No. 768,608. PATENTED AUG. 30, 1904.

R. K. LE BLOND & W. F. GROENE.

FEED AND SPEED CHANGING DEVICE FOR MACHINE TOOLS.

APPLICATION FILED MAY 17, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

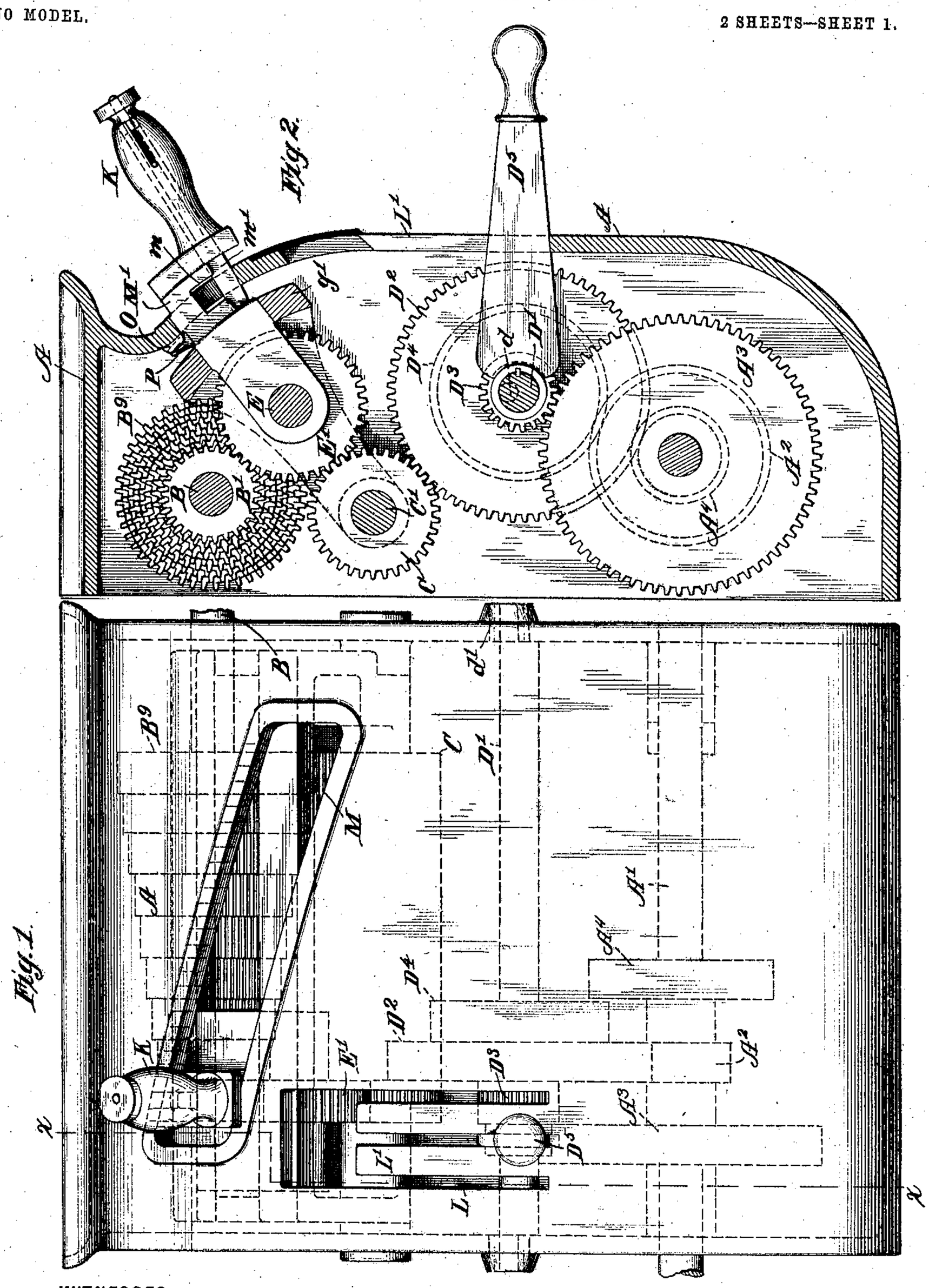


Fig. 1.

Fig. 2.

WITNESSES:

H. S. Austin

A. R. Hunter

INVENTORS

Richard K. LeBlond.

and William F. Groene

BY Robt. P. Hains.

ATTORNEY

No. 768,608. PATENTED AUG. 30, 1904.

R. K. LE BLOND & W. F. GROENE.

FEED AND SPEED CHANGING DEVICE FOR MACHINE TOOLS.

APPLICATION FILED MAY 17, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.

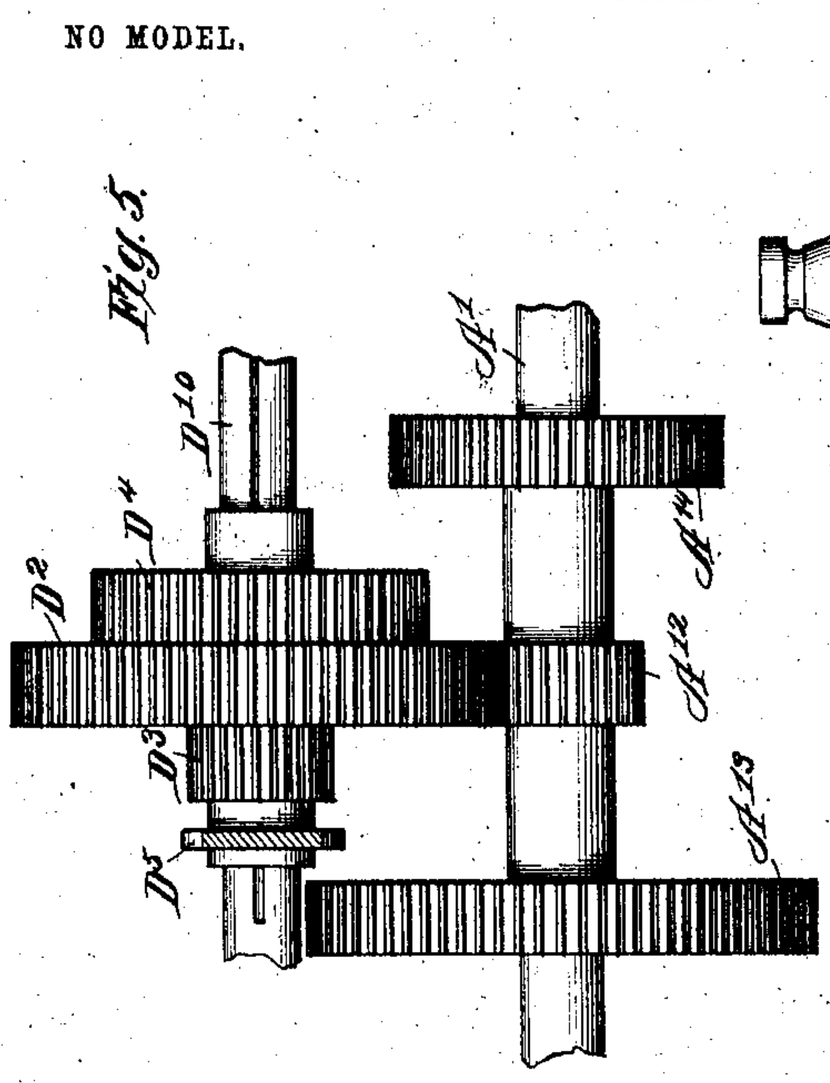
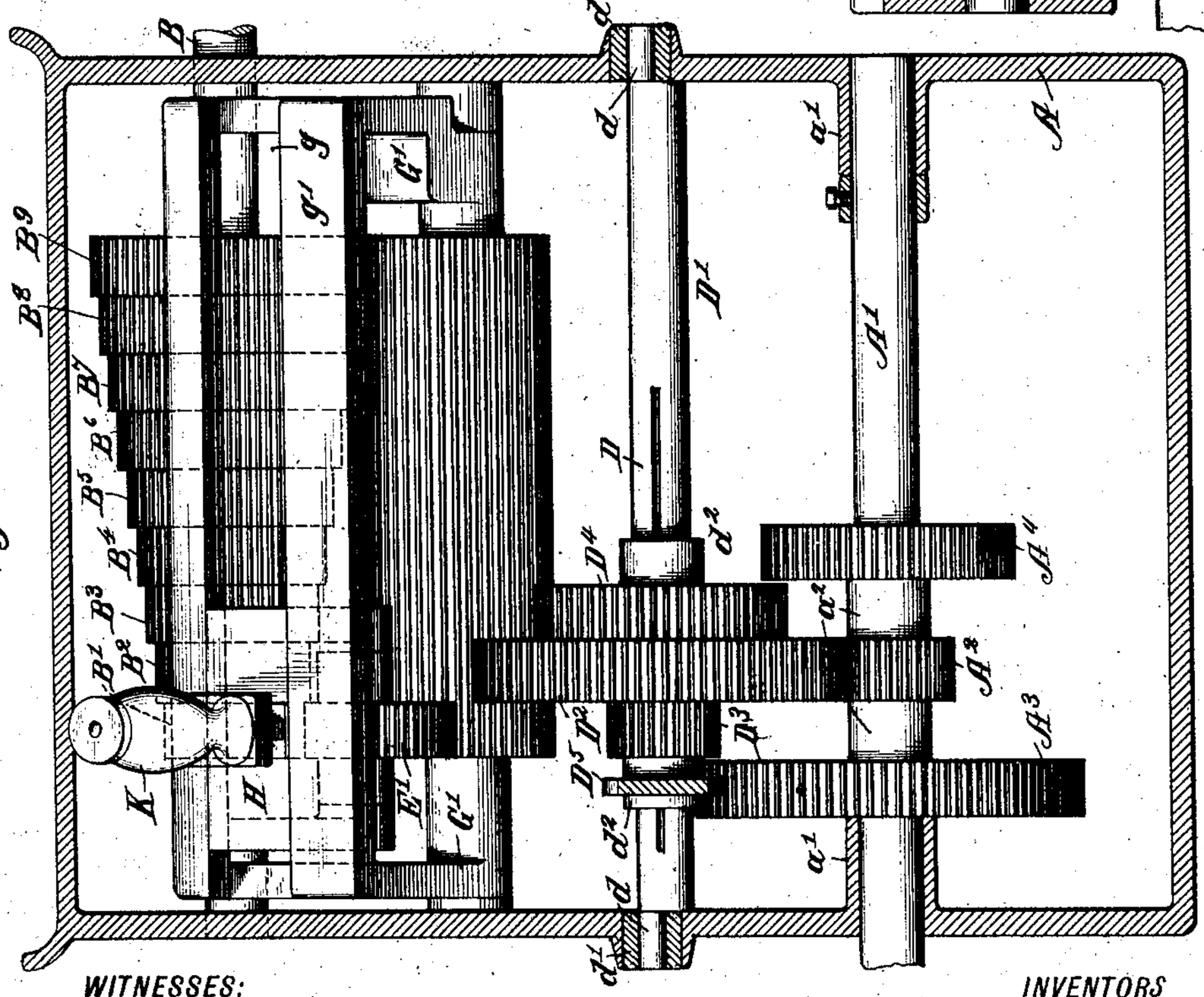


Fig. 3.



WITNESSES:

H. S. Austin

A. R. Hunter

INVENTORS

Richard K. LeBlond

and William F. Groene

BY Robt. P. Lewis.

ATTORNEY

No. 768,608. Patented August 30, 1904.

UNITED STATES PATENT OFFICE.

RICHARD K. LE BLOND AND WILLIAM F. GROENE, OF CINCINNATI, OHIO.

FEED AND SPEED CHANGING DEVICE FOR MACHINE-TOOLS.

SPECIFICATION forming part of Letters Patent No. 768,608, dated August 30, 1904.

Application filed May 17, 1904. Serial No. 208,422. (No model.)

To all whom it may concern:

Be it known that we, RICHARD K. LE BLOND and WILLIAM F. GROENE, citizens of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Feed and Speed Changing Devices for Machine-Tools, of which the following is a specification.

The invention to be hereinafter described relates to feed and speed changing devices which may be employed generally in any machine where it is desired that certain mechanism shall be driven at different speeds at different times; and the object of the present invention, generally stated, is to provide a device adapted to these conditions which will be susceptible of a wide range of variation in the speeds derivable therefrom and furnish a simple form of mechanical parts readily manipulated during the continued movement of the driving element to effect the changes desired.

With these generally-stated objects in view the present invention consists of the parts and combinations, as hereinafter more fully described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a front view of a device embodying the invention, showing the casing or inclosing box and its adjuncts and in dotted lines the gears and elements beyond. Fig. 2 is a section of the parts shown in Fig. 1 on line $x\ x$. Fig. 3 is a front view similar to Fig. 1 with the front of the casing or inclosing box removed; and Fig. 4 is a detached detail of the elongated gear and yoke-frames, some of the parts being in section. Fig. 5 is a detached detail of a modified form of transmitting-gearing.

In the drawings, A represents any usual or preferred character of casing for inclosing the working parts of the device. Mounted in suitable bearings—as, for instance, bearings $a'\ a'$—in the sides of the casing A is the shaft A′, which may be driven from any suitable source of power, and such shaft for the purpose of identification will hereinafter be referred to as the "driving-shaft." Also mounted in the casing A in appropriate bearings is the shaft B, from which the motion derived from the driving-shaft A is to be transmitted to any mechanism—as, for instance, a lead-screw of a machine-tool—which it is desired to drive at different speeds, and such shaft B for the purpose of identification will be hereinafter referred to as the "driven" shaft. The terms "driving" and "driven" are merely relative, and it is evident of course that the motion might be transmitted from shaft B to shaft A′, in which case shaft B would be the driving-shaft and shaft A′ the driven shaft.

Disposed between the driving and driven shafts is the elongated variable-speed gear C, mounted upon the shaft C′, sustained in any usual or desired manner by the casing A.

As a general statement of the contemplated embodiment of the invention, there is disposed between the driving-shaft A′ and elongated gear C variable-speed-transmitting gearing whereby the elongated gear C may be driven from the driving-shaft at variable speeds, and interposed between the driven shaft and the elongated variable-speed gearing C is a variable-speed-transmitting gearing, all of which will hereinafter be more fully and definitely described. From the general outline of the invention as thus stated it will appear that the elongated variable-speed gear C is driven from the driving-shaft A′ at variable speeds and that the variable speed of gear C is transmitted to the driven shaft B by a set of variable-speed gearing, so that the variable speed of the gear C may be transmitted at still varying speeds to the driven shaft.

Referring to the drawings for a detailed illustration of the embodiment of the invention, the driving-shaft A′ has mounted thereon to rotate therewith a series of gears $A^2\ A^3\ A^4$, said gears being of different diameters and the smallest gear A^2 of the series being placed between the other two gears $A^3\ A^4$ and separated therefrom by suitable spacing-collars a^2, for a purpose that will hereinafter appear.

Mounted in the casing A, adjacent the driving-shaft A′, is the transmitting eccentric shaft D, the ends of which, d, are contained in suitable bearings formed by the sleeves or

bushings d', so that by removal of said sleeves or bushings the shaft D may be removed from the casing at will. The transmitting eccentric shaft (indicated as a whole by the letter D) has an eccentric portion D', on which is mounted to rotate in unison a series of gears D^2, D^3, and D^4, said gears being of different diameters and being suitably held in their associated relation on the eccentric portion D' of the shaft, between the arms d^2, connected to the handle D^5, said arms d^2 being splined to the eccentric portion D' of the shaft, so that by means of said handle D^5 the series of gears D^2, D^3, and D^4 may be moved longitudinally of the shaft, as will be obvious, and by an upward or downward movement of the operating-handle D^5 the said transmitting eccentric shaft may be turned in its bearings, it being understood, of course, that the series of gears D^2 D^3 D^4, while maintained in their associated relation upon the shaft D in the manner stated, are free to rotate thereon and yet be movable longitudinally of the shaft by movement of the handle D^5, as already described.

It will be noted by reference to Figs. 2 and 3 of the drawings that the largest gear, D^2, of the series of gears on the transmitting eccentric shaft is in engagement with the elongated variable-speed gear C and, by virtue of the position of said gear C that, said engagement therewith of the largest gear D remains continuous, notwithstanding any eccentric motion that may be given to the series of gears by the upward or downward movement of the handle D^5. As hereinbefore stated, the gears A^2 A^3 A^4 on the driving-shaft are held in separate relation with respect to the smallest gear A^2 of the series, and such distance of separation is approximately equal to the faced width of the large gear D^2 of the series of transmitting-gears on the transmitting eccentric shaft, so that upon an upward movement of the handle D^5 the eccentric portion D' of the shaft D will disengage the series of gears D^2 D^3 D^4 from the gears on the driving-shaft, where, upon movement either to the right or the left from the position engaged in Fig. 3, the large gear D^2 will move to the space between the gears on the driving-shaft, and one of the other gears, D^3 D^4, will be brought into operative connection with their respective and corresponding gears A^3 A^4 on the driving-shaft to thereby give variable speed to the series of gears on the transmitting eccentric shaft and through them to impart variable speed to the elongated variable-speed gear C, all as will be readily apparent from Figs. 2 and 3.

Mounted to turn axially of the shaft C', carrying the elongated gear C, which shaft for identification I will term the "variable-speed" shaft, is the yoke-frame, (designated as a whole by G.) In the construction shown the arms G' of the yoke-frame G are mounted on the variable-speed shaft C' at each side of the elongated variable-speed gear C, which is thereby held from longitudinal movement upon said variable-speed shaft; but it will be evident, of course, that other details of mounting of the yoke-frame G may be employed.

Suitably mounted in the arms G' of the yoke-frame G is an intermediate shaft E, upon which is loosely mounted the intermediate gear E', which is free also to move longitudinally upon said intermediate shaft E, as more clearly indicated by Fig. 4.

The yoke-frame G carries a second yoke-frame, (designated as a whole by the letter H,) and said second yoke-frame H in the embodiment of the invention herein selected for illustration is provided with arms H', mounted upon the intermediate shaft E and embracing between them the intermediate gear E', said second yoke-frame being free to have longitudinal movement upon said intermediate shaft E. From the construction thus described it will be apparent that while the intermediate gear E' is movable longitudinally of the intermediate shaft E by the second yoke-frame that said intermediate gear E' remains in constant operative relation with the elongated variable-speed gear C.

In order that the yoke-frame G and the second yoke-frame H may have relative longitudinal movement by virtue of such movement to the second yoke-frame and yet such yoke-frames be not permitted free swinging movement independent of each other, it is necessary that such yoke-frames shall have another point of connection in addition to the mounting of the second yoke-frame on the intermediate shaft. While various forms of connection might be employed for this purpose, I have shown as one form thereof the yoke-frame G, provided with a longitudinal slot g, extending between the arms G' in the connecting-wall g', from which it will appear that while the second yoke-frame is movable longitudinally of the yoke-frame G to carry the intermediate gear into various positions along the elongated variable-speed gear C any upward or downward swinging movement of the second yoke-frame, by means of its connected handle K, will cause a corresponding swinging movement of the yoke-frame G, which for indentification may be known as the "main" yoke-frame.

Mounted upon the driven shaft B are a series of gears of different diameters B' to B^9, which, in effect, constitute a cone of gears, with any one of which the intermediate gear E' may be brought into engagement by the described motions of the second yoke-frame, so as to transmit to said cone of gears, and consequently the driven shaft B, in a variable manner the variable speeds imparted to the elongated variable-speed gear C by the variable-speed devices connecting said elongated variable-speed gear with the driven shaft E'.

The handle D^5, between the arms d^2 of which

the series of gears D^2 D^3 D^4 are associated, extends through suitable slots or openings L of the casing A, said slots being separated by portions L′, so that prior to longitudinal movement of the series of gears D^2, D^3, and D^4 longitudinal of the shaft D for carrying said gears into different operative relation and engagement with the gears on the driving-shaft, it is necessary to raise such handle D^5, and thereby turn the shaft D in its bearings, and by its eccentric portion D′ disengage the gears carried by said shaft D from the gears on the driving-shaft, a construction which, as will be obvious, prevents the simultaneous engagement or partial engagement of any of the gears D^2 D^3 D^4 with the gears on the driving-shaft, and therefore acts as a safety device to prevent destruction of the gears.

The casing A is likewise provided with a slot M, which in the present illustration is shown inclined to correspond to the inclination of the cone of gears on the driven shaft; but of course, as is obvious and as will be understood, variations may be made within the scope of the invention. Through this slot M in the casing extends the portion M′ of the second yoke-frame, having a recess *m* and a locking device or pin *m′*, which normally rests upon the lower straight wall of the slot M in the casing to hold the intermediate gear E′ in operative engagement with any one of the cone of gears on the driven shaft. By retracting the locking-pin *m′* the second yoke-frame, and with it the main yoke-frame, may be lowered or turned about its bearings for the arms G′ to thereby carry the intermediate gear E′ out of engagement with the cone of gears, in which position the second yoke-frame H may be moved longitudinally, carrying with it the intermediate gear E′ into position to be engaged with another one of the gears of the cone of gears when the second yoke-frame is raised into the position indicated in Fig. 2. If desired, suitable safety devices—as, for instance, the lugs *o* on the inside of the casing and the projection *p*, extending from the second yoke-frame—may be employed to prevent upward movement of the yoke-frame, except when the intermediate gear E′ is in proper position to engage one of the cone of gears, as will be obvious.

From the construction described it will be seen that the elongated variable-speed gear is driven from the driving-gear through a set of speed-changing gearing, which gives to the elongated gear any one of a series of different speeds, and that such different speeds may be transmitted to the driven shaft B at still varying speeds through the set of gearing carried by the yoke-frame, as hereinbefore described.

While we have described in detail the various features which preferably constitute the present embodiment of our invention, it is to be understood that the invention is not restricted to these precise details, but that they may be varied within wide limits by one skilled in the art. For instance, instead of the eccentric shaft D we may provide an ordinary shaft, as D^{10}, Fig. 5, and mount the gears D^2 D^3 D^4 thereon to turn together, and in order that said gears may be engaged with the gears on the driving-shaft without danger of injury, we may separate the gears on the driving-shaft a greater distance apart, as shown by A^{12}, A^{13}, and A^{14} in Fig. 5. In such modified form of device it is only necessary to move the gears on the shaft D^{10} lengthwise thereof by the usual handle to carry any one of said gears into engagement with its appropriate gear on the driving-shaft, as will be readily apparent to one skilled in the art. It will also be evident that a wide range of different speeds can be imparted to the driven shaft B by the general arrangement described, and such range of speeds is especially desirable in some forms of machine-tools.

What we claim, and desire to secure by Letters Patent, is—

1. In a feed and speed changing device for machine-tools, the combination of a driving-shaft, an elongated gear, variable-speed gearing disposed between the driving-shaft and said elongated gear and meshing with the latter for driving it at different speeds, a driven shaft, and variable-speed gearing connecting the said elongated gear with the driven shaft.

2. In a feed and speed changing device for machine-tools, the combination of a driving-shaft, a series of gears of different diameters carried thereby, an elongated gear, gearing disposed between the said series of gears and said elongated gear and meshing with the latter for driving it at varying speeds, a driven shaft, a series of gears of varying diameters mounted thereon, and means for transmitting the variable speed of the elongated gear to any of the gears on the driven shaft.

3. In a feed and speed changing device for machine-tools, the combination of a driving-shaft, a series of gears of different diameters mounted thereon, an elongated variable-speed gear, transmitting-gearing in position between the series of gears on the driving-shaft and said elongated variable-speed gear and in mesh with the latter to drive the same at different speeds, a driven shaft, a cone of gears mounted thereon, a variable-speed-transmitting gearing disposed between the cone of gears and the elongated variable-speed gear and in constant operative engagement with the latter for transmitting the variable speeds thereof to the driven shaft.

4. In a feed and speed changing device for machine-tools the combination of a driving-shaft, a driven shaft, an elongated variable-speed gear disposed between the said shafts, variable-speed gearing interposed between the driving-shaft and the elongated variable-speed gear, having constant driving connec-

tion therewith and movable longitudinally thereof while in such driving connection, variable-speed gearing disposed between the elongated variable-speed gear and the driven shaft in constant engagement with the elongated variable-speed gear and movable longitudinally thereof.

5. In a feed and speed changing device for machine-tools, the combination of a driving-shaft, a series of gearings of different diameters thereon, a driven shaft, a cone of gears thereon, an elongated variable-speed gear disposed between the said shafts, an eccentric transmitting-shaft disposed between said elongated gear and the driving-shaft, a series of gears of different diameters on the eccentric transmitting-shaft in constant operative engagement with the elongated variable-speed gear and movable longitudinally of the eccentric transmitting-shaft, a yoke-frame, an intermediate gear carried by said yoke-frame and in constant engagement with the elongated variable-speed gear and means for moving said intermediate gear while in engagement with the elongated variable-speed gear into and out of engagement with any gears of the cone of gears.

6. In a feed and speed changing device for machine-tools the combination of a driving-shaft, a series of gears of different diameters mounted thereon, a driven shaft, a cone of gears mounted thereon, an elongated variable-speed gear disposed between said shafts, an eccentric transmitting-shaft, a series of gears of different diameters longitudinally movable on said eccentric transmitting-shaft and in constant driving engagement with the elongated variable-speed gear, a main yoke-frame, an intermediate gear mounted in said yoke-frame and in constant engagement with the elongated variable-speed gear, a second yoke-frame mounted on the main yoke-frame, and means for moving the second yoke-frame longitudinally of the main yoke-frame to carry the intermediate gear into engagement with any one of the cone of gears.

7. In a feed and speed changing device for machine-tools, the combination of a driving-shaft, a driven shaft, a series of gears of different diameters on the driving-shaft, an elongated variable-speed gear disposed between said shafts, means for driving the elongated variable-speed gear from the driving-shaft at different speeds, a main and second yoke-frame, movable axially about the elongated variable-speed gear, an intermediate gear in constant driving connection with the elongated variable-speed gear and means for moving the second yoke-frame and with it the intermediate gear longitudinally of the elongated variable-speed gear into engagement with any of the gears of the cone of gears.

In testimony whereof we affix our signatures in presence of two witnesses.

RICHD. K. LE BLOND.
WILLIAM F. GROENE.

Witnesses:
CLARENCE EICH,
MARTHA E. YOUNG.