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PATENTED MAR. 27, 1906.

W. L. SCHELLENBACH.  
VARIABLE SPEED DRIVING MECHANISM.

APPLICATION FILED JAN. 31, 1903.

2 SHEETS—SHEET 1.

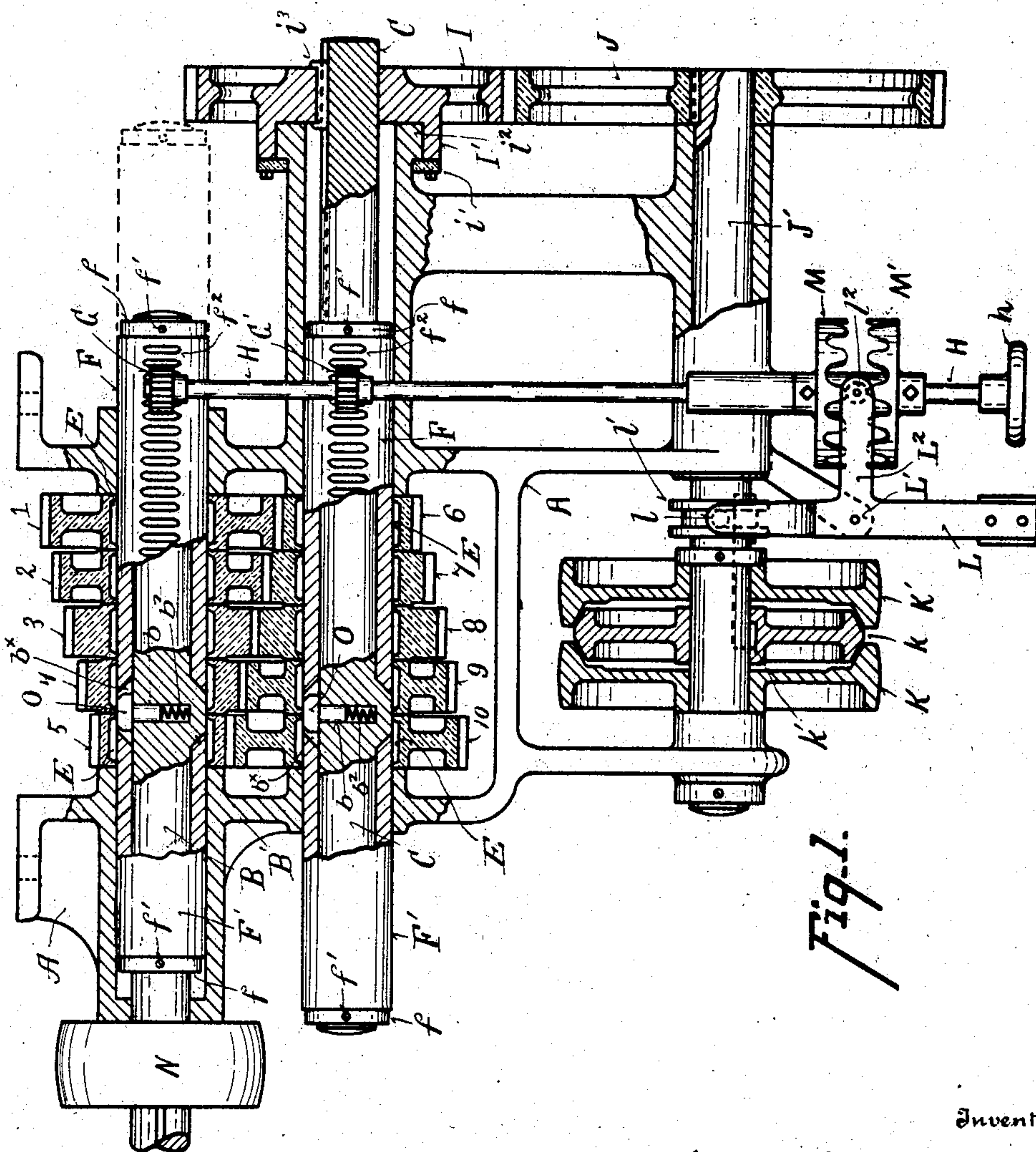


Fig. 1.

Witnesses

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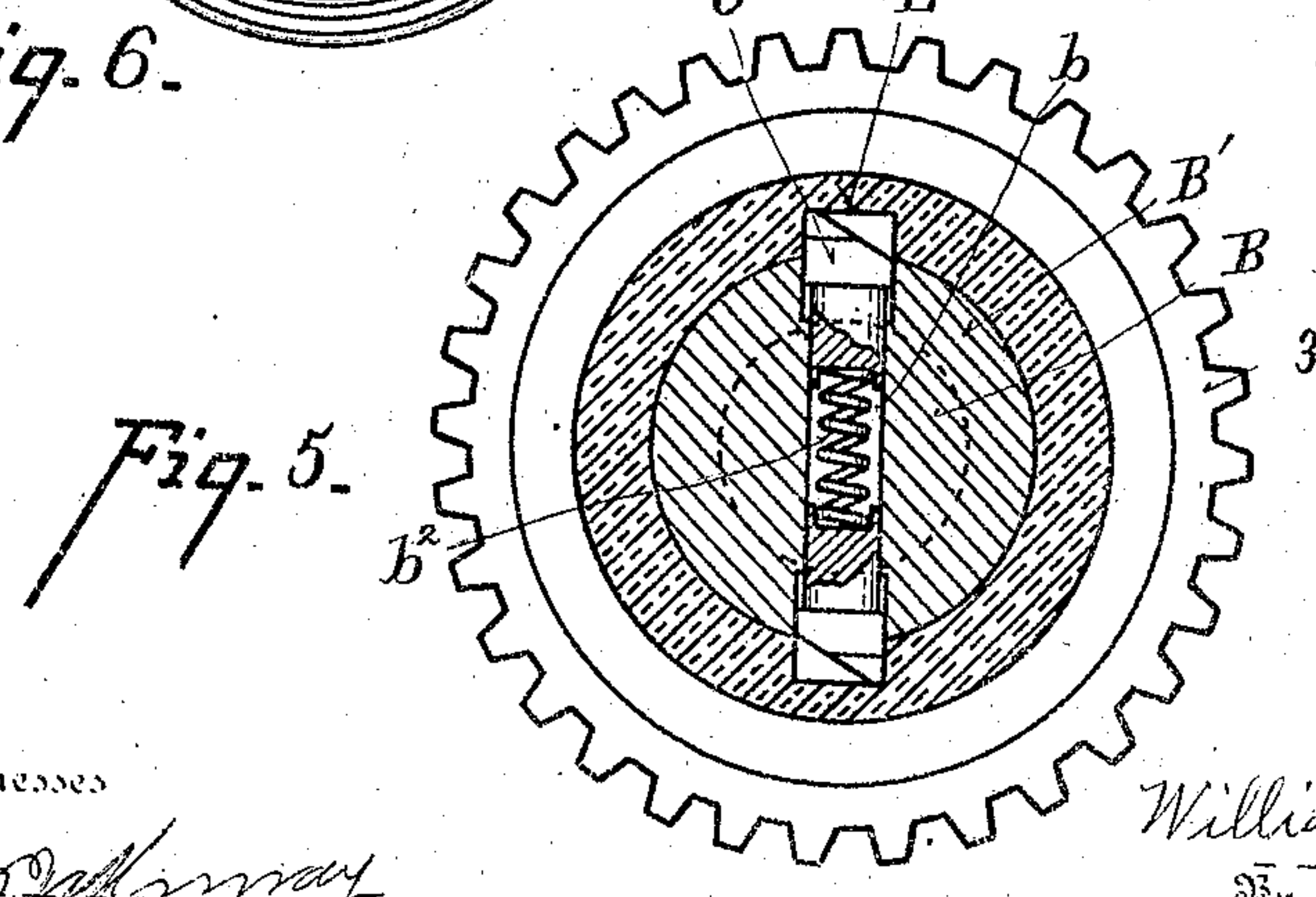
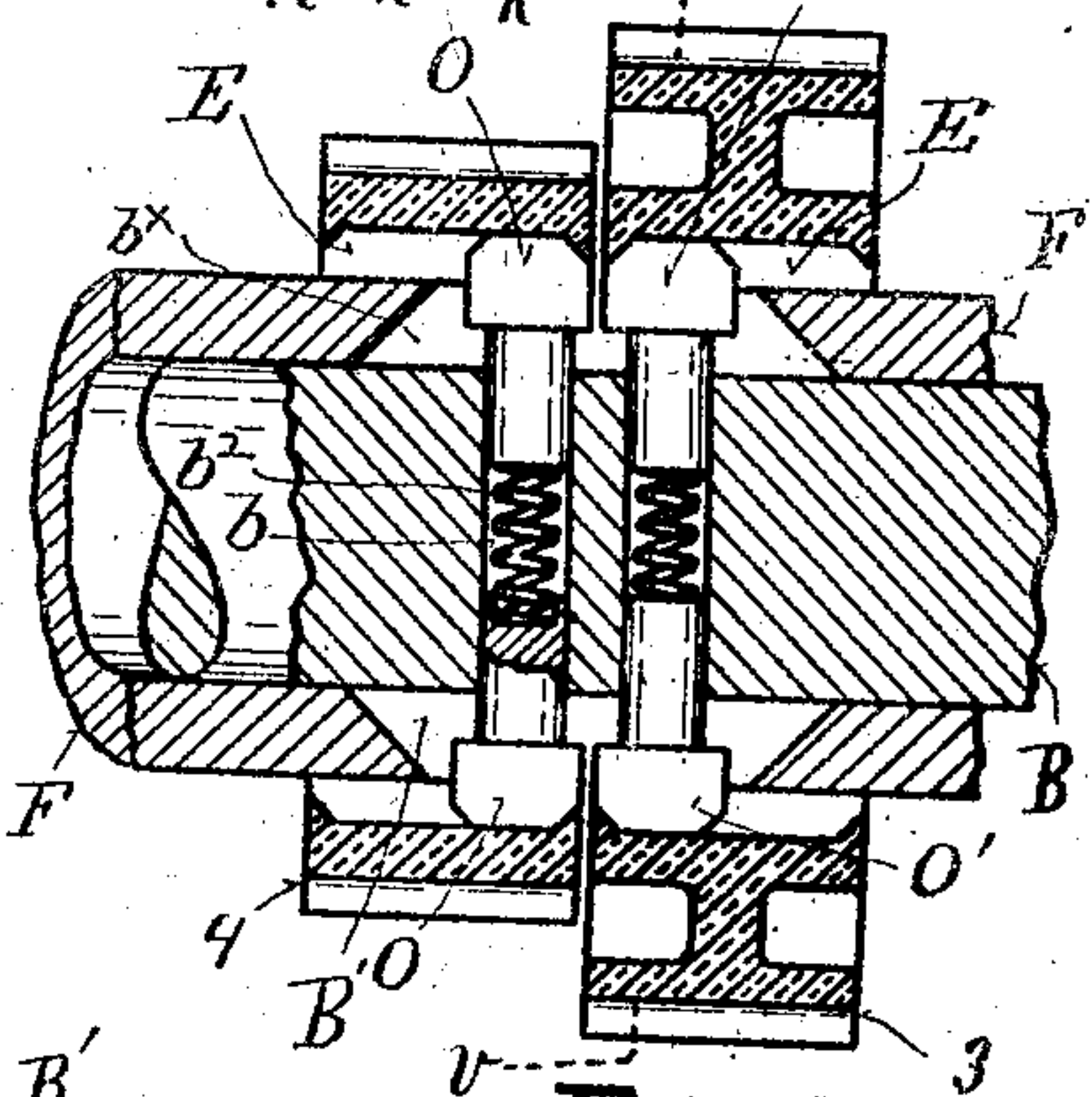
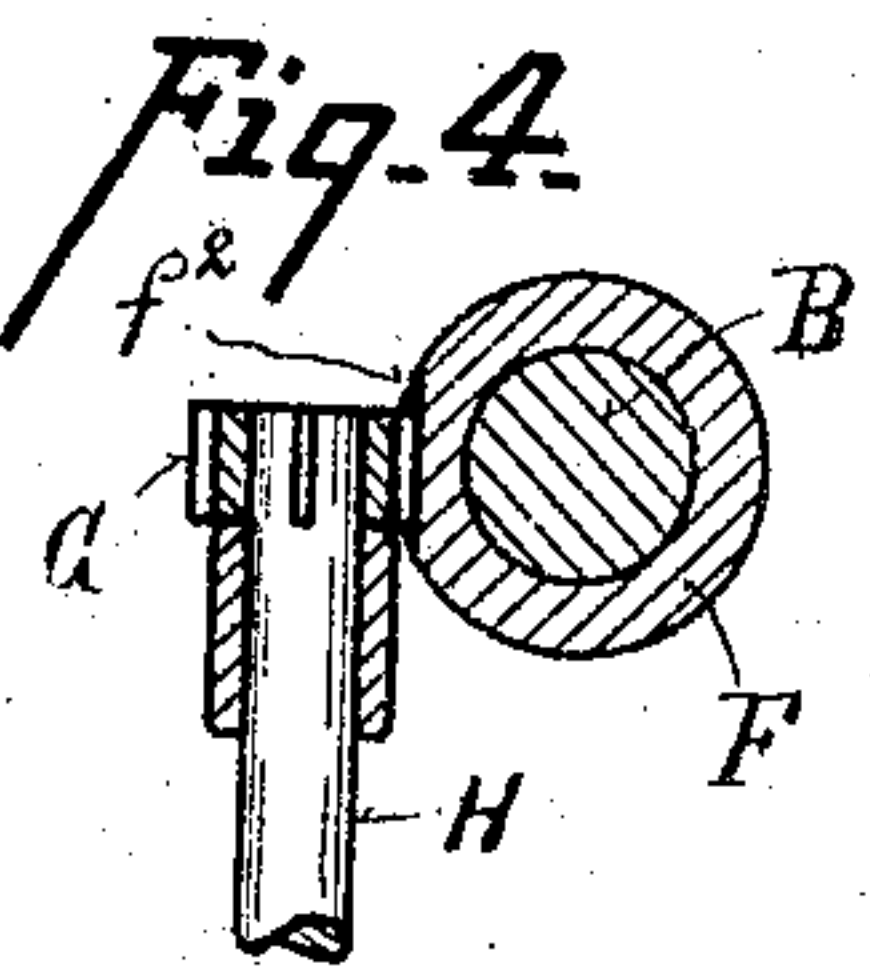
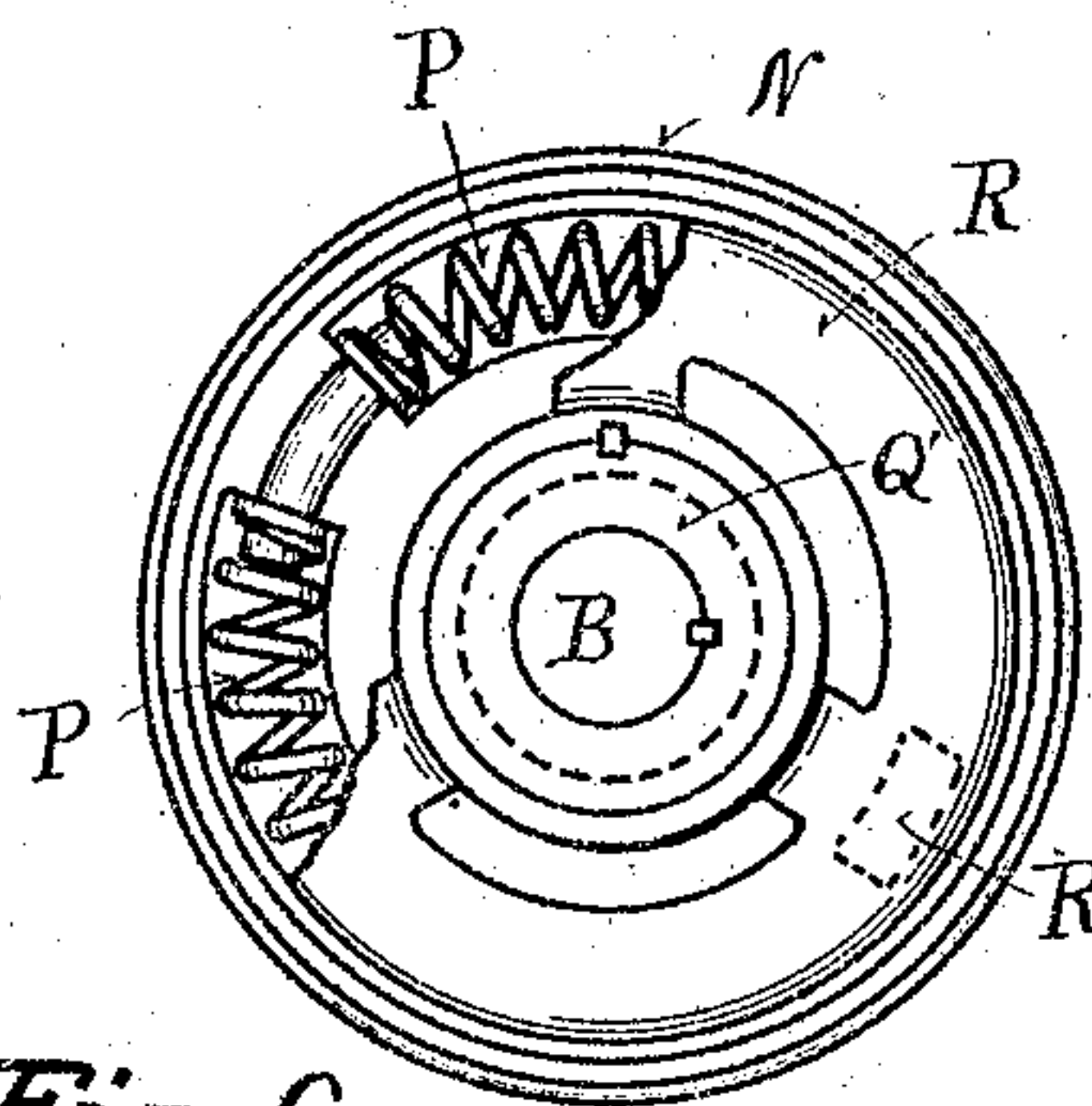
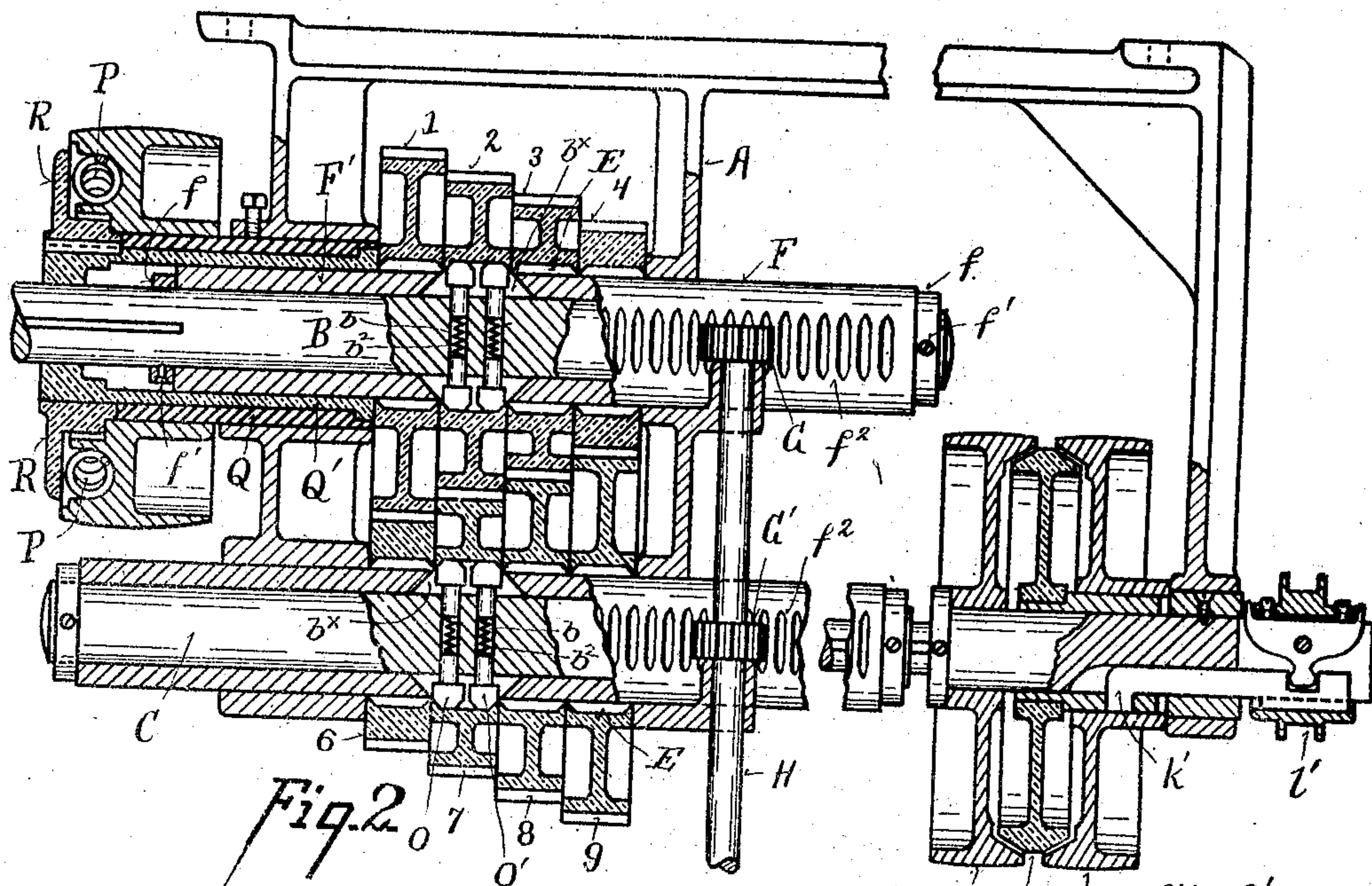
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2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

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## VARIABLE-SPEED DRIVING MECHANISM.

No. 816,128.

Specification of Letters Patent.

Patented March 27, 1906.

Application filed January 31, 1903. Serial No. 141,298.

*To all whom it may concern:*

Be it known that I, WILLIAM LORRAINE SCHELLENBACH, 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 Variable-Speed Driving Mechanism; 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 variable-speed driving mechanism. It is particularly adapted for use as a variable-speed counter-shaft, but may be employed to advantage in other relations where a variable speed is desirable. One of its objects is to provide a variable-speed driving mechanism in which the change of speed can be readily, conveniently, and quickly changed.

Another object is to provide a mechanism with which a wide variation of speeds can be attained.

Another object is to provide a mechanism in which a minimum number of parts are in action at one time.

Another object is to provide improved means for effecting a transition from one speed to another without injury or undue strain on the operating parts.

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

Figure 1 is a side elevation, partly in section, of a variable-speed counter-shaft embodying the preferred form of my invention.

Fig. 2 is a similar view showing a modification. Fig. 3 is an enlarged detail sectional view showing the method of connecting the respective change-gears to the shaft. Fig. 4

is a detail of the mechanism through which the change of speeds is effected. Fig. 5 is a section on line *vv* of Fig. 3. Fig. 6 is a detail of one of the belt-pulleys.

A represents the frame in which the operative parts are mounted.

1 2 3 4 5 represent a series of gears mounted on shaft B and meshing, respectively, with gears 6 7 8 9 10 on the shaft C.

B' represents a boss or enlargement of the shaft B, in which is cut a slot *b*, which serves as a seat for the stem of a clutch or pawl O, which is pressed outwardly by a spring *b*<sup>2</sup>.

E represents notches on the inner face of the gears to receive the head of the pawl.

F F' represent loose sleeves on opposite sides of the boss B', said sleeves being held in place against the boss by collars *f* and set-screws *f*<sup>1</sup>, and the boss serving to hold the sleeves spaced apart, thus to provide a slot or opening *b*<sup>x</sup>, through which the head of the pawl O projects into engagement with the notches E of the gears. The shaft C is provided with a similar boss, clutch, or pawl and sleeves.

The sleeves F have rack-teeth *f*<sup>2</sup> cut in their outer faces, which teeth are engaged by pinions G G', mounted on the controller-shaft H, which is turned by hand-wheel *h* to shift the shafts B C endwise to bring the pawls into engagement with any desired pair of gears thereon.

I represents a gear on the end of shaft C, which is retained in position by means of the collar I' and ring *i*<sup>1</sup> engaging the enlarged end *i*<sup>2</sup> of the journal-box, so that the key *i*<sup>3</sup> slides in the key-seat of the shaft as the shaft is shifted endwise.

J represents a gear meshing with gear I and mounted on shaft J', which may be employed either as the driving or driven shaft.

K K' represent pulleys, one of which receives a straight and the other a cross belt.

*k* represents a friction-clutch adapted to be shifted by the key *k*<sup>1</sup> to engage and drive either pulley K or K' and which when in a central position is disengaged from both.

L represents a shifter-arm pivoted at L' and carrying at its upper end rollers *l*, engaging a grooved collar *l*<sup>1</sup>, which is connected to and shifts the key *k*<sup>1</sup> and clutch *k*. The arm L<sup>2</sup> of the shifter carries a roller *l*<sup>2</sup>, which is engaged by the cams M M' on the controller-shaft whenever it is employed to change the speed, to first throw the clutch *k* to a central position and relieve the parts of the driving load, after which the cams come into position with their notches opposite the roller *l*<sup>2</sup>, so that the shifter can be employed to throw the clutch into engagement with either one of the pulleys again.

As shown in Fig. 1, the pawls are in the act of being shifted from one pair of gears to another. N represents a pulley mounted on shaft B in a manner similar to gear I, so as to be driven by a key entering a key-seat in the shaft B and so that the shaft can be shifted endwise through the gear. This pulley can be employed either as the driving or driven pulley, as desired. I preferably, however, employ the pulleys K K' as drivers, so that



when not in use all motion of the gears is avoided.

In the modification Figs. 2 and 3 I provide two pawls O O' side by side, which are so arranged that in the act of shifting the shafts endwise to vary the speed one pawl comes into possession to engage the adjacent gear before the other has become disengaged from the preceding one, as shown in Fig. 3, in which case either one or the other of the pawls is forced into its socket by reason of the gear moving faster than the pawl until both pawls have been shifted into engagement with the same gear. These pawls are beveled to cause them to catch in one direction only as they are shifted laterally, so that one pawl is in position to engage one gear and the other is still in position to engage the last-used gear. Thus the pawls on the driving-shaft will tend to drive both gears with which they engage, but the pawls on the driven shaft cannot both engage; but the one beneath the gear which is traveling the fastest will engage to drive the driven shaft, which will cause the driven shaft to revolve faster than the slow gear thereon, with the result that the slower gear on the driven shaft will at intervals, by means of the rear inclined faces of the pawl, force the pawl at appropriate intervals into the recess in the shaft. Thus I am enabled, particularly with light work, to avoid disengaging the clutch at every change of speed, as one set of pawls picks up the new speed and the other set is released without undue jar or strain.

Where the two sets of pawls are employed, I preferably employ cushioning-springs P between the shafts B and pulley N, which serve to take up or relieve any strain due to the change of speeds. This is preferably effected as follows:—Q represents a stationary bushing on which the pulley N revolves. Q' represents a revolving sleeve, which serves as a housing for the sleeve F' and is driven by the shaft B by means of a sliding key. This sleeve Q' carries a plate R, which has ear R'. The spring P rests at one end against the ear R' and at the other end against projections on the pulley, so that the strain of the belt on the pulley compresses the springs to a greater or less extent.

In Fig. 1 I have shown only one pawl to each shaft; but one or more may be employed, as desired, on one or more sides of the shaft. In Figs. 2, 3, and 5 they are shown projecting from opposite sides of the shaft.

In Fig. 2 I have shown the pulleys K K' and clutch k, mounted on an extension of the shaft C, thereby dispensing with the shaft J' and gears I J. The cams M M' are not shown in Fig. 2, but may be employed thereon, if desired.

The sleeve F' may, if desired, be tight on the shaft or integral therewith, forming part of the enlargement, but are preferably con-

structed as shown. As thus constructed there is less wear on the bore of the gears.

It will be noted that all the change gears except the pair in engagement with the pawls are out of contact with the shaft and idle and do not move.

Having described my invention, what I claim is—

1. In a variable-speed mechanism, a driving-shaft adapted to be adjusted endwise and provided with a key; a series of gears loosely mounted on said shaft and adapted to be respectively engaged and driven by said key; a driven shaft provided with a key and adapted to be shifted endwise; and a series of gears on said driven shaft in mesh with the gears on the driving-shaft, and adapted to respectively impart motion to the driven shaft by means of the key carried by the driven shaft.

2. In a variable-speed mechanism, a driving-shaft having an enlarged portion, a key seated in said enlarged portion; a sleeve serving as a journal for the reduced portion; a series of gears loosely mounted on the driving-shaft, and adapted to be respectively engaged by the key as the shaft is shifted endwise; means for engaging the sleeve to shift the shaft endwise; a driven shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for the reduced portion of said shaft; a series of gears loosely mounted on the driven shaft and in mesh with the gears on the driving-shaft, said gears being adapted respectively to engage the key on the driven shaft and transmit motion thereto by shifting the driven shaft endwise; and means engaging the sleeve on the driven shaft to shift it endwise.

3. In a variable-speed mechanism a driving-shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for one end of the shaft; a series of gears loosely mounted on the shaft and adapted to be respectively engaged by the key by shifting the shaft endwise; a driven shaft having an enlarged portion; a key seated in said enlarged portion of the shaft; a sleeve serving as a journal for one end of the shaft; a series of gears loosely mounted on the driven shaft, and adapted to be respectively engaged by the key of the driven shaft as said shaft is shifted endwise; and means engaging the sleeves of the driving and driven shafts to shift said shafts endwise in unison.

4. In a variable-speed mechanism, a driving-shaft having an enlarged portion; sleeves mounted on said shaft on opposite sides of said enlarged portion; a key seated in said enlarged portion; a series of gears loosely mounted on the shaft and adapted to be engaged respectively by said key as the shaft is shifted endwise; a driven shaft having an enlarged portion; sleeves upon opposite sides of said enlarged portion; a series of gears loosely



mounted on said shaft and in mesh with the gears on the driving-shaft, said gears on the driven shaft being adapted to be respectively engaged by the key of the driven shaft as it is shifted endwise to drive the driven shaft; and means engaging the sleeves at one end on the driving and driven shafts to shift said shafts endwise in unison.

5. In a variable-speed mechanism, a driving-shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for one end of the shaft; a series of gears loosely mounted on the shaft and adapted to be respectively engaged and driven by the key as the shaft is shifted endwise; a driven shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for one end of said shaft; a series of gears loosely mounted on said shaft and in mesh with the gears on the driving-shaft, said gears being adapted to be respectively engaged by the key of the driven shaft as it is shifted endwise to impart motion to the driven shaft; driving and driven pulleys; a controlling mechanism engaging the sleeves on the driving and driven shafts to shift said shafts endwise in unison; and means for automatically disengaging the load before each change of speed.

6. In a variable-speed mechanism, a driving-shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for one end of the shaft; a series of gears loosely mounted on the shaft and adapted to be respectively engaged and driven by the key as the shaft is shifted endwise; a driven shaft having an enlarged portion; a key seated in said enlarged portion; a sleeve serving as a journal for one end of said shaft; a series of gears loosely mounted on said shaft and in mesh with the gears on the driving-shaft, said gears being adapted to be respectively engaged by the key of the driven shaft as it is shifted endwise to impart motion to the driven shaft; driving and driven pulleys; a controlling mechanism engaging the sleeves on the driving and driven shafts to shift said shafts endwise in unison and means operated by the controlling mechanism for disengaging the load before each change of speed.

7. In a variable-speed mechanism, a driving-shaft adapted to be adjusted endwise and provided with a key; a series of gears loosely mounted on said shaft and adapted to be respectively engaged and driven by said key; a driven shaft provided with a key and adapted to be shifted endwise; a series of gears on said driven shaft in mesh with the gears on the driving-shaft, and adapted to respectively impart motion to the driven shaft by means of the key carried by the driven shaft; a driving and driven pulley; a controlling mechanism adapted to shift the shafts endwise; and means operated by the controlling

mechanism for disengaging the load before each change of speed.

8. In a variable-speed mechanism, a driving-shaft adapted to be adjusted endwise and provided with a key; a series of gears loosely mounted on said shaft and adapted to be respectively engaged and driven by said key; a driven shaft provided with a key and adapted to be shifted endwise; a series of gears on said driven shaft in mesh with the gears on the driving-shaft, and adapted to respectively impart motion to the driven shaft by means of the key carried by the driven shaft; a pulley adapted to drive said mechanism in the forward direction; a pulley adapted to drive said mechanism in the reverse direction; a clutch adapted to engage and be driven by either of said pulleys; a controlling mechanism adapted to shift the driving and driven shafts endwise; and means operated by the controlling mechanism for shifting said clutch to release the load before each change of speed.

9. In a variable-speed mechanism, a driving-shaft provided with a sliding clutch; a releasing-clutch influencing the rotation of said shaft, a plurality of different-sized gear-wheels suspended around said shaft and adapted to engage said sliding clutch; a driven shaft provided with a sliding clutch; a plurality of different-sized gear-wheels suspended around said shaft and adapted to engage said clutch, and means for actuating the releasing-clutch on the driving-shaft and shifting the driving and driven shaft clutches in unison at a single movement.

10. In a variable-speed mechanism, a driving-shaft, a driven shaft, a plurality of gears of different sizes mounted concentrically with but not in contact with said shafts, clutch members on the respective shafts adapted to travel through said gears in unison and to respectively bring into operation different pairs of said gears, a controlling mechanism adapted to shift said clutch members along the shafts, and means operated by the controlling mechanism for disengaging the load before each change of speed.

11. In a variable-speed mechanism, a driving-shaft, a driven shaft, a plurality of different-sized gears through the bores of which said shafts pass, clutch members on the respective shafts adapted to travel through the bores of the gears, and to respectively bring into operation different pairs of said gears to effect a change of speeds, a controlling mechanism adapted to shift said clutch members along the shafts, and means operated in unison with the controlling mechanism for disengaging the load before each change of speed.

12. In a speed-variator, a pair of shafts, means for driving one of said shafts, a clutch controlling the said drive, intermeshing pairs of gear-wheels of different diameter



loosely supported relative to said shafts, clutch-sleeves sliding on said shafts within the gear-wheel bores, the said sleeves having racks, gear-wheels between said sleeves engaging said racks, and means for actuating said last-named gear-wheels, whereby the said clutch-sleeves are shifted simultaneously in either direction, substantially as described.

10 13. In a speed-variator, a pair of shafts, means for driving one of said shafts, intermeshing pairs of gear-wheels of different diameter loosely supported relative to said shafts, clutches sliding within said gear-wheel bores adapted to fix any selected pair of intermeshing gear-wheels to their shafts, and rack and gear wheel mechanism for shifting said clutches simultaneously, substantially as described.

20 14. In a variable-speed mechanism, a driving-shaft having an enlargement, a series of pawls seated in the enlargement, a sleeve constituting a journal for one end of the shaft, a series of gears loosely mounted on the shaft and adapted to be respectively engaged and driven by the pawls as the shaft is shifted endwise, a driven shaft having an enlargement, a series of pawls seated in the enlargement, a sleeve constituting a journal for one end of the shaft, a series of gears loosely mounted on the shaft and in mesh with the gears on the driving-shaft, said gears being adapted to be respectively engaged by the pawls on the driving-shaft as it is shifted  
35 endwise to impart motion to the driven shaft,

the arrangement of each of the pawls of each shaft being such that one of the gears is engaged by a part of said series of pawls before the preceding gear is released by the remaining pawls.

40 15. A speed-changing mechanism, comprising two shafts, separate gears of different size revolubly supported on each shaft, the gears on one shaft meshing with those on the other shaft in reverse order, each shaft movable axially with reference to the gears thereon, a feather for locking each shaft to any one gear thereon, and means for shifting the shafts through the gears and thereby unlocking them from one pair of meshing gears and locking them to another pair of meshing gears, as set forth.

16. A speed-changing mechanism, comprising two shafts, separate gears of different size on each shaft, the gears on one shaft meshing with those on the other shaft in reverse order, each shaft movable axially with reference to the gears thereon, a feather for locking each shaft to any one gear thereon, and connections between the two shafts whereby the axial movement of one shaft effects the axial movement of the other shaft, as set forth.

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

WILLIAM LORRAINE SCHELLENBACH.

Witnesses:

C. W. MILES,  
CHARLES F. DOLLE.