No. 799,131. PATENTED SEPT. 12, 1905.

W. N. WOODRUFF.

GEARING FOR PORTABLE TOOLS.

APPLICATION FILED AUG. 1, 1904.

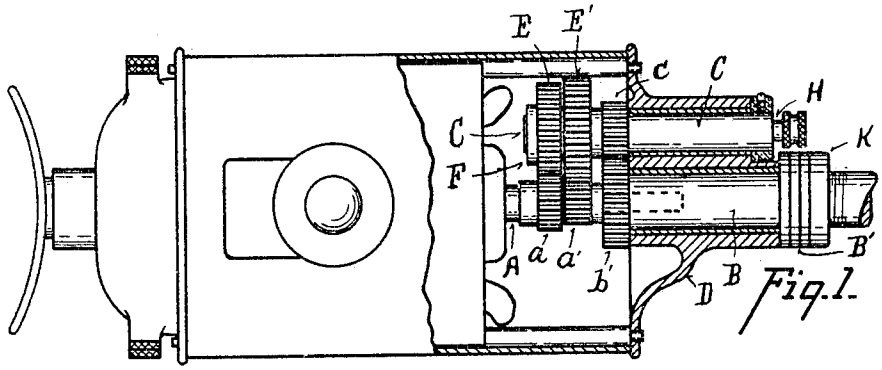



Fig. 1.

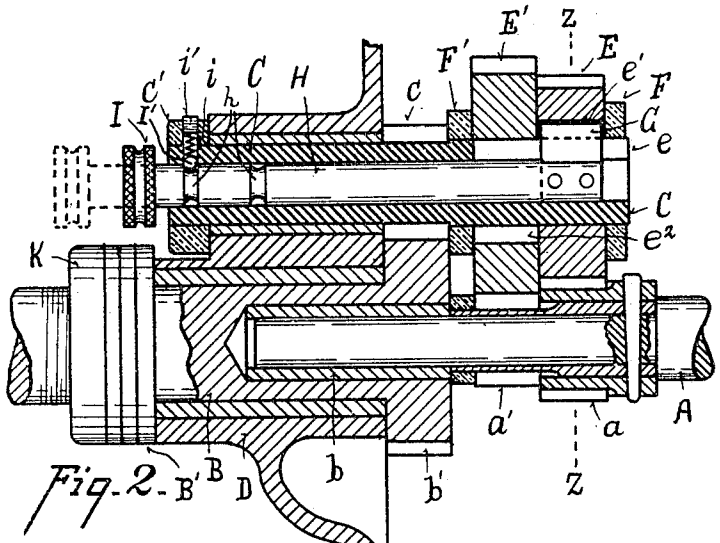



Fig. 2.

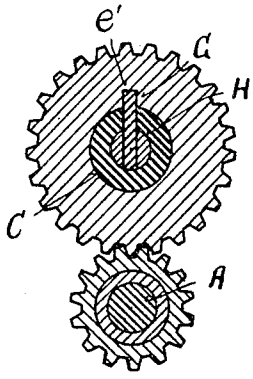



Fig. 3.

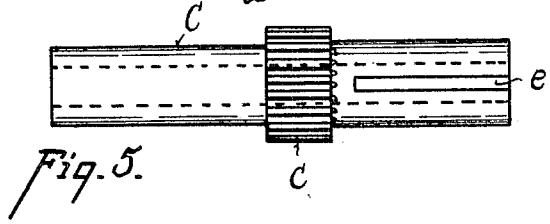



Fig. 5.

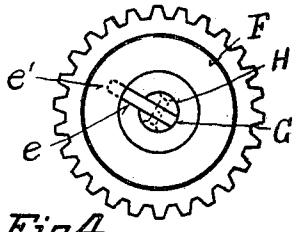



Fig. 4.

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# UNITED STATES PATENT OFFICE.

WILLIAM N. WOODRUFF, OF CINCINNATI, OHIO.

## GEARING FOR PORTABLE TOOLS.

No. 799,131. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed August 1, 1904. Serial No. 219,036.

*To all whom it may concern:*

Be it known that I, WILLIAM N. WOODRUFF, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Gearing for Portable Tools; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in speed-changing mechanism, particularly adapted for use on portable tools. One of its objects is to provide a simple and reliable mechanism for effecting changes of speed, which is of light weight and small compass.

Another object is to provide a speed-changing mechanism of the character indicated which can be readily and conveniently shifted to effect the changes of speed.

It further consists in certain details of form, combination, and arrangement, all of which will be more fully set forth in the description of the accompanying drawings, in which—

Figure 1 is a side elevation of a portable drill embodying my improvements, part of the casing being broken away to show the operative parts. Fig. 2 is a central vertical section through the speed-changing mechanism upon an enlarged scale. Fig. 3 is a section on line *z z* of Fig. 2. Fig. 4 is an end view of the secondary shaft. Fig. 5 is a side elevation of the secondary shaft detached.

A represents the driving-shaft, to which power may be directly imparted by an electric, pneumatic, or other motor.

B represents the driven shaft or tool-spindle, and C the secondary shaft, through which the speed changes are effected.

The driving-shaft is provided with two or more gears *a a'*, of different diameters, and the end of the driving-shaft preferably journaled in a bearing *b*, formed in the end of the driven shaft, thereby securing a firm support for the driving-shaft and reducing the friction, due to the rapid revolution thereof, by reason of both driving and driven shafts revolving in the same direction.

The driven shaft is suitably mounted and journaled in the frame or head of the machine D.

The secondary shaft C is provided with a gear *c*, mounted rigidly thereon or formed integral therewith, and is also journaled in a bearing in the frame or head D, being prevented from endwise movement by the gear *c* at one end of the bearing and a collar *c'* at the opposite end.

E E' represent gears loosely journaled on the shaft C and locked in position thereon between the collars F F'. That portion of shaft C in contact with gears E E' is slotted at *e* to receive a key G, which is secured to one end of the shifting-bar H. Key seats or splines *e' e²* in the bores of the gears E E' receive the outer end of the key G, and thereby lock the change-gears to the shaft C.

I represents a knurled head swiveled to the end of shifting-bar H.

I' represents a ball seating in grooves *h* in the shifting-bar, and held in place by the spring *i* and screw *i'*.

The gear *c* meshes with gear *b'* on the inner end of the driven shaft B.

B' represents ball-bearing collars interposed between the frame D and the nut K on the tool-spindle, balls being interposed between the collar to form a frictionless thrust-bearing and to limit the endwise movement of the tool-spindle or driven shaft.

The collar F' in addition to locking the gears E E' against movement endwise also serves to prevent the spreading of the shaft C due to the slot *e*.

I am thus enabled to provide a light, strong, and reliable speed-changing mechanism which may be incorporated in small space, and is particularly adapted for use on portable tools where the above-named features are of importance.

The mechanism herein shown and described is capable of considerable modification without departing from the principle of my invention.

Having described my invention, what I claim is—

1. In a mechanism of the character indicated, a supporting-frame, a driving-shaft, a plurality of gears of different diameter carried thereby, a secondary shaft journaled at one end in the machine-frame and provided with a slot, a series of loosely-mounted gears carried by the secondary shaft in mesh with the gears on the driving-shaft and having key-seats in their bores, a key sliding in said slot in the secondary shaft and adapted to engage the key-seats of said loosely-mounted gears, a shifting-rod seated in a longitudinal recess in the secondary shaft with its end projecting outside the machine-frame, said rod being attached to the key to shift the key in the

slot, a gear rigid on the secondary shaft, a driven shaft coaxial with the driving-shaft and a gear on the driven shaft in mesh with said last-named gear.

2. In a speed-changing mechanism, a driving-shaft, a plurality of gears of different diameter carried thereby, a driven shaft in axial alinement with the driving-shaft and forming a bearing for the end thereof, a gear carried by the driven shaft, a secondary shaft having a slot at one end, a gear rigidly mounted thereon and in mesh with the gear on the driven shaft, a plurality of gears loosely mounted on the secondary shaft and provided with key-seats in their bores, a key adapted to slide in the slot in the secondary shaft to selectively connect the loose gears to said shaft, and means for shifting said key.

3. In combination with a driving-shaft and a driven shaft, gears rigidly mounted thereon, a secondary shaft having a slot at one end, a gear rigidly mounted thereon and in engagement with one of said first-named gears, a plurality of different-diameter gears loosely mounted on said secondary shaft at one side of the rigidly-mounted gear and provided with key-seats in their bores, a key sliding in said slot, means for shifting the key to selectively lock the loose gears to the shaft, and a collar fitting the slotted end of the secondary shaft outside the gears to lock the gears in place endwise, and to prevent the spreading of the slotted end of said shaft.

4. In a speed-changing mechanism, a driving-shaft, a plurality of gears carried thereby, a driven shaft in axial alinement with and forming a bearing for the end of the driving-shaft, a gear rigidly mounted on the driven shaft, a secondary shaft, a rigidly-mounted gear carried thereby and in mesh with the gear on the driven shaft, a plurality of loosely-mounted gears on the secondary shaft in mesh with the gears on the driving-shaft and having key-seats in their bores, a shifting-bar sliding endwise in a recess in the secondary shaft, a key carried by said bar, said key sliding in a slot in the secondary shaft beneath the loosely-mounted gears thereon, and means for locking the shifting-bar to its adjusted positions.

5. In a mechanism of the character indicated, a supporting-frame, a driven shaft journaled in said frame and having a bore in the end thereof, a driving-shaft coaxial therewith and having one end journaled in the bore of the driven shaft, a plurality of different-diameter gears rigidly mounted on the driving-shaft, a hollow secondary shaft journaled at one end in the frame of the mechanism at one side of the driven shaft journaled and slotted at the opposite end, a plurality of different-diameter gears loosely mounted on said secondary shaft and in mesh with the gears on the driving-shaft and provided with key-seats in their bores, a key sliding in said slot in the secondary shaft to selectively lock said loosely-mounted gears to the shaft, a collar on the end of said secondary shaft to hold the loosely-mounted gears in place, and to prevent the slotted end of the secondary shaft from spreading, a shifting-bar seated in the bore of said secondary shaft to shift the sliding key, a gear rigidly mounted on the secondary shaft, and a gear rigidly mounted on the driven shaft in mesh therewith.

6. In a mechanism of the character indicated, a supporting-frame, a driven shaft journaled in one end of said frame and provided with a central recess at one end, a driving-shaft coaxial with the driven shaft and having one end journaled in said recess therein, a plurality of different-diameter gears rigidly mounted on the driving-shaft, a hollow secondary shaft journaled at one end in the end of the frame at one side of the driven-shaft journal and slotted at the opposite end, a plurality of different-diameter gears loosely mounted on said secondary shaft in mesh with the gears on the driving-shaft, and provided with key-seats in their bores, a key sliding in said slot in the secondary shaft to selectively lock said loosely-mounted gears to the shaft, a collar on the end of said secondary shaft to hold the loosely-mounted gears in place endwise, and to prevent the slotted end of the secondary shaft from spreading, a shifting-bar seated in the bore of said secondary shaft with its end projecting outside the frame, a gear rigidly mounted on the secondary shaft, and a gear rigidly mounted on the driven shaft in mesh therewith.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM N. WOODRUFF.

Witnesses:
WM. EHRLICH,
C. W. MILES.