chuck to the carriage. A side extension F of the frame is provided with ways, to which is clamped in the normal use of the machine a wheel-head adapted for a variety of uses. When it is desired to use a special tool on the same machine, this wheel-head is removed and the fixture shown in Fig. 1 of the drawings put in place thereof. This fixture comprises a base 1, having a suitable clamp or clamps 2, by which it is firmly secured in place upon the part F of the frame. This base carries in the present instance two supports 3, extending upwardly and forwardly from said base. One of said supports is provided at its end with a bearing 4 and the other with a bearing 5. The metal of which the fixture is formed is split at the bearing 5 and provided with a clamping-bolt 6 in order that a sleeve or spindle supported by bearing 5 may be properly held therein. From the inner support 3 a bracket 7 extends at right angles and carries the bearing 8 in alinement with bearings 4 and 5. A web 10 is provided connecting the three bearings on the outside in order to stiffen and give strength to the structure, and this web is split for some portion of its length at and adjacent bearing 5, as indicated at 9, Fig. 2, for the purpose already noted. Journaled in suitable bearings in connection with the base 1 of the fixture are screws 11, provided with locking-nuts 12 and having at their inner ends conical bearing-points, as indicated in dotted

lines in Fig. 1. Supported by these bearing-points is an angularly-shaped casting or member which is provided with upwardly-extending supports 13, one of which is shown in side elevation in Fig. 2 and both in dotted lines in Fig. 1, which supports carry, preferably integral therewith, a bearing-sleeve 14, which is split at one side and provided with clamping-screws 14′. The horizontal extension 15 of this angular casting, which is thus pivoted between the bearing-points of the screws 11, is provided with a hand-screw 16, the end of which bears against the base 1, so that by adjusting said hand-screw the bearing-sleeve 14 may be rocked about the pivots formed by the set-screws 11, thus carrying with it the shaft 17, for which the sleeve 14 furnishes an elongated and rocking bearing. The shaft 17 carries at one end the pulley 18, which is adapted to be belted to the counter-shaft or any other suitable source of power, and at its other end the large pulley 19, clamped thereon by the nut 20. This pulley 19 is adapted to be belted, as shown in dotted lines in Fig. 1, to a pulley 24, carried by a pulley-spindle 23, mounted in antifriction-bearings within the bearings 4 and 8. At its outer end this spindle 23 is threaded, and a threaded sleeve 25 is placed thereon, provided with a conical bearing-surface 26. This sleeve is adjustable with reference to the spindle to adjust the bearings by means of its threaded connection therewith and may be locked by means of a check-nut 27, screwed onto the threaded outer end 27′ of the spindle, which is reduced in size for this purpose. The bearing 4 is recessed or provided with a rabbet within which fits ball-cup 28, whereby the balls 29 are properly held against the conical bearing-surface 26. A dust-cap 30 may be provided at the outer end of the spindle for inclosing these parts. At the inner end of this pulley-spindle a sleeve 31 is provided, which has an annular conical bearing-surface for the balls 32, and a retaining ball-cup 33 is situated in a recess of bearing 8. It will be seen that with this construction an independent pulley-spindle is provided, having ball-bearings at its two ends so constructed that they are capable of close and accurate adjustment in order to allow the attainment of extremely high speeds with a minimum amount of friction. To adjust these bearings, it is only necessary to remove the dust-cap, loosen the check-nut 27, and then while holding the cone-sleeve to prevent it from rotating by rotating the pulley-spindle 23 in the desired direction the bearings will be properly adjusted thereon. At its inner end the spindle 23 is increased in diameter, providing a shoulder 34, against which the bearing-sleeve 31 is held. The spindle is also recessed or bored out at this end to provide a socket for the insertion and connection of a tool or wheel spindle 35, which is supported within a sleeve 36, preferably increased in diameter at one end, as at 36′, so that it may have a relatively large bearing-surface fitting the bearing 5 to be clamped therein while in use. The outer end of this sleeve 36 is provided with a tapering bearing-surface 37, coöperating with a cone 38 upon the spindle. The grinding-wheel 39 is carried upon the end of the spindle and locked between a nut 41 on the outer threaded end 40 of the spindle and a cap 42, which has an inwardly-extending annular flange surrounding the end of the sleeve 36 to prevent the entrance of dust.

It will be understood that in internal grinding as well as in other classes of work it is necessary to provide a grinding-wheel of small diameter so supported that it may be advanced some distance within the socket or bore being ground without having any projecting parts of the bearing to interfere with or contact with the work. At the same time the bearing must be such as to provide the stability necessary for a rapidly-revolving grinding-wheel. It is also necessary in practice to grind out holes of widely-varying diameter, and for this purpose different sizes of grinding-wheels must be provided if the work is to be performed economically. I accomplish these and other ends by my construction of the bearings for the tool-spindle and the connection between the tool-spindle and the pulley-spindle by which it is driven, such that with a single fixture I may use interchangeably a series of tools having wheels of different diameter, one being removed and another inserted with the same facility with which a drill is removed from its chuck, as will now be apparent.

The inner end of spindle 35 is surrounded by a sleeve 43, preferably pinned thereto, but which may be made integral therewith, if desired, the end of which sleeve projects beyond the end of the spindle and has a fork 44, which coöperates with a pin 45, projecting from the inside of the socket in the end of the pulley-spindle 23, so that by engagement between the pin and fork the two spindles may be locked together for rotary movement, but may be disengaged by drawing the wheel-spindle out longitudinally. The enlarged end 36′ of the sleeve 36 is recessed or bored out to provide a socket 46. Sleeve 43 is threaded for the reception of a threaded sleeve 47, which bears at its inner end against the shoulder within the sleeve 36, formed by the lower end of the socket. This socket 46 in the sleeve 36 is of such depth that the end of the pulley-spindle 23 may extend therein in order to protect the parts from dust. A hole 48 is provided in the sleeve 47 for the insertion of a pointed instrument by which the sleeve may be turned up to adjust the spindle 35, and it is held in any desired adjusted position by a set-screw 49, a hole 49′ being provided through the sleeve 36′ in order that an instrument may be inserted for loosening and tightening the set-screw. It will be seen that by this construction the bearing 38 on the spindle 35 may be adjusted with relation to its bearing-surface 37 by turning up the

sleeve 47, which having a thrust-bearing against the outer inclosing sleeve must draw the spindle tighter to its bearings upon being adjusted or allow it to be loosened, as desired.

The operation and application of the parts described will now be clear. When it is desired to use a small internal-grinding wheel in place of the large grinding-wheel usually in position upon the frame of the machine, the main grinding-wheel frame is removed and the frame or base 1 put in position upon the base of the machine and clamped thereto. Thus a self-contained fixture is provided and no adjustment or alinement of parts is necessary. The rigid connection between what may be termed the "speeding-shaft" 17 and the "pulley-shaft" 23 prevents a transverse disarrangement of such parts, such that the belt connecting the pulleys on the two shafts would not run true. If, however, through any cause the belt becomes loose or slack, it may be tightened by adjustment of the sleeve-bearing 14 through the hand-screw 16. Thus there is no delay in adjusting, and damage to the machine through neglect or ignorance of the attendant is obviated so far as possible. The long sleeve, at the outer end of which the grinding-wheel spindle has its bearings, permits the wheel to be supported in close proximity to the work and a cut to be taken of any desired depth. The arrangement of the bearings in connection with the pulley-spindle 23 is such that these parts may be readily assembled and quickly adjusted, while at the same time providing efficient bearing-surfaces. When it is desired at any time to adjust the bearing of the wheel-spindle, by loosening the clamp 6 the sleeve and spindle may be bodily withdrawn from connection with the pulley-spindle and the adjustment of the wheel-spindle obtained, as in the manner already noted. If it is desired to use a smaller or larger grinding-wheel, a second sleeve which carries a spindle and grinding-wheel of desired size may be inserted, the enlarged ends of all such sleeves being of the same diameter in order that they may fit within the bearing 5. Thus any desired size of grinding-wheel may be used, the only operation to be performed in releasing one and positioning another being that of loosening the clamp 6, so that they may be inserted with the same readiness that a drill is inserted in its chuck. The advantage of such construction in saving time and permitting one fixture to be used with various wheels of different diameters will be readily apparent.

It will be obvious that instead of having a sleeve such as 36, which is thickened or enlarged at its end in order to fit the bearing 5, there could be provided a separate sleeve or bushing which corresponds to the elongated end of the sleeve, the other parts remaining the same. Figs. 4 and 5 illustrate such a construction, which is particularly applicable in cases where the diameter of the grinding-wheel, and consequently of the spindle, is very small. In these figures, 50 represents a bearing-sleeve carrying spindle 35, and 51 is a separate sleeve of a diameter to be clamped within the bearing or support 5. Sleeve 50 passes through and is supported in a bore in sleeve 51. It is necessary with this construction that the adjusting-sleeve 47 should have a thrust-bearing against both the inner wall of socket 46 in sleeve 51 and against the end of the sleeve 50 in order that the parts may be adjusted by turning said sleeve 47. Where the diameter of the parts is so small, as in Fig. 5, it is necessary for this purpose to flange or bend inwardly the end of sleeve 47, as indicated at 52, in order that sufficient bearing-surface may be obtained. The ends of the sleeves 43 of each tool are enlarged where necessary in order that all may fit the socket in the end of pulley-spindle 23.

It will be obvious that various features of this invention are of general application, and while I have illustrated the invention in connection with a grinding-machine various features of the invention may be applied to a variety of uses in other types of machines.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A tool-carrying fixture comprising a base 1, bearing-sleeves 4, 5, and 8, rigidly supported therefrom, and a bearing-sleeve 14 pivotally mounted thereon, substantially as, and for the purposes set forth.

2. A tool-carrying fixture comprising a base 1, bearing-sleeves 4, 5, and 8 rigidly supported therefrom, and a bearing-sleeve 14 pivotally mounted thereon and adjustable by means of screw 16, substantially as, and for the purposes set forth.

3. In combination with a work-holding base, a fixture adapted to be detachably secured to said base, bearings for a driving-spindle carried rigidly with said fixture, and bearings for a tool-spindle also carried rigidly therewith, whereby permanent alinement is secured between the driving and driven spindles.

4. In combination with a work-holding base, a fixture adapted to be detachably secured to said base, bearings for a tool-spindle carried rigidly with said fixture, bearings for a driving-spindle also carried rigidly therewith whereby permanent alinement is secured between the driving and driven spindles, and means for varying the distance between said spindles while still preserving the transverse alinement thereof.

5. In a device of the class described, a pulley-spindle, bearings therefor, a tool-spindle and support therefor in longitudinal alinement with said bearings, and means whereby said spindles may be connected so as to rotate together but be free for separation in a longitudinal direction.

6. In a device of the class described, a driven spindle, bearings therefor, a tool-spindle, a separate bearing therefor, and a pin-

and-fork connection between said spindles whereby they may be connected for rotary movement, but free to be separated longitudinally.

7. In combination, a tool-spindle, a sleeve having a bearing at one end coöperating with a bearing-surface on said spindle, an internally-threaded adjusting-sleeve on the other end of said spindle coöperating with a threaded surface in connection therewith, said sleeve having a bearing at its inner end against said first-mentioned sleeve, whereby said spindle may be adjusted in its bearing by turning said adjusting-sleeve.

8. In a device of the class described, in combination, a base carrying a speeding-shaft, a pulley-spindle belted to said shaft and supported in suitable bearings by said base, and a tool-spindle supported on said base and operatively, but detachably connected to said pulley-spindle.

9. In combination, a driving-spindle 23, having a shoulder at one end thereof, a bearing ring or sleeve 31 located adjacent said shoulder, a ball-cup and balls coöperating with said bearing-ring, an internally-threaded sleeve 25 at the other end of said spindle coöperating with the threaded end thereof, the bearing-surface 26 in connection with said sleeve, a ball-cup and balls coöperating with said bearing-surface, and suitable supports for said ball-cups, substantially as and for the purposes set forth.

10. In combination, a spindle, suitable supports therefor, bearing devices at one end of said spindle carried by one of said supports and adapted to be adjusted by longitudinal movement of said spindle, a threaded adjusting-sleeve on the other end of said spindle, said sleeve carrying a bearing-surface coöperating with a ball-cup and balls in connection with the other of said supports, and a check-nut on said spindle outside of said sleeve.

11. A tool adapted to be used as one of a series of interchangeable tools in connection with a driving-spindle having a suitable socket therein, said tool comprising a sleeve 35, having an enlarged end adapted to fit a suitable support, a bearing-surface 37 within said sleeve, a tool-spindle 35 passing through said sleeve, having a bearing 38 cooperating with said bearing-surface, a sleeve 47 adjustable on said spindle 35, and having a thrust-bearing against the end of said sleeve 36, whereby by adjusting said sleeve 47, the tool-spindle may be adjusted within its bearing, and means on the ends of said spindle whereby it may be detachably connected to the driving-spindle, substantially as and for the purposes set forth.

12. In an interchangeable tool of the class described, a supporting-sleeve having a socket in one end thereof, a tool-spindle passing through said sleeve and having a conical bearing at one end coöperating with a corresponding bearing-surface within the sleeve, the other end of said spindle having a threaded surface in connection therewith and an internally-threaded sleeve therein adapted to bear against the end of said socket, whereby said spindle may be adjusted with reference to said sleeve.

In testimony whereof I affix my signature in the presence of two witnesses.

ZECHARIAH RHODES TUCKER.

Witnesses:
HENRY C. BABCOCK,
ALICE H. ALOM.