No. 682,507. Patented Sept. 10, 1901.

J. E. SWEET.

CHANGEABLE SPEED GEARING.

(Application filed Jan. 16, 1899.)

(No Model.) 2 Sheets—Sheet 1.

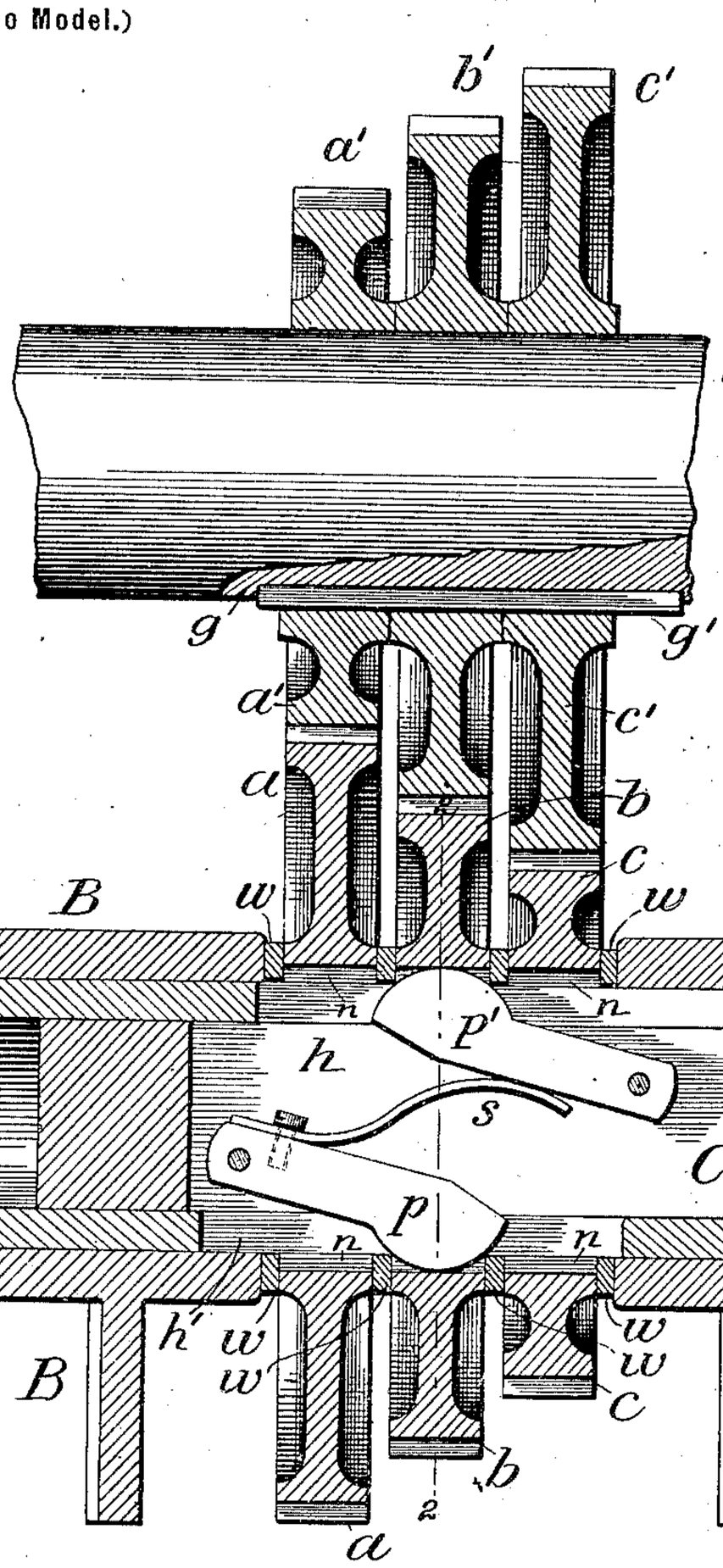
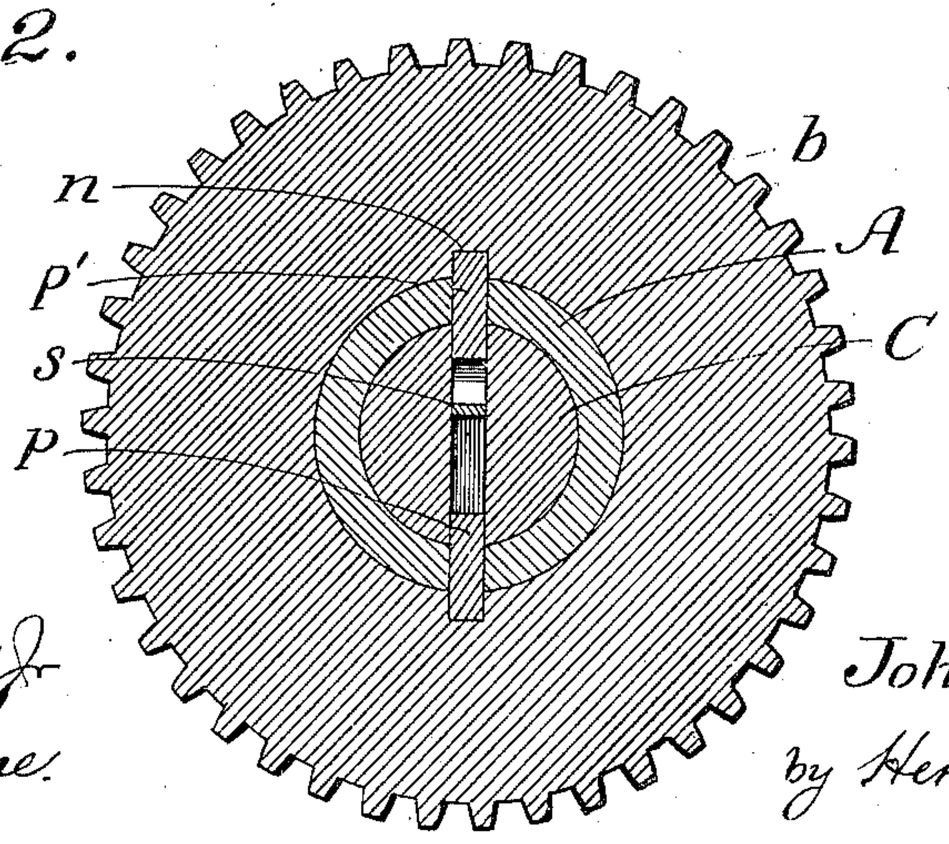


Fig. 1.

Fig. 2.



Witnesses.
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Fig. 3.

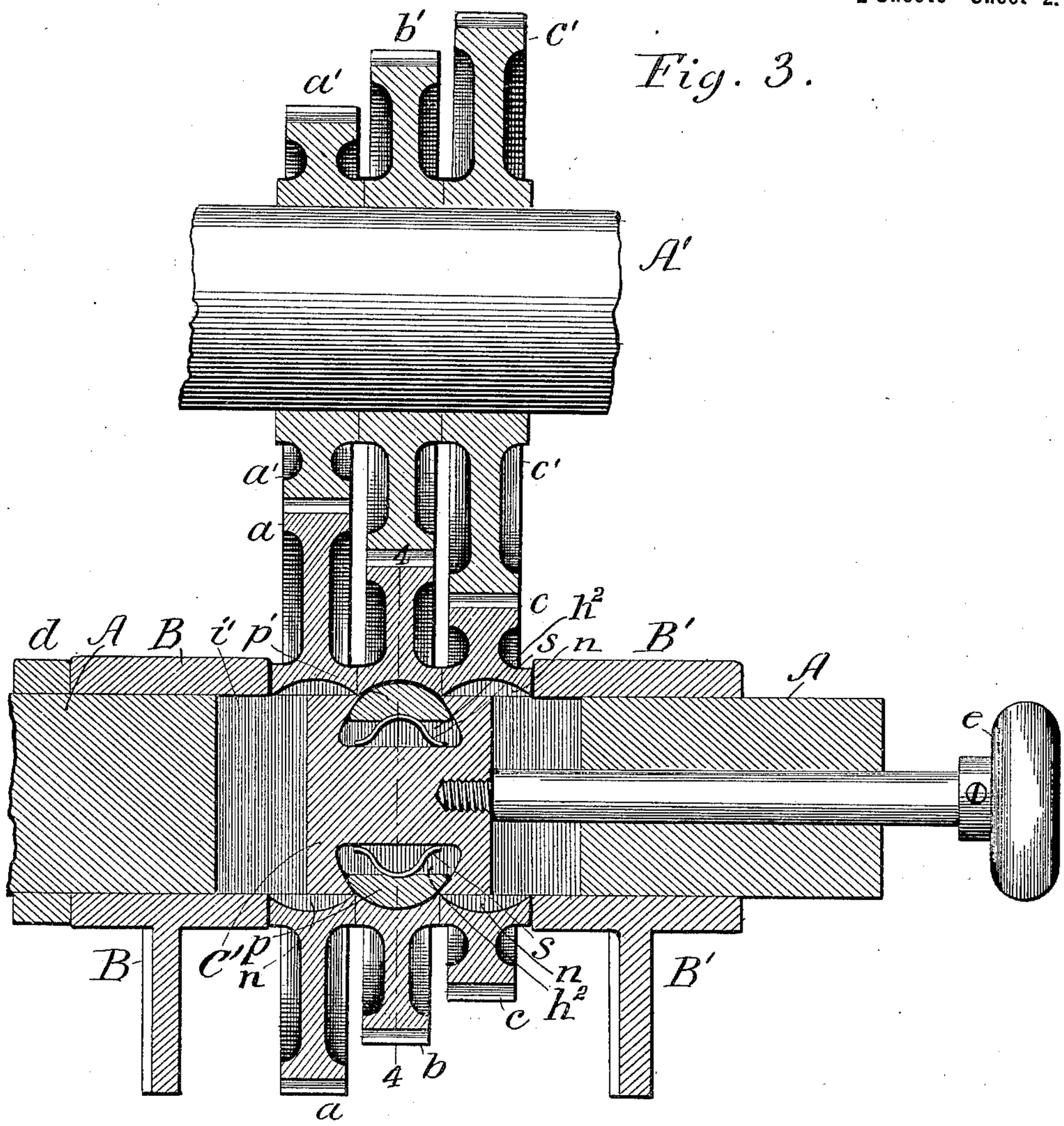
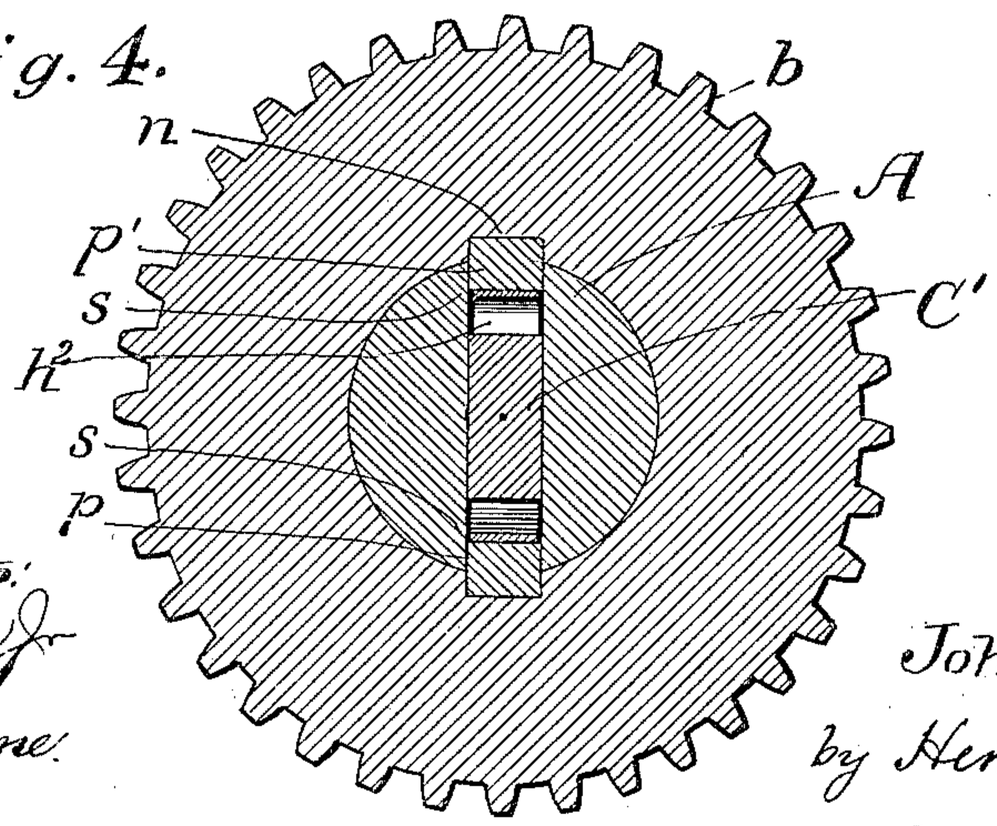


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN E. SWEET, OF SYRACUSE, NEW YORK.

CHANGEABLE-SPEED GEARING.

SPECIFICATION forming part of Letters Patent No. 682,507, dated September 10, 1901.

Application filed January 16, 1899. Serial No. 702,296. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. SWEET, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Changeable-Speed Gearing; 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 changeable-speed gearing; and it consists in a device whereby the speed ratios of two interdependent revolving shafts can be instantaneously and safely changed while the said shafts are in motion, which is a desideratum in lathe and screw-cutting machinery, as well as many other kinds, saving the delay in stopping and starting the machine and in the removal and substitution of parts, as ordinarily practiced.

In the drawings forming part of this specification, Figure 1 is a longitudinal sectional elevation of my improvement. Fig. 2 is a transverse vertical section thereof on line 2 2 of Fig. 1. Fig. 3 is a longitudinal sectional elevation of the device in a slightly-modified form. Fig. 4 is a transverse vertical section taken on line 4 4 of Fig. 3.

Like letters refer to like parts in the several figures.

A is a rotary shaft supported in suitable bearings B B′ and may be either a driving or a driven shaft.

P is a pulley, either driving or driven, keyed or otherwise firmly secured on shaft A, adapted to receive a belt for the transmission of power to or from said shaft. On said shaft are mounted, so as to rotate independently, the loose running-gears *a b c*, which may be of any required number and all of different diameters to meet the required exigencies of the different speed ratios desired. Between said gears and outside of the same are placed in Fig. 1 the washers *w w*, for a purpose to be presently explained. The said gears are slotted by transverse slots or keyways, either straight or concave, on opposite sides of their respective centers, as shown at *n n* in all the figures. The shaft A, Figs. 1 and 2, is bored a suitable distance from its extremity with a cavity *i*, into which fits a sliding plunger C. Said plunger is slotted with a diametral slot *h*, in which slot is mounted the pivoted or swinging splines *p p′*, normally pressed apart by a spring or springs *s*. The shaft A is also slotted for a suitable distance on opposite sides of the axis of the cavity *i*, said slots *h′* being coincident with the slot *h* of plunger C. The splines *p p′* project through these slots *h′* into the slots *n* when normally opposite said slots, being retained therein by outward pressure of spring *s*.

d is a collar on shaft A.

e is a suitable pull or handle by which sliding plunger C is manipulated.

f is an annular stop surrounding plunger-handle *e* in the extremity of cavity *i*, held in place by any suitable mechanical means.

A′ is a rotary shaft, either driving or driven, mounted in the same plane with and usually parallel to shaft A in suitable bearings. On said shaft A′ are mounted the gears *a′ b′ c′*, of different diameters, equal in number to gears *a b c* on shaft A and meshing therewith. Said gears *a′ b′ c′* are keyed or otherwise securely fastened on shaft A′, so as to rotate with it by key *g′* in slot *g* or in any other suitable manner.

In Figs. 3 and 4 the same device is shown in slightly-modified form, the washers *w* being dispensed with, and slots *n* being formed concave instead of straight. C′ is the sliding block or plunger, in this case moving in a rectangular slot or cavity *i′* instead of a cylindrical one, as in Fig. 1, and said cavity *i′* extends entirely across the shaft, rendering slots *h′ h′*, as shown in Fig. 1, unnecessary. Sliding block C′ is recessed at h^2 h^2 to form suitable receptacles and seats for the splines *p p′* and springs *s s*, which force the same outward. The action is thus precisely the same as in the device of Figs. 1 and 2. The functions of the edges of the gears at the extremities of slots *n n*, Fig. 3, and of the washers *w w*, whether integral with the gears or detached, as shown in Fig. 1, is to depress the splines *p p′* when being shifted longitudinally from one keyway to another, so that they shall be entirely out of engagement with one keyway before entering another one, which is essential to safe operation when the shafts are in motion. It is evident, however,

that slots *n* may be cut part way instead of entirely across, it being only a question of economy of construction, in which case the washers would be practically integral with the gears on one or both sides, as is the case in Fig. 3, where the keyways are milled out concave. The closed extremities of the keyways in this case perform the same function of depressing the splines as is performed by the washers in Fig. 1.

The operation of the device is as follows: When it is desired to change from one speed ratio to another, it is only necessary to shift the position of the plunger C, by means of the handle *e*, till the movable splines fall out of engagement with their respective keyways and enter the keyways of the companion gear, which gives the desired ratio of speed between the driving and the driven shaft, which ratio may be anything desired, provided gears enough are supplied with varying ratios between the numbers of driving and driven teeth. When the handle *e* is pulled or pushed, as the case may require, the movable splines are pushed inward by the resistance of the washers *w* or the integral edges of the gear-keyways, leaving all the loose or running gears momentarily free to revolve irrespective of the rotation of shaft A. Said splines, however, immediately spring outward and engage the next keyway to which they come opposite, when the movable piece C is stopped with the splines opposite to the pair of gears having the desired ratio of respective pitch diameters. The motion is then immediately taken up to the driven shaft, the running-gears on shaft A not engaged by the splines being free to rotate independently of shaft A at the respective rates at which they are driven by the intermeshing fixed gears on shaft A′. Said gears should of course be supplied with proper lubrication.

It is obvious that the operation will be the same if only one movable spline is employed; but for mechanical reasons it is preferable to employ them in pairs to balance the strain. Said splines may also be forced outward by any means which is the mechanical equivalent of the spring or springs *s*. Springs are shown as the simplest and most obvious means for such purpose. Pulley P may be replaced by a spur or bevel gear, where the transmission of motion is not made by belting. Belted gears might be used in place of the intermeshing spur-gears described without departing from the essence of this invention. Bevel-gears are employed when the shafts are inclined to each other.

I claim and desire to secure by Letters Patent—

In changeable-speed gear, a rotary shaft having a slotted cavity, a sliding member mounted within the cavity of the shaft, radially-movable splines mounted in said sliding member, projecting therefrom beyond the rotary shaft, a plurality of gears mounted directly upon said shaft side by side and running loosely thereon, said gears provided with keyways on their inner bearing-surfaces, springs to press the said splines outward to engage said keyways in succession as the sliding member is moved, and intervening annular portions between adjacent keyways, flush with the inner contacting-faces of said gears, whereby said splines are disengaged from each keyway as they pass from one to the other by the movement of the sliding member, substantially as specified.

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

JOHN E. SWEET.

Witnesses:
W. H. THOMAS,
W. T. POWERS.