No. 736,238. PATENTED AUG. 11, 1903.

W. DONALDSON.

VARIABLE SPEED DRIVE FOR MACHINE OR OTHER TOOLS.

APPLICATION FILED MAY 6, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

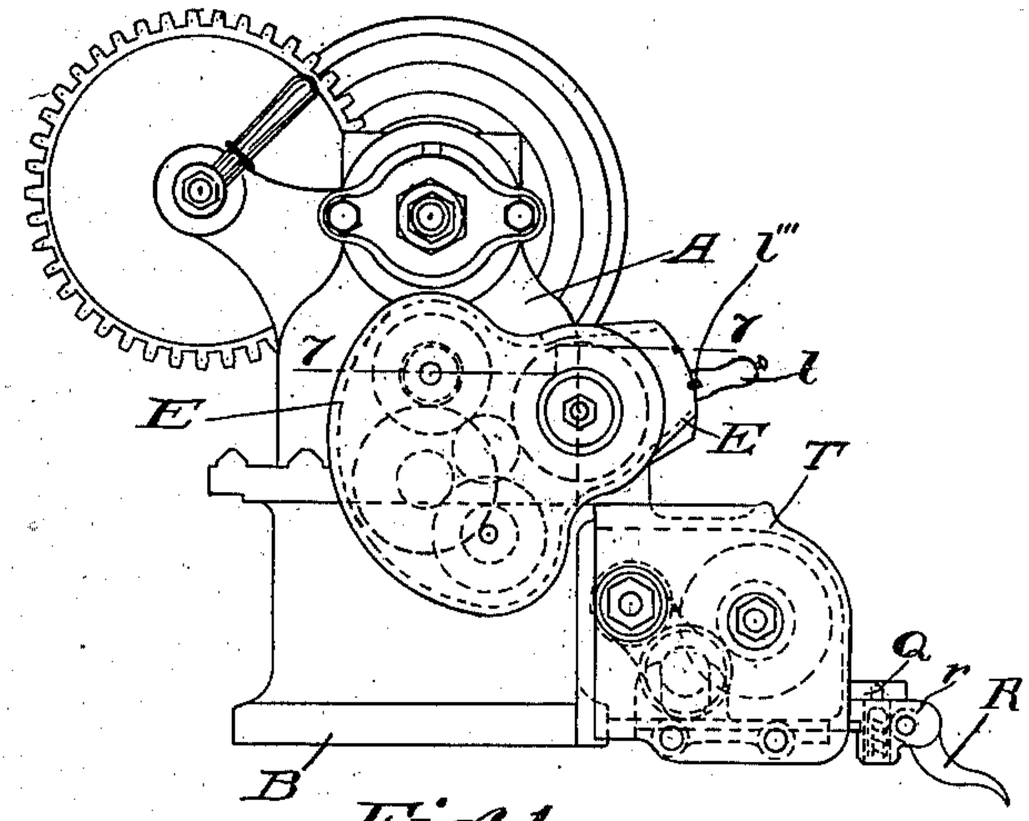

Fig. 1.

INDEX										
NOTCH	THREADS									
1	2	2½	2½	2¾	2⅞	3	3½	3⅜	3½	4
2	4	4½	5	5½	5¾	6	6½	6¾	7	8
3	8	9	10	11	11½	12	13	13½	14	16
4	16	18	20	22	23	24	26	27	28	32

Fig. 10.

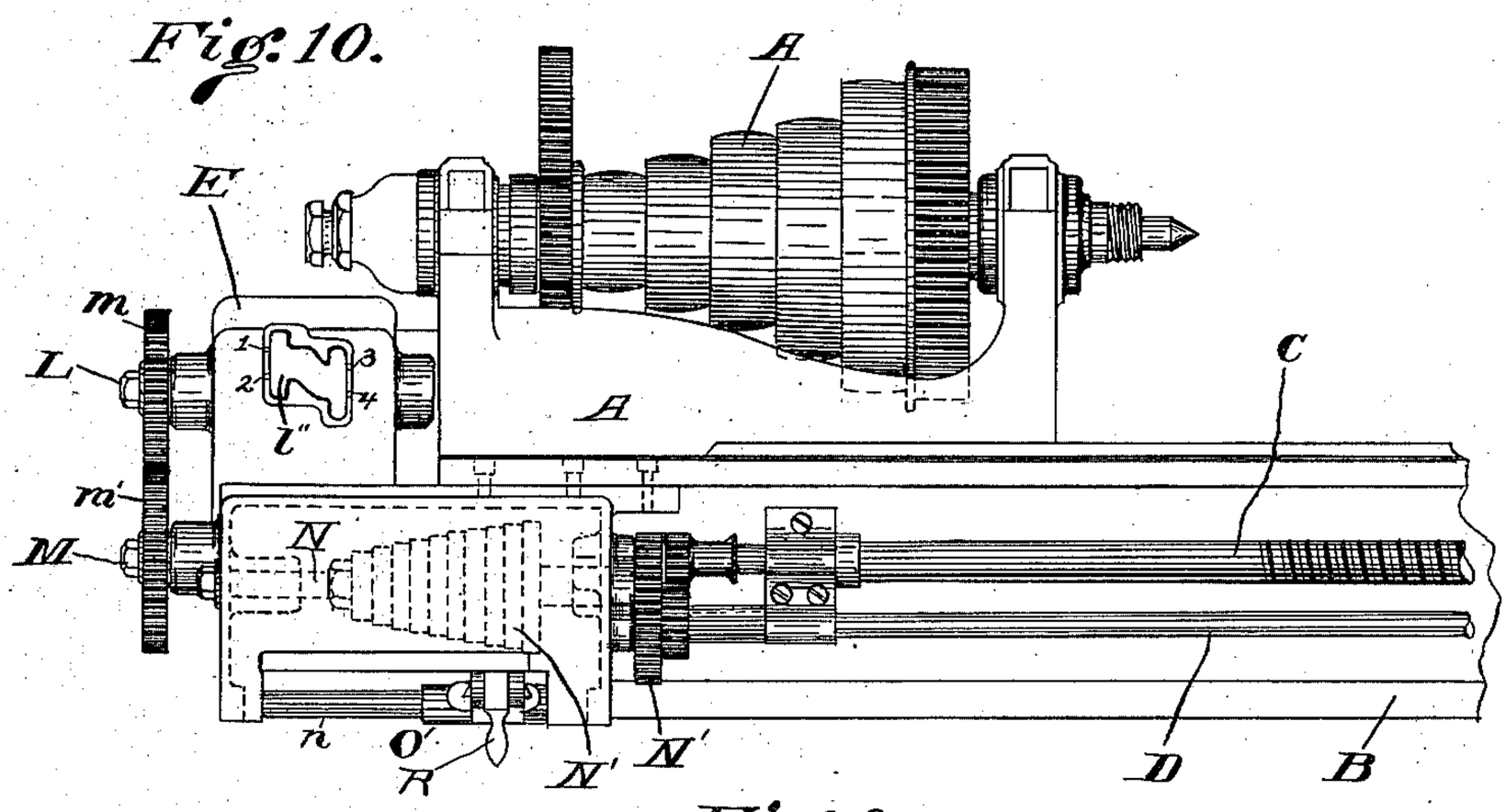

Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 2.

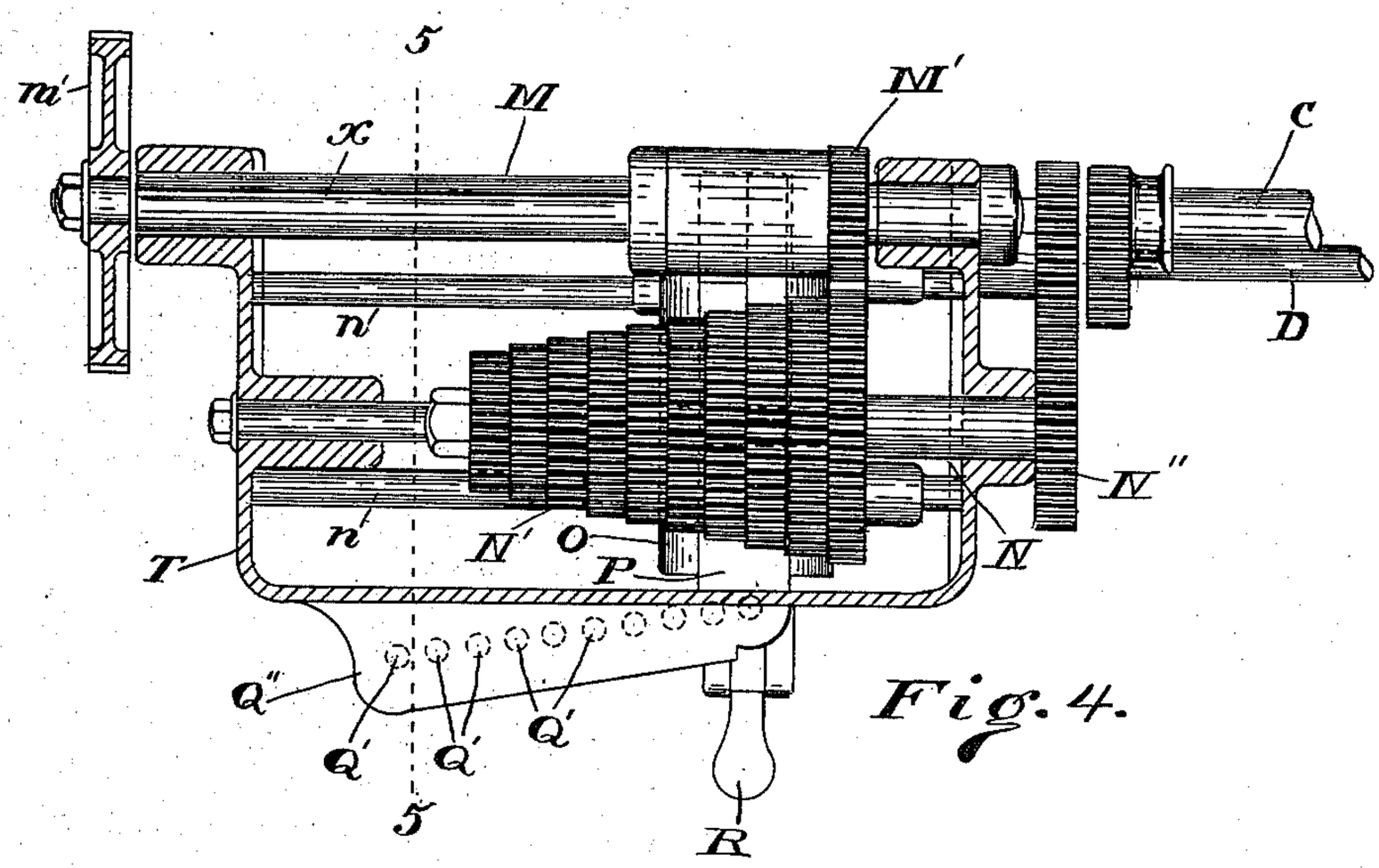

Fig. 4.

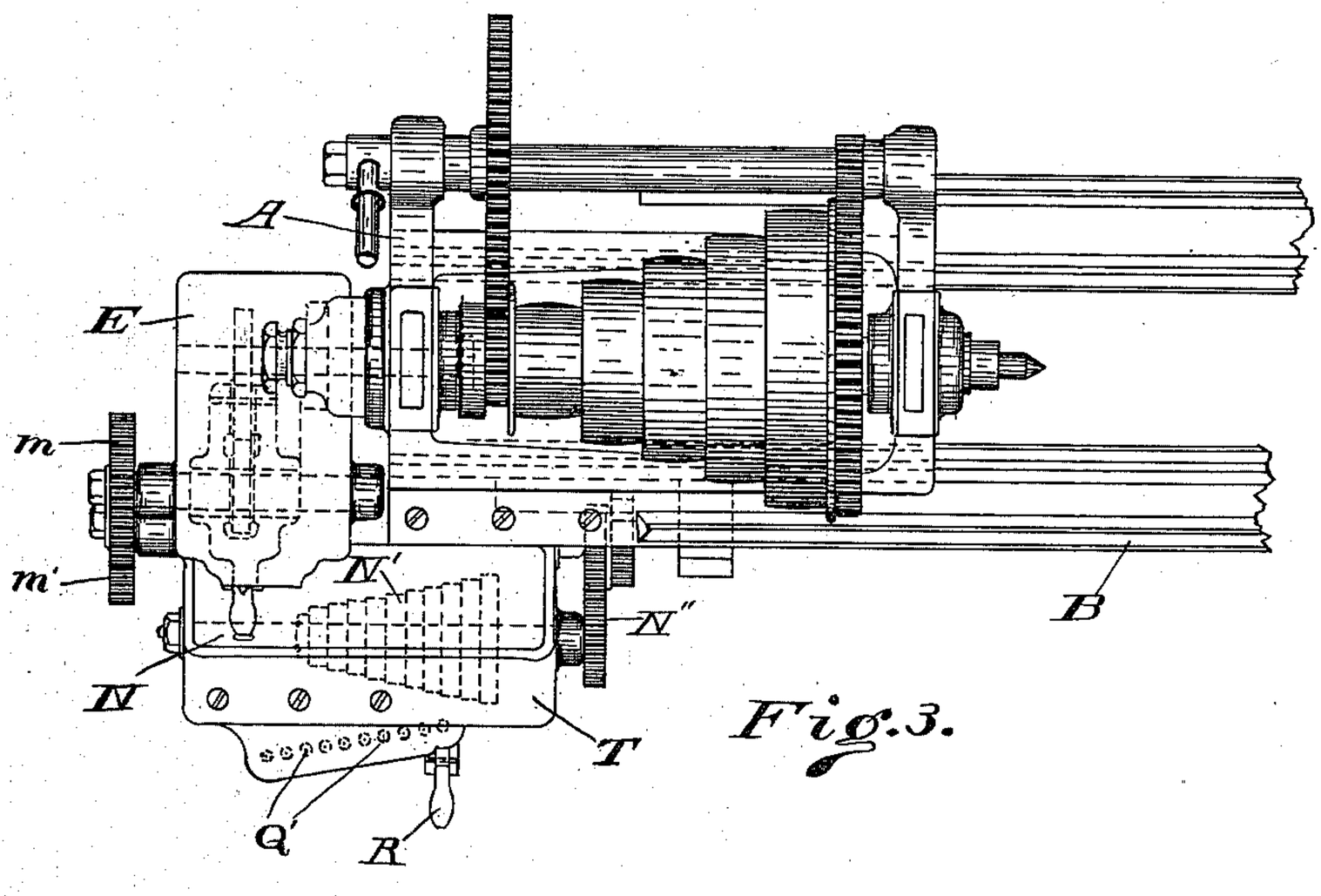

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 3.

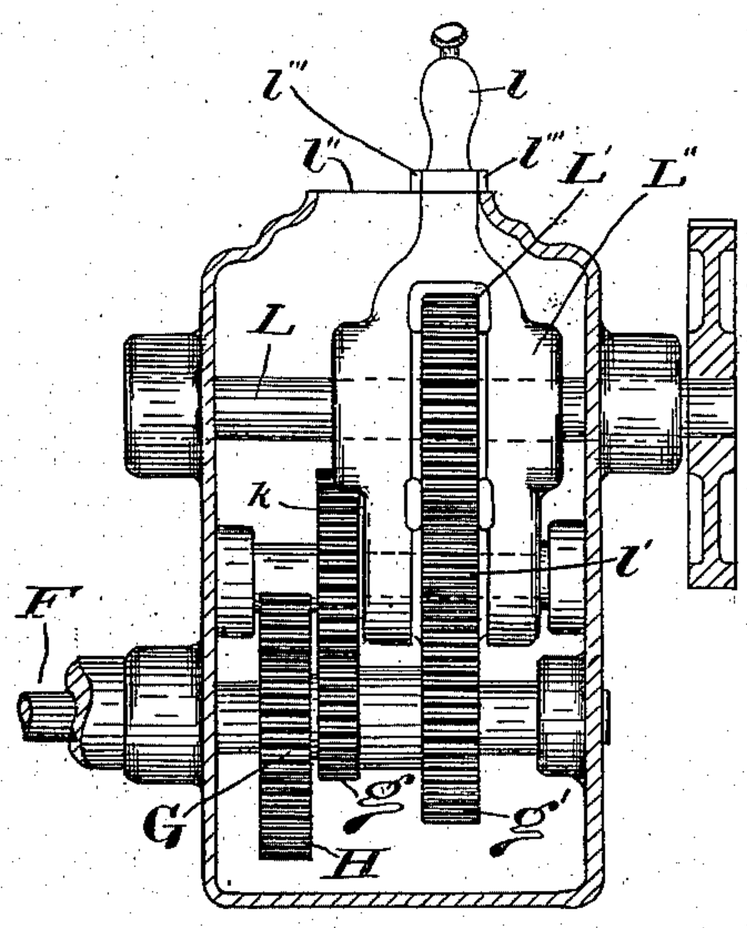

Fig. 7.

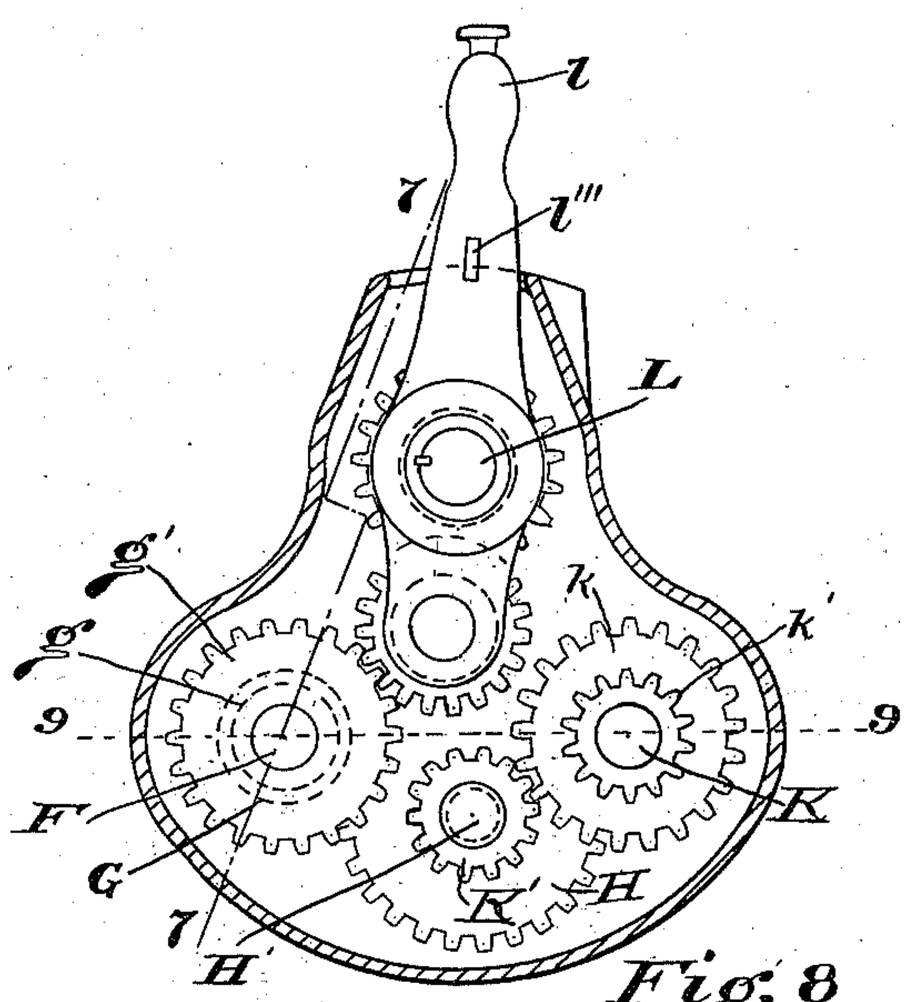

Fig. 8

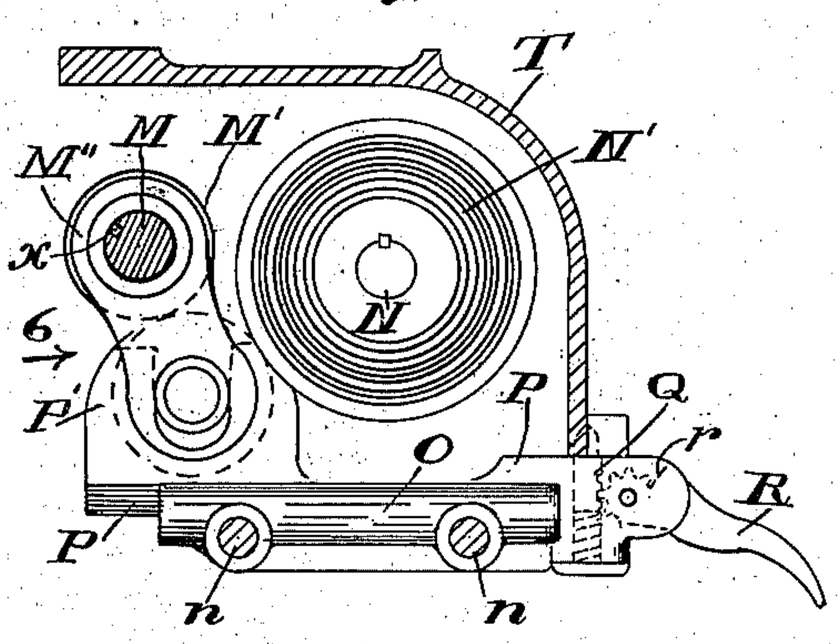

Fig. 5.

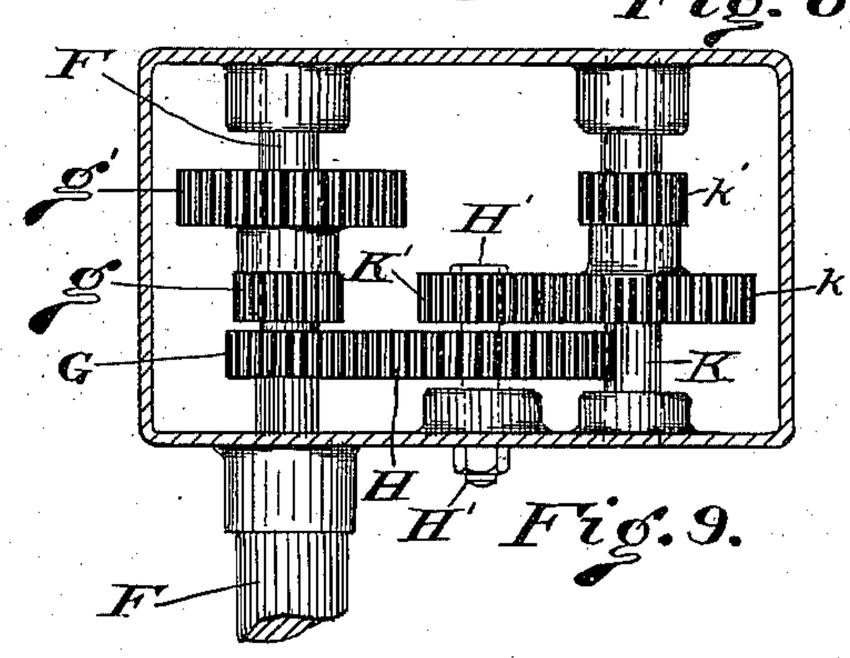

Fig. 9.

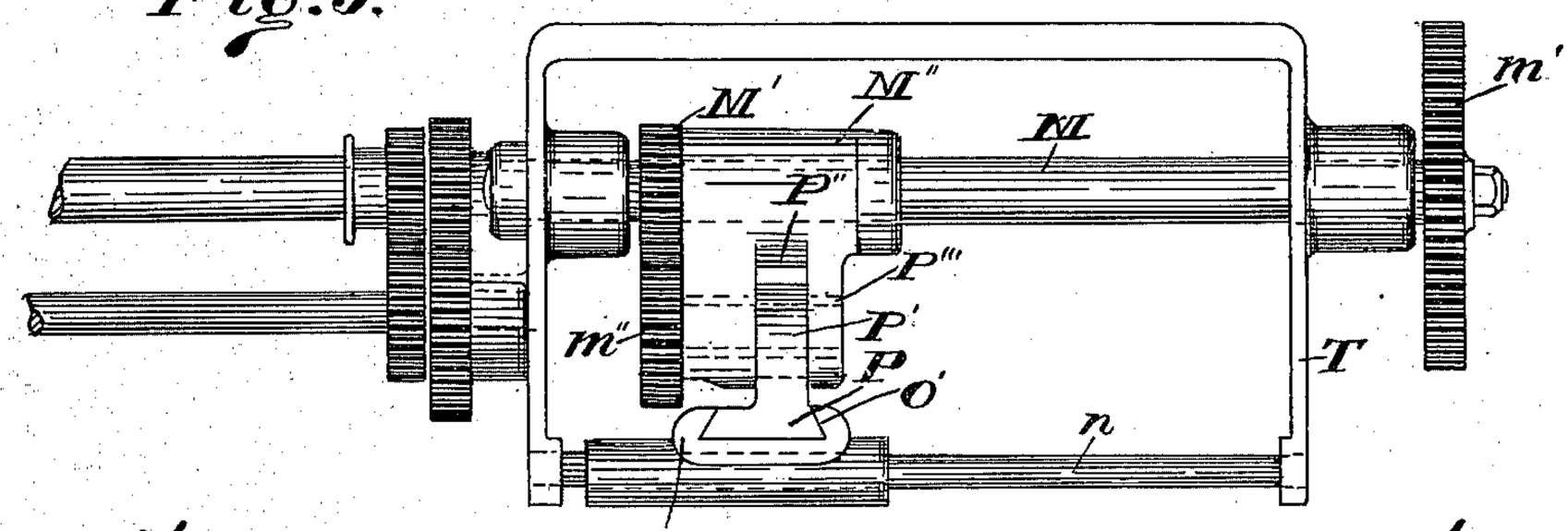

Fig. 6.

Witnesses
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No. 736,238. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM DONALDSON, OF LUDLOW, KENTUCKY, ASSIGNOR TO BRADFORD MACHINE TOOL COMPANY, OF CINCINNATI, OHIO.

VARIABLE-SPEED DRIVE FOR MACHINE OR OTHER TOOLS.

SPECIFICATION forming part of Letters Patent No. 736,238, dated August 11, 1903.

Application filed May 6, 1903. Serial No. 155,843. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM DONALDSON, a citizen of the United States, residing at Ludlow, in the county of Kenton, in the State of Kentucky, have invented certain new and useful Improvements in Variable-Speed Drives for Machine or other Tools, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of my specification.

My invention relates to machine-tools, and more particularly to the mechanism by which changes in the feed of the tool or when applied to the lead-screw in screw-cutting lathes changes in the number of threads to be cut may be produced.

The object of my invention is to provide such a mechanism that the full number of changes possible in the machine may be made in the shortest possible time and with little or no chance for error. Its advantages will appear more fully as I proceed with my specification.

In the drawings, Figure 1 is an end elevation of a lathe provided with my improved mechanism. Fig. 2 is a front elevation of a portion of the same. Fig. 3 is a top plan view. Fig. 4 is a horizontal section through the cone-gear box. Fig. 5 is a vertical section through the same on the line 5 5 of Fig. 4. Fig. 6 is a view of the gear-box as seen looking in the direction of the arrow 6 in Fig. 5, the cone-gear being omitted. Fig. 7 is a section through the speed-box on the line 7 7 of Fig. 1. Fig. 8 is a vertical section through the same. Fig. 9 is a section through Fig. 8 on the line 9 9, and Fig. 10 is an indicator-card.

A is the head-stock, mounted on the bed B in the usual manner, C the lead-screw, and D the feed-rod, mounted in suitable bearings.

E is a box, hereinafter called the "speed-gear" box, containing gears and a shifting device whereby the speed of the intermediate or sliding gear which operates the cone-gears may be multiplied one or more times. In the machine illustrated this box contains gearing so arranged that the sliding gear referred to may be given any one of four different speeds of any desired proportion to each other, and these several speeds may be produced by the simple manipulation of a lever, as will now be described.

Mounted in suitable bearings in the speed-gear box E is a shaft F, which projects into the frame of the machine, where it is provided with the usual tumbler-gears, so as to be driven in either direction from the spindle. Three gears G, g, and g' are keyed to the shaft F. Of these three the first, G, meshes with a gear H, keyed to a stud-shaft H'. The other two, g and g', are in line, respectively, with two gears k and k', which are keyed to a shaft K, mounted in suitable bearings on the opposite side of the box E. A gear K' on the end of the stud-shaft H' meshes with the gear k, so that the shaft K is driven from the shaft F through the gears G, H, K', and k. The gears g' and k and the gears g and k' are respectively the same size, the diameters of the first two being twice those of the second two. The gears between the shafts F and K are of such size that the speed of the latter is one-fourth that of the former. Of course other proportions might be adopted; but these are taken for illustration.

A shaft L is mounted in the front end of the box E, and to this shaft is feathered a gear L', provided with hubs at each side, upon which is journaled a swinging frame L'', provided at one end with a handle l and at the other end with suitable journals, in which an intermediate gear l' is mounted, so as to mesh with the gear L'.

As shown in Figs. 7, 8, and 9, the gear l' is in mesh with the gear g' on the shaft F. It is thus evident that the shaft L will be rotated from the shaft F at a certain speed. The swinging frame L'' being journaled on the hub of the gear L' and said gear being feathered to shaft L, it is evident that the intermediate gear l' may be brought into mesh with any one of the four gears g, g', k, and k', thereby producing four different speeds in the shaft L, these speeds being related to each other in the ratios of two to one, one to one, one to one-half, and one to one-fourth. This shaft drives the sliding gear which operates the cone-gears, as will be presently described.

The handle l of the swinging frame L'' projects through the staggered slot l'' in the face of the speed-gear box E, and the edges of said

slot or opening are provided with notches 1, 2, 3, and 4, corresponding to the positions of the handle *l* when the intermediate gear *l'* engages, respectively, with the four gears *g'*, *k'*, *g*, and *k*. Said handle *l* is provided with any usual spring-controlled catch *l'''*, adapted to engage with the notches 1 2, &c.

We now pass to a description of the cone-gear box and the mechanism by means of which the sliding gear, whose speed is determined by that of the shaft L, may be shifted, so as to operate any one of the cone-gears. Said sliding gear is feathered to a shaft M in the back of the cone-gear box T (see Figs. 4, 5, and 6) and is lettered in the drawings M'. The shaft M is driven from the shaft L by means of two intermeshing gears of equal diameter, *m* and *m'*, mounted, respectively, at the ends of said shafts, Fig. 2. A swinging frame M'' is journaled on the hub or bushing of the gear M' and carries at one end, suitably journaled to it, a gear *m''*, which meshes with the gear M'.

N' N' N' are the cone-gears keyed to a shaft N, which is suitably journaled in the cone-gear box T and projects at one end through said cone-gear box. It is there provided with a gear N'', from which the feed-rod B and the lead-screw C are driven in any usual or customary manner.

The intermediate gear *m''* is adapted to engage any one of the cone-gears N', (in this case ten,) and such engagement is brought about in the following manner: Extending the length of the cone-gear box and at the bottom thereof are two rods *n n*, upon which slide a frame O, provided with a dovetailed groove O'. A frame P slides in this groove O' and has at its inner end an upwardly-extending bifurcated leg P', which fits in a slot P'' in the swinging frame M'' and there embraces the bushing P''', which forms the journal of the gear *m''*. It is thus evident that by means of the sliding frame O and the sliding frame P, the motion of one being at right angles to that of the other, the intermediate gear *m''* may be brought into mesh with any one of the cone-gears N', so as to drive said cone-gears from the shaft M. The sliding frame P is provided at its outer end with a spring-controlled pin Q, adapted to engage with the holes Q' in the under side of a guide-plate Q'', attached to the front face of the cone-gear box T. This pin is controlled by a handle R, pivoted in the end of the frame P. The handle R is provided with a shoulder *r*, adapted to engage with the front face of the guide-plate Q'' in such manner as to sufficiently guide the operator in moving the slide so as to make the gear *m''* engage with the several cone-gears.

The operation and manipulation of my speed-gear mechanism are apparent from the description. In order to get any certain speed, it is only necessary to bring the handle *l* into position such that the catch *l'''* will engage the proper notch in the speed-gear box and then adjust the sliding frame P so as to bring the pin Q into the proper hole Q''. In order to illustrate the ease with which my speed-gear may be manipulated, I show in Fig. 10 an index-card. In the first column are the numerals "1," "2," "3," and "4," which correspond to the notches in the speed-gear box, and for each of these notches there are ten threads indicated, (corresponding to the different speeds,) that may be cut with the catch *l'''*, adjusted to the first notch. There is the same for each of the other three notches. For example, in order to cut twenty-four threads to the inch the catch *l'''* is adjusted so as to engage with the notch 4 and the handle R is adjusted so as to have the pin Q engage with the sixth hole in the guide-plate O''. In practice these several threads are arranged in columns above the holes Q''. Thus above each hole would be indicated on the indicator-card four threads, one which would be cut with the catch *l'''* in the notch 1 of the speed-gear box, the second corresponding to the thread which would be cut with the catch *l'''* in the notch 2 of the speed-gear box, &c. It is thus apparent that by the suitable manipulation of the handles *l* and R any one of four speeds may be imparted to any one of the cone-gears.

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

1. In a speed-changing device, the combination of two shafts, the one driven by the other at a predetermined ratio to the speed of the other, gears of different sizes keyed to said shafts, a variable-speed shaft, a swinging frame on said shaft and mechanism for locking it in position, a sliding gear on said shaft movable with said swinging frame, and an intermediate gear journaled in said frame and meshing with said sliding gear, and adapted to engage either of the gears on the first two shafts, substantially as and for the purpose described.

2. In a speed-changing device, the combination of the shafts F and K, gears secured thereto in the manner described, the shaft L, a sliding pinion thereon, and mechanism whereby said sliding pinion may be connected to either of the gears on the shafts F and K, together with means to securely lock the same in position when so connected.

3. A speed-changing device comprising a shaft running at a fixed speed, an auxiliary shaft operated by the first shaft at a predetermined ratio to said fixed speed, gears keyed to said shafts, a variable-speed shaft provided with a sliding pinion, an intermediate gear meshing with said sliding pinion, and means whereby said intermediate gear may be brought into mesh with any one of the gears on the first two named shafts, together with locking mechanism for holding it there, substantially as and for the purpose described.

4. A speed-changing mechanism comprising a driving-shaft and two driven shafts, one

of the driven shafts being constantly geared to the driving-shaft, different-sized gears on said first two shafts, a gear feathered to the third shaft and provided with hubs, a swinging frame mounted thereon, an intermediate gear carried by said swinging frame and meshing with the first gear, and locking mechanism whereby said intermediate gear may be locked in a position to engage any of the several different-sized gears, substantially as and for the purpose described.

5. In a machine-tool, a shaft operated at a fixed speed in either direction from the spindle, gears of different diameters driven from said shaft at predetermined ratios to said fixed speed, a variable-speed shaft, intermediate mechanism whereby said variable-speed shaft may be driven from any one of said gears, in combination with the cone-gears and mechanism intermediate said variable-speed shaft and said cone-gears whereby the latter are operated, substantially as and for the purpose described.

6. In combination, a shaft, a sliding gear thereon, a swinging frame journaled with said gear, an intermediate gear carried by said swinging frame, meshing with said sliding gear, a set of cone-gears, and mechanism movable in a straight line whereby said intermediate gear may be brought into mesh with any one of said cone-gears, substantially as and for the purpose described.

7. In combination, a shaft, a sliding gear thereon, a swinging frame journaled on said gear, an intermediate gear carried by said swinging frame, meshing with said sliding gear, a set of cone-gears, and mechanism controlling the movement of said intermediate gear, comprising a slide having a fixed path in one plane and a second slide having a path at right angles thereto, together with locking mechanism for locking said slides in position, substantially as and for the purpose described.

8. In combination, a shaft, a sliding gear thereon, a swinging frame journaled on said gear, an intermediate gear carried by said swinging frame, meshing with said sliding gear, a set of cone-gears, and mechanism controlling the movement of said intermediate gear comprising a frame sliding in one plane and a second frame sliding on the first at right angles to the plane of its travel, and means for connecting said second slide with said intermediate gear, substantially as and for the purpose described.

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