

No. 703,411.

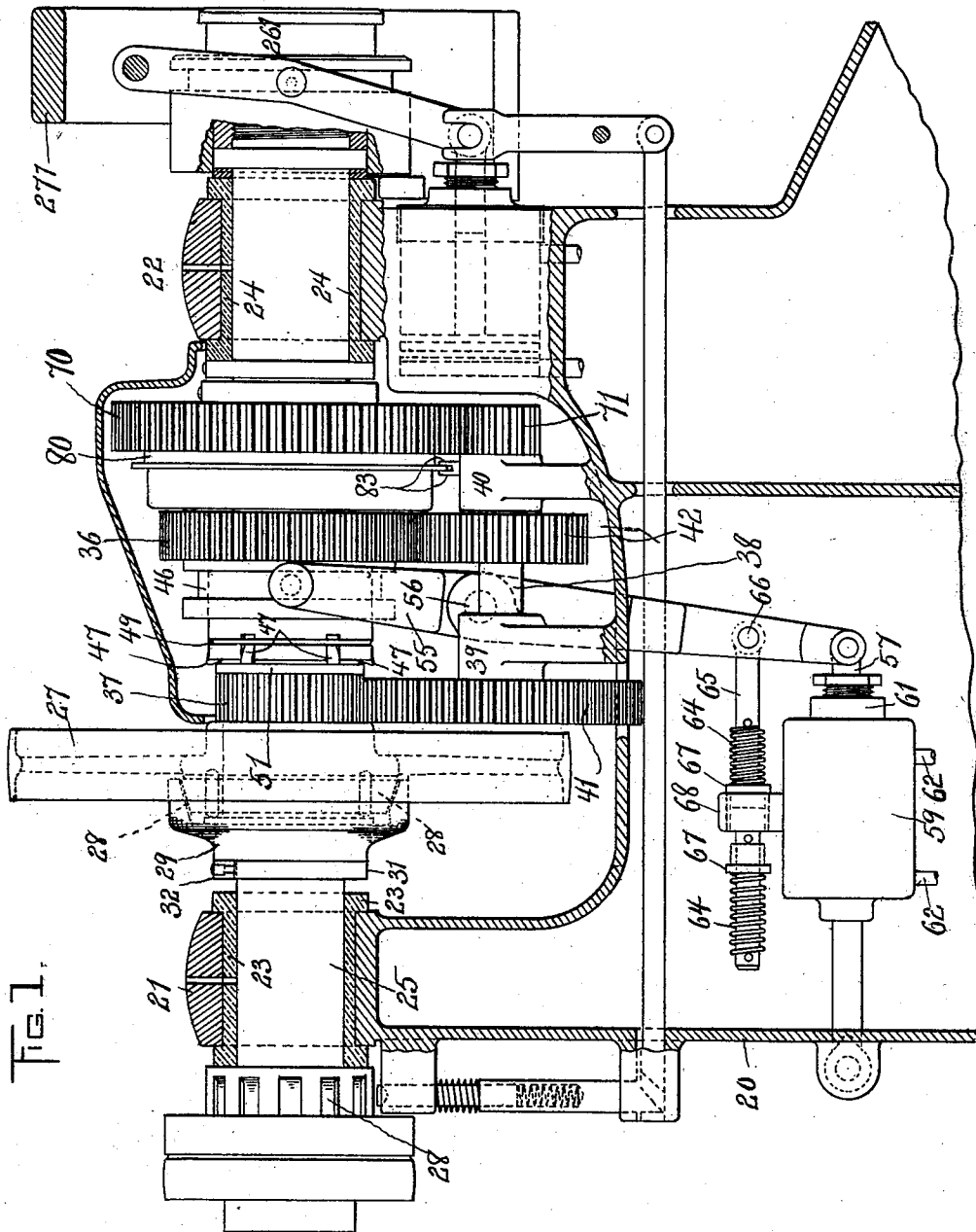
Patented July 1, 1902.

J. HARTNESS.
BACK GEARING FOR LATHES.

(Application filed Mar. 20, 1901.)

(No Model.)

6 Sheets—Sheet 1.



WITNESSES:

Horace Brown

W. H. Brown

INVENTOR:

James Hartness

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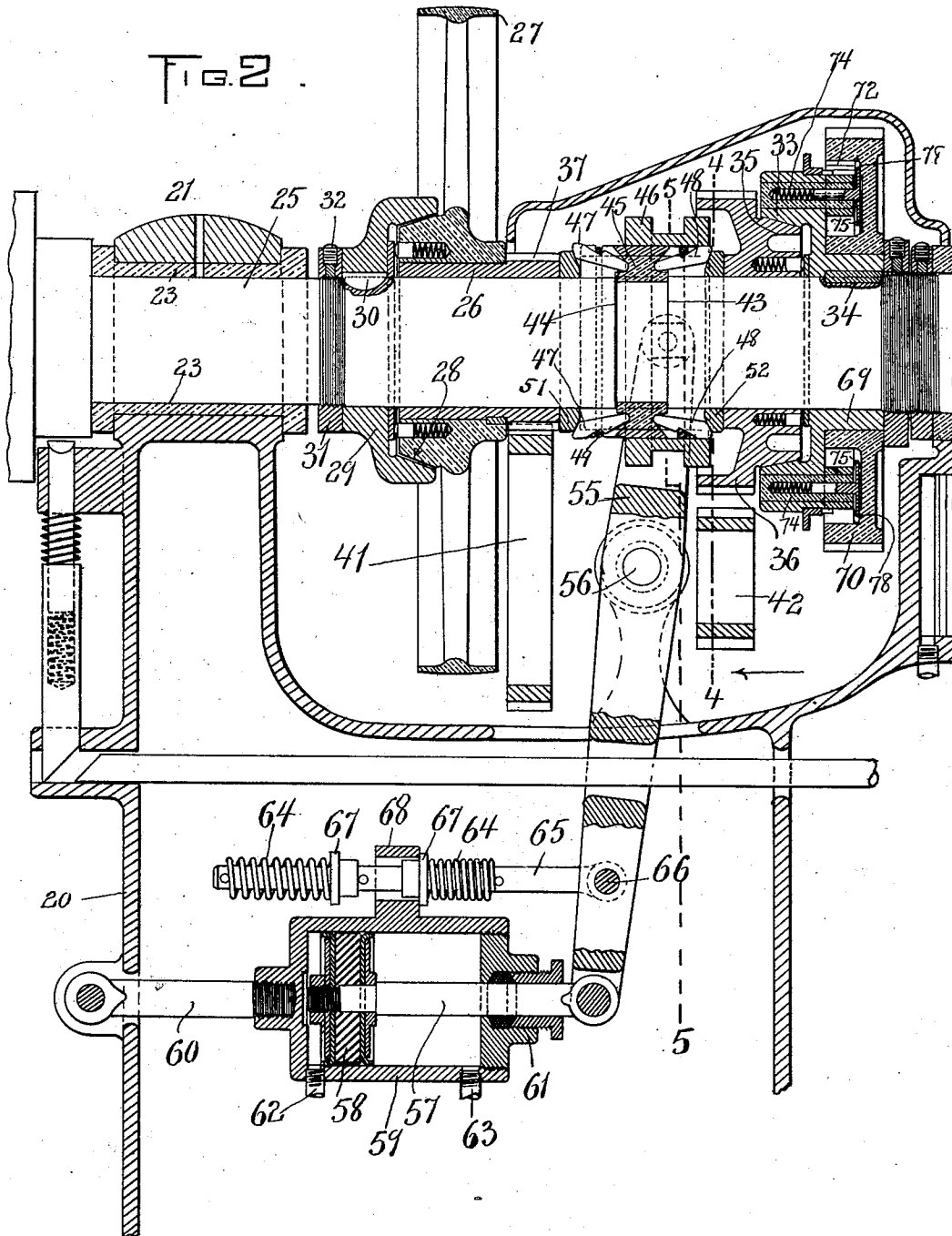
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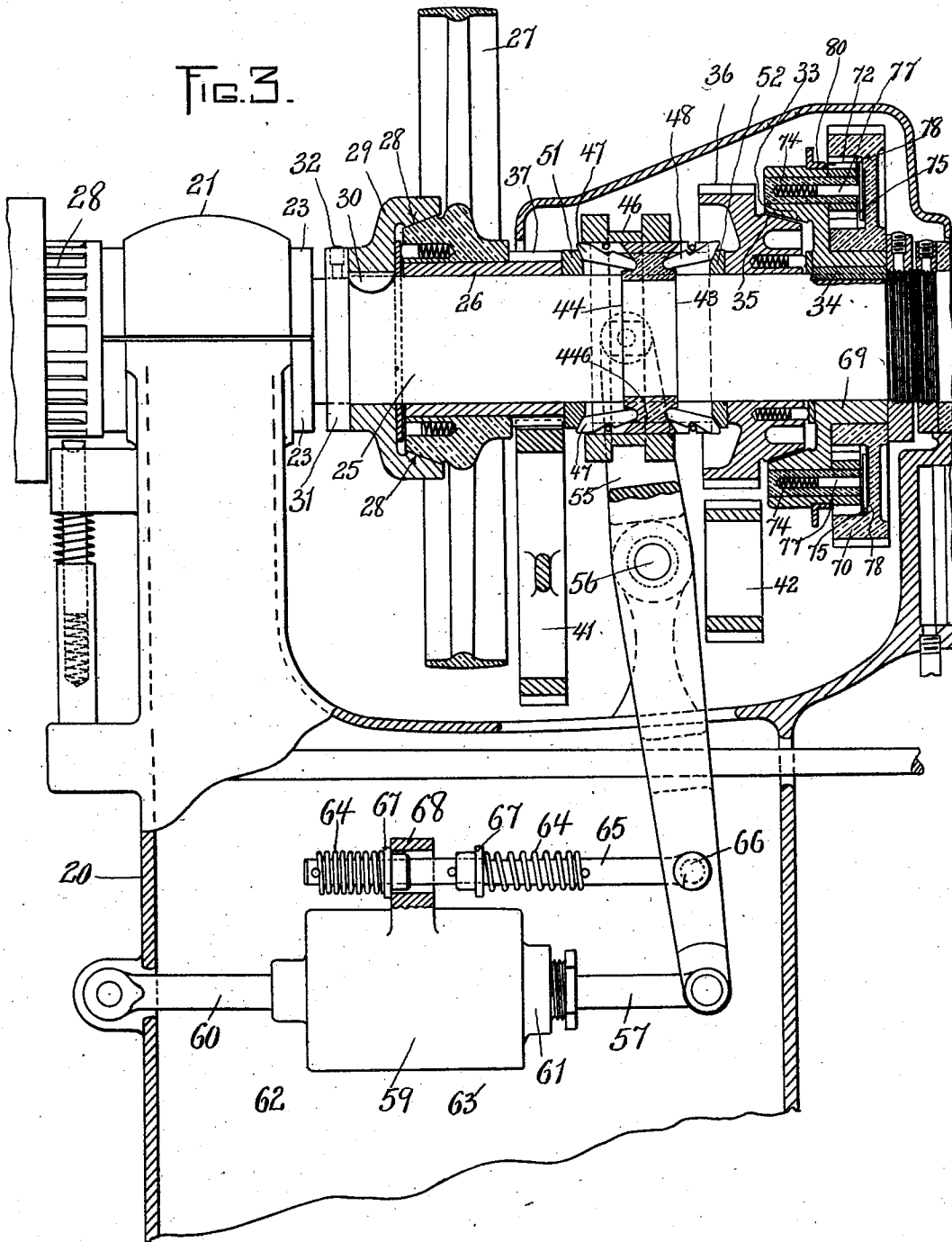
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FIG. 3.



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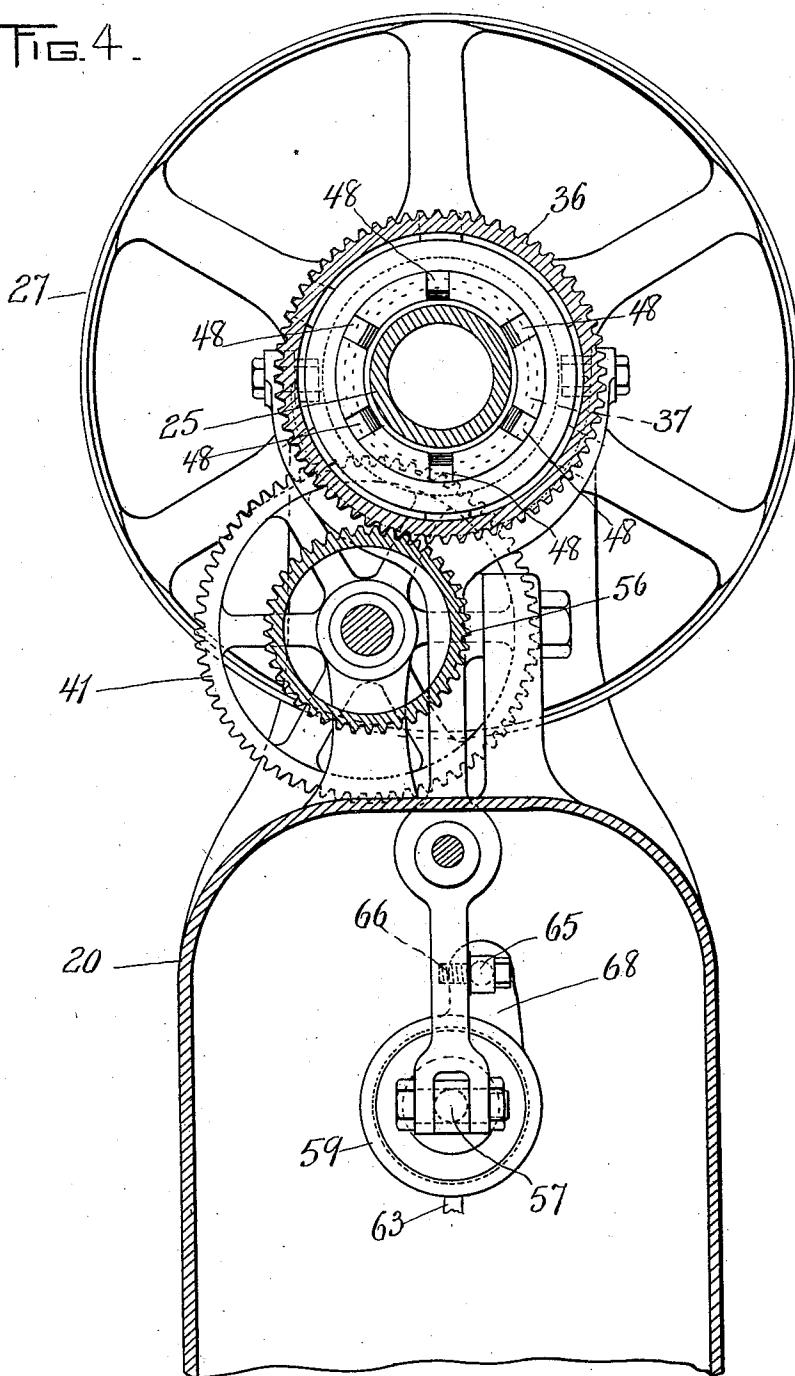
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FIG. 4.



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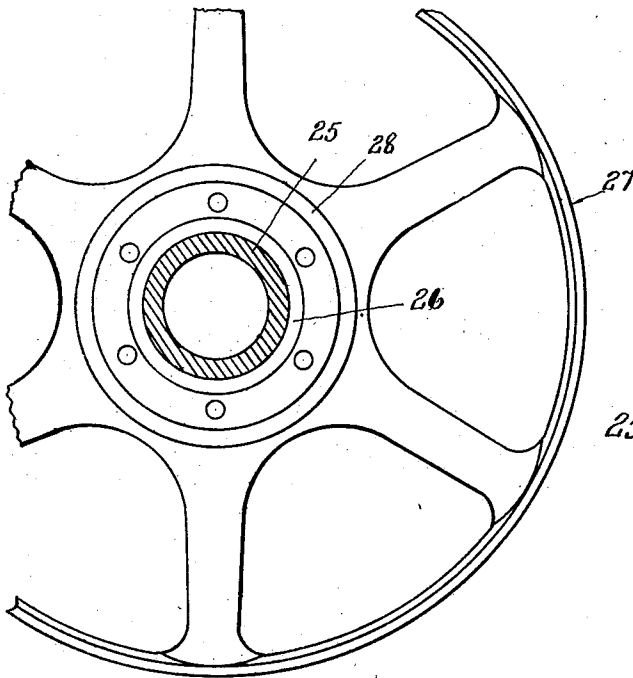


FIG. 6.

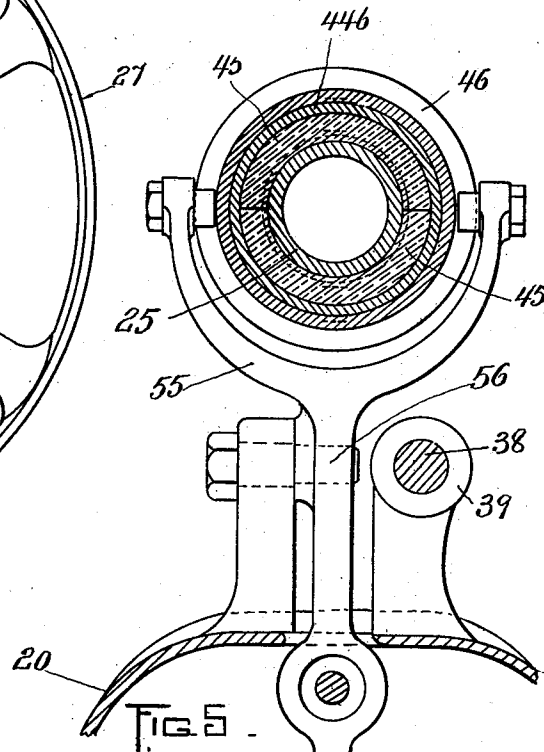


FIG. 5.

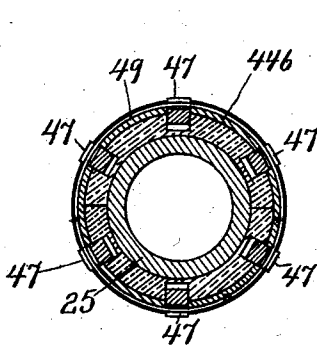


FIG. 8.

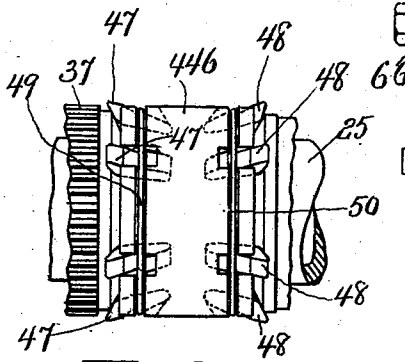


FIG. 7.

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UNITED STATES PATENT OFFICE.

JAMES HARTNESS, OF SPRINGFIELD, VERMONT.

BACK GEARING FOR LATHES.

SPECIFICATION forming part of Letters Patent No. 703,411, dated July 1, 1902.

Application filed March 20, 1901. Serial No. 52,046. (No model.)

To all whom it may concern:

Be it known that I, JAMES HARTNESS, of Springfield, in the county of Windsor and State of Vermont, have invented certain new and useful Improvements in Back Gearing for Lathes, of which the following is a specification.

This invention has relation to lathes, and more particularly to "back gearing" (so called) therefor.

It is the object of the invention to provide an improved back gear by means of which the spindle may be driven at any one of at least three speeds by mechanism under one control or by mechanism controlled by a single member, such as a clutch-lever. To accomplish this object, I employ in the present embodiment of the invention two friction-clutches and a positive clutch, the latter being of the ratchet type and being reversible to permit the spindle being driven in opposite directions. I provide friction-clutches for connecting the two high-speed driving mechanisms with the spindle and utilize the positive clutch for connecting the low-speed driving mechanism with the spindle, although it is obvious that I may reverse the order without departing from the scope and purpose of the invention.

Referring to the accompanying drawings, Figure 1 represents the head end of a lathe equipped with my invention. Fig. 2 represents a longitudinal section through the spindle with an intermediate driving mechanism connected to the spindle. Fig. 3 represents a section with the high-speed mechanism connected to the spindle. Fig. 4 represents a section transversely of the spindle on the line 4 4 of Fig. 2 looking in the direction of the arrow. Fig. 5 represents a section on the line 5 5 of Fig. 2. Fig. 6 represents the end elevation of the large driving-pulley with the spindle in section and shows the spring-pressed pins. Figs. 7 and 8 illustrate the clutch for the intermediate driving mechanism. Figs. 9 and 10 are views representing the positive clutch more or less in section and looking from opposite ends. Fig. 11 illustrates the clutch members in positive engagement with the driving-wheel. Fig. 12 represents a longitudinal section, partially in elevation, through the said clutch mechanism.

Figs. 13, 14, 15, and 16 represent details in the construction of said positive clutch mechanism.

The invention is shown upon the drawings as being placed upon a lathe such as illustrated in my copending application, Serial No. 52,043, filed March 20, 1901; but it may be employed in connection with other types of lathes, if desired.

On the said drawings, and particularly in Figs. 1, 2, and 3, the framework of the lathe is indicated at 20 and provides two bearings 21 and 22, in which are placed bearing blocks or bushings 23 and 24, respectively, for the shaft or hollow spindle 25. This spindle carries at one end a chuck 261, which is surrounded by a housing 271 on the bed, and on the other end a roller-feed 28. The mechanism for operating the roller-feed and chuck are described in my said application and need not be referred to herein, as they form no part of the present invention.

Loose on the spindle is a sleeve, to which is keyed a large driving-pulley 27 by a key. (Not shown.) This pulley rotates at a relatively high rate of speed and is utilized to drive the spindle at what I term the "high" speed. The hub of the pulley is formed with a tapering friction-surface 28, which may be moved into engagement with the complementary surface of the collar 29, secured by a key 30 to the spindle 25. To prevent the collar or clutch member 29, as it is in reality, from moving longitudinally of the spindle, I employ a nut 31, screwed on the spindle and held against rotation by the screw 32. By this collar I am enabled to adjust the clutch member 29, as will be readily understood. The hub of the pulley constitutes the other clutch member, and when the two are moved into engagement the spindle rotates in unison with the belt-pulley 27. There is another clutch member 33, which is keyed, as at 34, to the spindle, its complementary member being indicated at 35 and being placed loosely upon said spindle. This member 35 is provided with gear-teeth 36, while the sleeve 26 is provided with gear-teeth 37. 38 (see Fig. 1) is a shaft journaled in bearings 39 and 40 and supported by the frame of the machine and having thereon gears 41 and 42, intermeshing with the gear-teeth 37 and 36, re-

spectively. The gears 37, 41, 42, and 36 form a reducing-speed driving mechanism, and they are constantly rotating so long as the pulley 27 is in motion.

5 Held against longitudinal movement on the spindle by shoulders 43 and 44 is an abutment 45, which is formed in two semicircular parts held upon the spindle by a sleeve 446. This abutment and sleeve are provided with
10 a series of slots for the reception of wedging dogs 47 and 48, held against displacement by encircling springs 49 and 50, set in grooves in the abutment. The outer wedge-shaped ends of these dogs bear, respectively, against
15 loose collars 51 and 52, interposed between the clutch 28 and the clutch 35. Placed slidably on the sleeve 446 is an externally-grooved collar 46, whose ends are adapted to engage and depress the larger ends of the
20 dogs 47 or 48. By sliding the collar 46 in one direction or the other the dogs 47 or 48 will be wedged or thrust inward, and the clutch 28 or the clutch 35 will be thrust into frictional engagement with its complementary
25 clutch member to drive the spindle at a fast or at an intermediate speed. This mechanism thus far described does not differ from that now in use. To move the said collar 46, I provide a yoke 55, which is fulcrumed at 56
30 and is connected at its lower end to the piston-rod 57. This piston-rod is secured to the piston 58 in the cylinder 59, loosely supported at one end on the supporting-bar 60, pivotally attached to the frame. The piston-rod
35 passes through a stuffing-box 61 on the cylinder-head, and it, together with the frame 60, supports the cylinder. Fluid is introduced into the opposite ends of the cylinder through the conduits 62 and 63, respectively, and when
40 the supply of fluid is cut off by a valve (not shown) being moved to a neutral position the yoke 55 is moved into position to unclutch both of the clutch members from the spindle by springs 64 64, attached at their outer ends
45 to the rod 65, pivoted at 66 to the yoke, and bearing at the inner ends against collars 67, which are adapted to engage an eye 68 on the cylinder. As the piston moves in opposite directions first one collar is engaged and then
50 the other, as will be readily understood. So far as I am aware I believe I am the first to provide fluid-operated mechanism for actuating the back-gear clutch, and I do not limit myself to any of the details which I have described or which are illustrated upon the
55 drawings.

To distinguish the clutch 35 and the mechanism which operates it, I call them the "intermediate-speed clutch" and the "intermediate-speed driving mechanism."

60 I will now proceed to describe the low-speed clutch, which is positive in its action, and the low-speed driving mechanism. Loose upon the hub 69 of the clutch member 33 is a relatively large gear 70, which intermeshes with the continuously-moving small gear 71, Fig. 1, which with the gear 70 I designate the "low-

speed driving mechanism." On the inner wall of the rim of gear 70 are a plurality of clutch-teeth 72 (see Figs. 9 to 12) with which may
70 be engaged pawls or clutch members 73. These pawls are pivotally mounted upon arbors 74, projecting from the clutch member 33. The pawls are normally disengaged from the teeth on the gear when either of the other
75 two clutches is clutched to the spindle; but said pawls are adapted to be moved to engage said teeth for driving the clutch member 33 in either direction, according to the direction of rotation of the gear 70. To this end I at-
80 tach to each pawl a disk 75, having a pin 76 extending loosely into an aperture in the disk and having a pivoted stud 77 projecting into an aperture in the arbor 74 and bearing against the spring 75, which thrusts it out-
85 ward. The outer face of these disks near its outer edge bears frictionally against an outer annular surface 78, formed on the gear 70, so that the tendency of the disks and the sur-
90 face is to be rotated in one direction or the other so far as possible, the annular ring 78 engaging said disk at points relatively remote from the axis upon which said disks are adapted to rotate. In order, therefore, to pre-
95 vent the pawls from engaging the clutch-teeth except at the proper time, I employ a shell-like guard 80, having slots through which the pawls are adapted to be projected at times. This shell is adapted to be moved relatively to the
100 gear 70, so as to be interposed between the pawls and the teeth of the positive clutch member or gear 70. This shell or guard is shown in Fig. 12 as supported upon and loosely movable relatively to the clutch member 33, which
105 is movable with the spindle. The said shell is formed at one end with a flange 82, adapted to be frictionally engaged between two lugs 83, which are held together by their inherent resiliency to frictionally grip the flange and retard the rotation of the shell or guard. The
110 lugs are formed upon the bearing 40 for the shaft 38. Under ordinary conditions; such as when either the high-speed or the intermediate-speed clutch is clutched to the spindle, the clutch member 35 is traveling at a
115 greater rate of speed than the gear 70. Therefore the frictional engagement of the annular surface 78 with the disk 75 throws the positive pawls in the direction of the arrow *a* in Fig. 9, the gear 70 rotating in the direc-
120 tion of the arrow *b*. At the same time, however, the engagement of the lugs 83 with the shell or guard retards the latter to such an extent that it is interposed between the pawls and the internal ratchet-teeth on the clutch
125 70. This will happen if the spindle be rotated in either direction, provided always that the clutch member which carries the pawls is traveling at a higher rate of speed than the gear 70. When, however, the yoke
130 45 is moved to neutral position to unclutch both the high-speed and the intermediate clutch devices from the spindle, the spindle will gradually slacken in speed until the

clutch member 33 is traveling at a lower rate of speed than the gear 70. The effect of this is to immediately oscillate the pawls 73 in a direction opposite to the arrow *a*, and the shell being at the same time retarded the pawls will be permitted to pass from the apertures or notches in the shell and engage the ratchet-teeth of the gear 70. Thus all that is necessary to throw in the low-speed clutch is to unclutch the high-speed and intermediate-speed clutches and permit the speed of the spindle to slacken until it is rotating at a lower rate of speed than the low-speed driving-gear 70. Just as soon, however, as either of the other driving mechanisms is clutched to the spindle and the spindle is caused to rotate at a greater rate of speed than the gear 70 the dogs are thrown automatically to operative position and the shell or guard is interposed between them and the ratchet-teeth. This action of the positive clutch mechanism is somewhat peculiar; but the latter is positive in action and is thrown automatically into operation by unclutching either of the other mechanisms, although it is not connected therewith except through the gear. It is evident that the number of clutches which I employ may be varied and that I may dispense with one of the friction-clutches which I have shown without departing from the spirit and scope of my invention.

The invention is not limited to the particular type of pawl and ratchet employed, as I contemplate using any mechanical equivalents therefor, the words "pawl" and "ratchet" being employed to designate all other contrivances which perform substantially the same functions in substantially the same way.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. In combination, a shaft, two driving mechanisms adapted to be driven in either direction, a friction-clutch for connecting one of said driving mechanisms to the shaft, a reversible ratchet-clutch in constant potential relation to the other said driving mechanism, for connecting it to the shaft, and provisions for throwing the friction-clutch into and out of operation.

2. In combination, a shaft, two driving mechanisms adapted to be driven in either direction, a friction-clutch for connecting one driving mechanism with said shaft, a reversible ratchet-and-pawl clutch for connecting the other driving mechanism with said shaft, means for throwing said friction-clutch into and out of operation, and provisions for holding the pawl out of engagement from the ratchet when the friction-clutch is in operation.

3. In combination, a shaft, two driving mechanisms adapted to be driven in either direction, a clutch for connecting one driving

mechanism with the shaft, means for throwing said clutch into and out of operation, and a positive clutch operable when the first-mentioned clutch is out of operation, said positive clutch having a ratchet and automatically-reversible pawls for engaging said ratchet.

4. In combination, a rotary shaft, three differently-speeded driving mechanisms, clutch mechanism located between two of said driving mechanisms and having a member movable in opposite directions to clutch said last-mentioned driving mechanisms to the shaft, and a third clutch mechanism thrown automatically into operative relation to the third driving mechanism when said movable member occupies a middle or neutral position.

5. In combination, a rotary shaft, three differently-speeded driving mechanisms adapted to be driven in either direction, friction clutch mechanism located between two of said driving mechanisms and having a member movable in opposite directions to clutch said last-mentioned driving mechanisms to the shaft, and a third clutch mechanism thrown automatically into operative relation to the third driving mechanism, irrespective of the direction of rotation of said driving mechanism, when said movable member occupies a middle or neutral position.

6. In combination, a rotary shaft, three differently-speeded driving mechanisms, clutch mechanism located between two of said driving mechanisms and having a member movable in opposite directions to clutch said last-mentioned driving mechanisms to the shaft, and a positive clutch mechanism thrown automatically into operative relation to the third driving mechanism when said movable member occupies a middle or neutral position.

7. In combination, a rotary shaft, three differently-speeded driving mechanisms, friction clutch mechanism located between two of said driving mechanisms and having a member movable in opposite directions to frictionally clutch said last-mentioned driving mechanisms to the shaft, and a positive clutch mechanism thrown automatically into operative relation to the third driving mechanism, when said movable member occupies a middle or neutral position.

8. In combination, a shaft having two differently-speeded driving-wheels thereon, adapted to be driven in either direction, independent clutches for rotating said driving-wheels in either direction, means for operating one of said clutches, and devices disconnected from said operating means whereby when said last-mentioned clutch is inoperative, the other clutch is operated, and vice versa.

9. In combination, a shaft, a driving mechanism for rotating said shaft in either direction, and automatic mechanism whereby when the speed of the shaft exceeds the speed of the driving mechanism in either direction the latter is unclutched therefrom, and when the

speed of the shaft is less than that of the driving mechanism the latter is clutched thereto.

10. In combination, a shaft, two differently-speeded driving mechanisms rotatable in
5 either direction, a clutch for the high-speed driving mechanism, and automatic mechanism whereby when the shaft is clutched to the high-speed mechanism, the low-speed driving
10 mechanism is unclutched, and when the speed of the shaft is less than that of the low-speed mechanism, the latter is clutched thereto.

11. In combination, a shaft having a member, a positive clutch member, said members
15 being respectively fast and loose on said shaft and rotating in the same direction, and one or more independently-movable pawls carried by one of said members and moved into operative position by the other of said members
20 to positively clutch said members together when the speed of said members differs.

12. In combination, a reversibly-rotatable shaft having a fast member and a loose member rotating in the same direction, one of said
25 members having ratchet-teeth, and one or more pawls carried by the other member to cooperate with said teeth for connecting said members, said pawl or pawls being automatically reversible by a change in the speed of
30 movement of the loose member.

13. In combination, a driving member, a driven member, a pawl carried on one member, ratchet-teeth on the other member, automatic provisions by which the pawl is moved
35 to inoperative position when the speed of the

driven member exceeds that of the driving member and is moved to operative position when the speed of the driven member is less than that of the driving member, and a guard for preventing the pawl from engaging the
40 ratchet-teeth when it is in inoperative position.

14. In combination, a driving member adapted to move in either direction, a driven member, an oscillatory reversible pawl carried by one member, ratchet-teeth on the
45 other member, provisions for automatically oscillating said pawl to inoperative position when the speed of the driven member in either direction exceeds that of the driving member
50 and to operative position when the speed of the driven member is less than that of the driving member, and an automatic guard which automatically prevents the engagement of the pawl with the ratchet-teeth when
55 said pawl is in inoperative position.

15. In combination, a driving member, a driven member, an oscillating pawl on one member having a single operative end, ratchet-teeth on the other member, a friction-
60 surface on the last-mentioned member, and a rotatable disk on said pawl to engage said friction-surface, substantially as described.

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

JAMES HARTNESS.

Witnesses:

J. W. BENNETT,
D. S. BROWNELL.