No. 683,003. Patented Sept. 17, 1901.

W. L. SCHELLENBACH.

VARIABLE SPEED MECHANISM.

(Application filed Apr. 17, 1901.)

(No Model.)

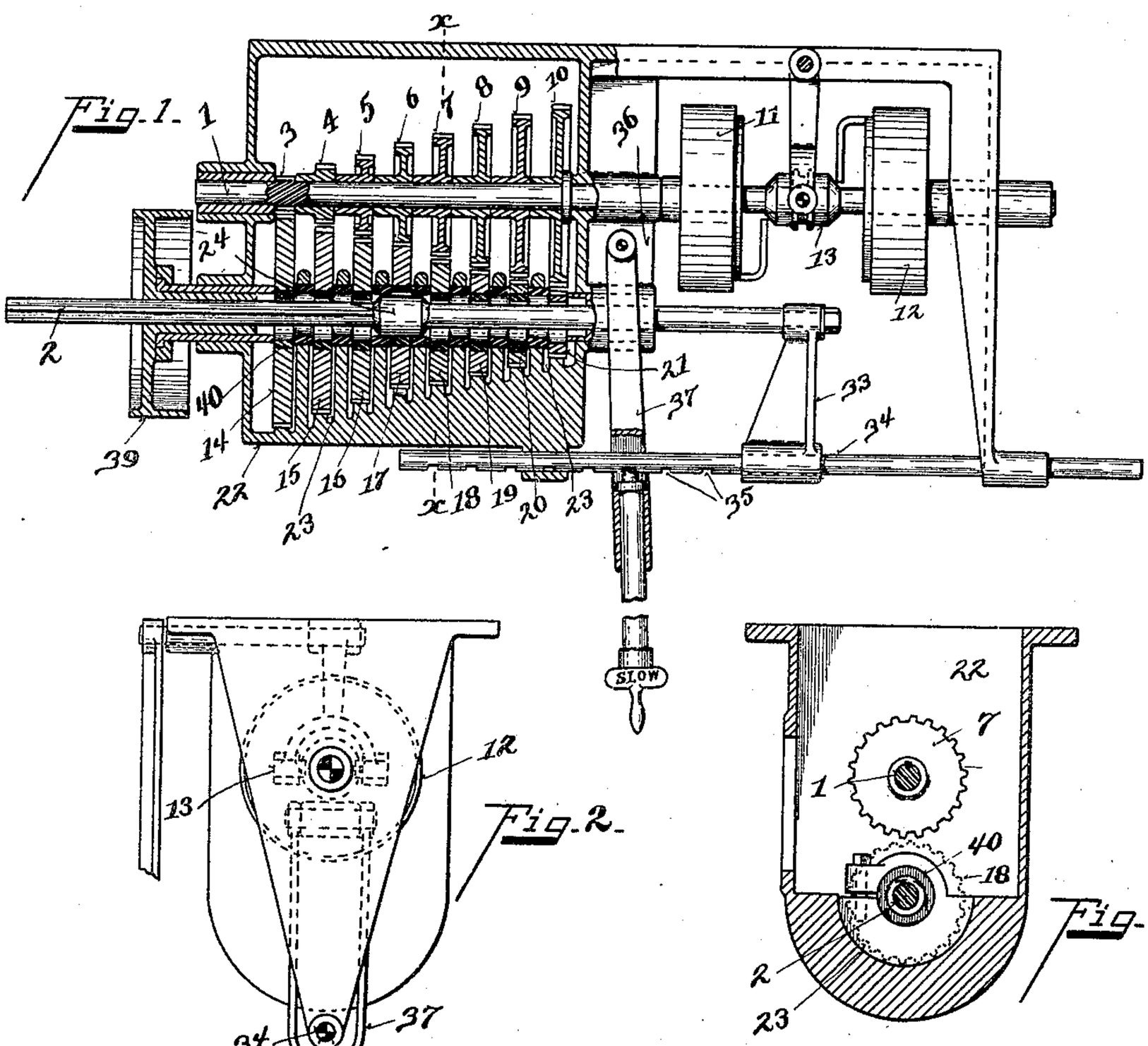

Fig. 1.

Fig. 2.

Fig. 3.

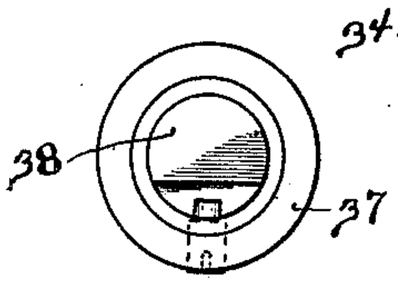

Fig. 7.

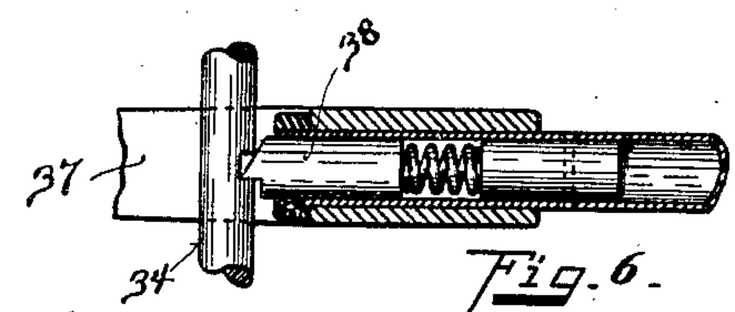

Fig. 6.

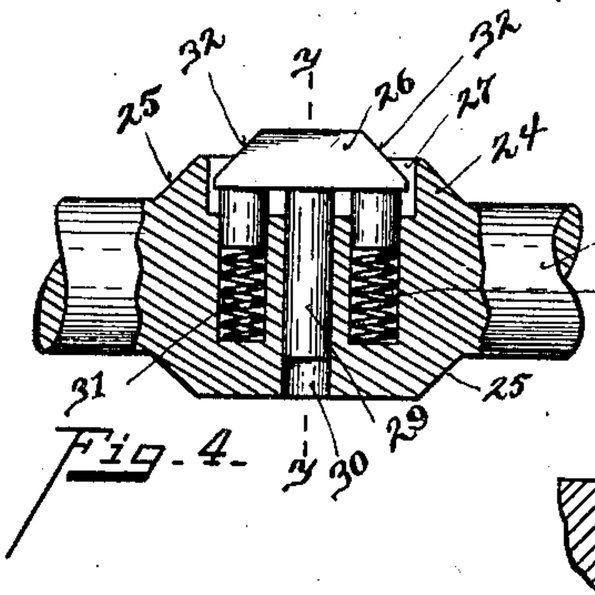

Fig. 4.

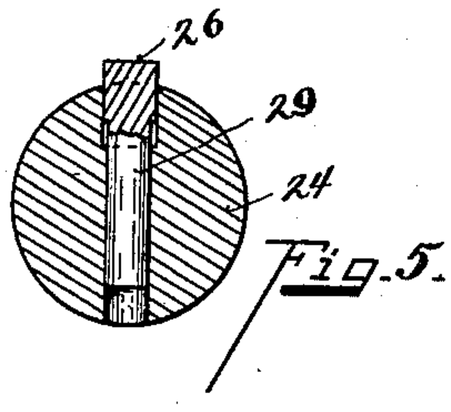

Fig. 5.

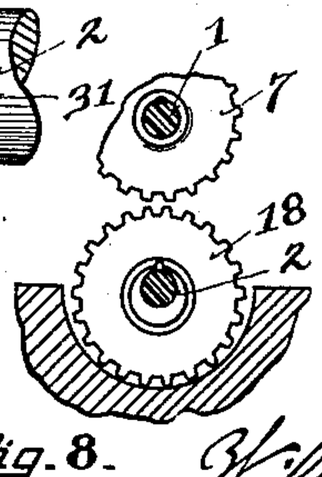

Fig. 8.

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Witnesses

Oliver B. Kaiser

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UNITED STATES PATENT OFFICE.

WILLIAM L. SCHELLENBACH, OF CINCINNATI, OHIO, ASSIGNOR TO THE NATIONAL MACHINE TOOL COMPANY, OF SAME PLACE.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 683,003, dated September 17, 1901.

Application filed April 17, 1901. Serial No. 56,300. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. 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 Mechanism, of which the following is a specification.

My invention relates to an improved variable-speed device primarily adapted as a counter-shaft speed-changer, but applicable by slight modifications to any of the immense class of mechanisms in which a variety of speed changes is desirable.

One of the objects of my invention is to obtain a device readily applied to and operated upon the overhead counter-shaft of the shop.

Another object of my invention is to provide a mechanism which will give the desired number of speed changes with the least possible number of parts, with the least possible wear, and with the least possible mechanical movements.

Another object of my invention is to provide a mechanism whereby only the selected two given gear-wheels of the system engaged at a particular time are intermeshed, thereby eliminating practically all the idle movements and the consequent useless wear of the parts.

Another object of my invention is to provide means for conveniently operating the said speed-changing device.

Other features and objects of my invention will be understood from a description of the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a central vertical section of my improvement. Fig. 2 is an end view of the same. Fig. 3 is a section on line *x x*, Fig. 1. Fig. 4 is a sectional detailed view of the shifting clutch with its spring-key. Fig. 5 is a section on line *y y*, Fig. 4. Fig. 6 is a sectional view of the shifting lever. Fig. 7 is an end view of Fig. 6. Fig. 8 is a detail view showing the relation of gears not in mesh.

1 2 represent parallel shafts which have the relationship of driving and driven shafts, which relationship may be inversed without change of function or result. The shaft 1, say, is the ordinary counter-shaft and, as shown, is the driving-shaft, while 2 is a shaft parallel to it containing the driven members.

Fixed to shaft 1 to turn therewith are the eight gear-wheels 3 4 5 6 7 8 9 10, spaced apart and preferably arranged in the shape of a cone, as shown. 11 12 represent the usual direct and reversing belt-pulleys on the said shaft 1, operated through the usual intermediate clutch 13.

14 15 16 17 18 19 20 21 represent in the form shown the driven gear-wheels. These gear-wheels are each provided with a central bore greater in diameter than the diameter of the shaft 2, which passes through them normally loosely. These gears are supported within a housing 22, each gear having a separate compartment 23, within which it seats in its periphery. These gear-wheels, it will be noted, are arranged in the form of a cone the inverse of the cone of gear-wheels on shaft 1, each gear-wheel being supported substantially under its respective opposite driving gear-wheel. The said supports for the said loose gear-wheels hold them normally out of mesh with the respective driving gear-wheels on shaft 1 and also normally out of contact with the shaft 2, so that shaft 2 normally passes eccentrically through the gears and turns without contacting any of the gears other than the one selected for a given work. Also the supports or compartments for these loose gear-wheels form vertical guides for the gear-wheels in their movements up and down to and from engagement with their oppositely-disposed driving gear-wheels.

On shaft 2 is a clutch 24, (see Fig. 4,) fixed to turn therewith. This clutch exactly fits the bore of the loose gears, and it is provided at its outer edges upon each side with inclines 25. This member 24 is a double-cone-shaped boss fitting the bores of the loose gear-wheels. Each of the gears 14 to 21 has a key-way. The clutch 24 is provided with a key 26, mounted in a seat 27 on the face of the said clutch 24. This key is mounted on a plunger 29, movable in a guide-slot 30 in the clutch 24, and the ends of the key are affixed to coil-springs 31, seated in orifices in the said clutch and forcing the key normally outward. The key at its outer edges in each di-

rection is provided with inclines 32. In the form shown the clutch 24 is fixed to turn with the shaft 2, and the shaft and its clutch are longitudinally movable within the bores of the gears 14 to 21. The shaft 2 is journaled in proper bearings in the ends of the housing to allow of this longitudinal sliding of the shaft in either direction. Of course other arrangements could be made—that is, the clutch could be mounted on a sleeve sliding on the shaft 2 or the mechanisms otherwise modified in various ways—without departing from the principle here shown.

33 represents an arm depending from the shaft 2, to which is affixed a rack-bar 34, provided with notches 35. 36 represents a depending arm, to which is pivoted a shifting lever 37. The upper end of this lever 37 is U-shaped, as shown in Fig. 2, and straddles the said rack-bar 34. This shifting lever is provided with a central spring-latch 38, (see Fig. 6,) operated from the lower end of the lever-handle to automatically engage and disengage the notches. The latch or pin 38 is shown wedge-shaped at its engaging end, turned to form a tooth which engages with one side of the notches of the shifting rack-bar 34. As the lever is moved to the right the incline on the face of the latch is carried against the opposite edge of the notch, which pushes the latch in, thereby automatically releasing the engagement, and the lever may be swung in this direction over two or three notches. This makes an automatic release or engagement of the latch. In the position shown the handle on the end of the lever is marked "Slow," indicating that the latch is set in position for shifting from a higher to a lower speed. When it is desired to shift from a lower to a higher speed, this handle is rotated on its own axis half over, which reverses the position of the latch and allows it to engage with the opposite edges of notches 35 for shifting from a lower to a higher speed change.

39 represents a pulley splined to the shaft 2 for transmitting power to the machine which this variable-speed device drives.

40 represents collars between the loose gear-wheels, having their bores of a diameter equal to the diameter of the clutch 24 and held rigidly in the housing concentric with shaft 2, which passes through them.

Mode of operation: As the lever 37, with its spring-latch, is pivotally moved to engage one of the notches it may be swung in either direction, carrying the rack 34 correspondingly and with it the shaft 2 and clutch 24. By this means the clutch 24 may be successively brought into the bore of each of the loose gears, through which shaft 2 passes. As the inclined edges of the clutch enter successively these bores they gradually raise the said gear-wheels successively until a selected gear-wheel is properly seated on the clutch 24, which movement has raised the said gear-wheel into engagement with its oppositely-disposed driving gear-wheel on shaft 1. Looking at Fig. 1, the clutch is shown to be in engagement with gear-wheel 17, which has raised said gear-wheel until it is intermeshed with its opposite driving gear-wheel 6. Therefore as gear-wheel 6 turns gear-wheel 17 at a given point of revolution of the gear-wheel 17 the key of the gear-wheel 17 is brought opposite the spring-key 32 of the clutch 24, when the said key will be expanded into said keyway, so that the said gear-wheel 6 rotates shaft 2 through the gear-wheel 17. As the clutch 24 is shifted in either direction to make a new engagement the disconnection with the said gear-wheel 17 is gradually made in like manner. The contact of the tapered edges of the key with collars 40 contracts the key flush with the face of the clutch, and it is again expanded within the bore of the gear-wheel. The next engagement, say, with either gear-wheels 16 or 18 is likewise gradually made. So when any speed change is required this clutch is successively passed from its engagement at the time the change is to be made through each intervening gear-wheel to the selected gear for the next change. Thus the speed of shaft 2 is gradually lowered or raised, and hence the spindle of the machine driven is not subjected to sudden jumps of speed. The clutch may be moved intermediate of any two gear-wheels on shaft 2, if desired, so that all of the gear-wheels on shaft 2 are idle. Of the driving and driven gear-wheels the only two intermeshed are those selected for a given work. This of course affords the greatest possible life and efficiency of the parts. Various means could be devised for shifting this clutch.

This arrangement is compact and simple, completely housed, convenient, and efficient in operation. The fewest possible parts are employed and the greatest durability is insured by the mode of operation.

The mechanism embodying this principle of speed-changing may be variously modified to adapt it to an innumerable number of uses in the mechanical arts, and I do not desire to limit myself to the application or to the particular mechanisms not specifically enumerated in the claims.

Having described my invention, what I claim is—

1. In a variable-speed device, a driving and a driven shaft, gear-wheels of different diameter oppositely disposed on said shafts normally out of mesh, and means for intermeshing any one of said gear-wheels with its opposite gear-wheel, substantially as specified.

2. In a variable-speed device, a driving and a driven shaft, gear-wheels of different diameter oppositely disposed on said shafts normally out of mesh, and means for intermeshing any one of said gear-wheels with its opposite gear-wheel and fixing it to its shaft, substantially as specified.

3. In a variable-speed system, a shaft, a plu-

rality of gear-wheels of different diameter fixed to said shaft, a second shaft, a plurality of gear-wheels of different diameter loosely supported relative to said second shaft whereby the loose gear-wheels are normally out of mesh with the fixed gear-wheels, and means for intermeshing any selected loose gear with its opposite fixed gear and also fixing the loose gear to its shaft, substantially as specified.

4. In a variable-speed device, a shaft, a plurality of gear-wheels of different diameter fixed to said shaft, a second shaft, a plurality of gear-wheels of different diameter supported normally eccentric of said shaft, whereby the loose gears are normally held out of mesh with the fixed gears, and means adapted to intermesh any one of the loose gears with its opposite fixed gear and also to concentrically fix said loose gear to its shaft, substantially as specified.

5. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels through which said second shaft loosely passes, and a shifting clutch adapted to throw any selected one of said loose gears into mesh with its opposite fixed gear, substantially as specified.

6. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels supported normally eccentric of said second shaft, whereby the loose gears are held normally out of mesh with the fixed gears, and a clutch interposed between the loose gears and the second shaft adapted to lift any selected one of the loose gears into mesh with its opposite fixed gear, and also to concentrically fix said loose gear to its shaft, substantially as specified.

7. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels each having a bore greater than the diameter of the second shaft, means for supporting the loose gears out of engagement with the second shaft and out of mesh with the fixed gears, and means for engaging any selected one of the loose gears with its shaft and opposite gear, substantially as specified.

8. In a variable-speed device, a shaft, a plurality of gear-wheels of different diameter fixed to said shaft, a second shaft, a plurality of gear-wheels of different diameter supported normally eccentric of said second shaft, whereby the loose and fixed gears are free, a clutch on the second shaft adapted to be interposed into the bore of any selected loose gear whereby the said selected gear is intermeshed with its opposite fixed gear and also fixed to turn with the said second shaft, substantially as specified.

9. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels through which said second shaft loosely passes, a clutch fitting the bores of the loose gear-wheels, adapted to intermesh any one of the loose gears with its opposite fixed gear and to clutch the said selected loose gear to said second shaft, substantially as specified.

10. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels each having a bore greater than the bore of the second shaft passing normally loosely through, a clutch fixed to the second shaft laterally slidable within the loose-gear bores adapted to fix said loose gear-wheels successively to the second shaft, and to lift them successively into mesh with the respective oppositely-disposed fixed gears, substantially as specified.

11. In a variable-speed device, a shaft, a plurality of gear-wheels of different diameter fixed to said shaft, a second shaft, a plurality of gear-wheels of different diameter through which the second shaft passes, means for supporting said last-named gears normally out of engagement with the second shaft and out of mesh with the opposite fixed gear-wheels, and means for lifting one of the loose gears from its supported idle position into engagement with its opposite fixed gear and also into fixed relation with the second shaft, substantially as specified.

12. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels through which the second shaft passes, means for supporting each of the last-named gears loosely relative to the shaft and out of driving contact with the opposite fixed gears, a clutch on the second shaft provided with inclined surfaces at the ends adapted to be shifted successively in either direction into the bore of each loose gear-wheel to engage a selected gear with its opposite fixed gear, and to fix the loose gear to its shaft, and means for shifting said clutch in either direction, substantially as specified.

13. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels each having a bore greater than the diameter of the second shaft, means for supporting said gears loosely relative to the second shaft, a clutch movably mounted within the loose-gear bores, adapted to successively fix each of the loose gears to the second shaft, whereby the loose gears are also successively lifted into engagement with the respective opposite fixed gears, the meeting surfaces of the loose gears and clutch being formed to make a gradual engagement in either direction of movement, substantially as specified.

14. In a variable-speed device, a shaft, a

plurality of different-diameter gear-wheels fixed to said shaft, a plurality of different-diameter gear-wheels supported opposite the fixed gear-wheels but normally out of mesh therewith, a second shaft passing through the bores of the last-named gear-wheels normally loose, a clutch on the second shaft within the gear-bores, movable in either direction and formed to lift each loose gear into intermesh with its respective opposite fixed gear and also fix each loose gear to its shaft, and means for positively shifting said clutch and locking it in different positions of adjustment, substantially as specified.

15. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a plurality of different-diameter gear-wheels supported substantially under the fixed gear-wheels but normally out of mesh therewith, vertical guides for each loose gear-wheel, a second shaft passing normally loosely through the said second series of gear-wheels and means on the second shaft adapted to raise any one of the loose gears into engagement with its opposite fixed gear and also to fix said loose gear to its shaft, substantially as specified.

16. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, an opposing plurality of different-diameter gear-wheels, a support for said second series of gear-wheels substantially under the first-named gear-wheels, holding said second series of gear-wheels out of mesh with the fixed gear-wheels, a shaft passing through the bores of the supported gear-wheels normally eccentric thereof, the said support forming a housing for the gears and a vertical guide for the movement of each loose gear-wheel from supported position into engagement with the respective opposite fixed gear-wheels, and a shifting clutch adapted to lift each of the loose gears into engagement with the respective opposite fixed gear-wheels and also to fix each loose gear to its shaft, substantially as specified.

17. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a support, having a series of compartments each under one of the fixed gears, adapted to receive and support the periphery of a contained gear-wheel and forming vertical guides, a plurality of different-diameter gear-wheels normally seated in said compartments out of engagement with the opposite fixed gears, a shaft passing normally loosely through the bores of said seated gear-wheels, and means for lifting each gear from its seat into engagement with its opposite fixed gear-wheel and also fixing it to turn with the said second shaft, substantially as specified.

18. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels supported on said shaft normally out of driving engagement therewith as well as out of mesh with the opposite fixed gears, a clutch on said shaft adapted to be moved into each of the loose gears to lift any selected one of said gears into intermesh with the opposite fixed gear and to fix the loose gear to its shaft, the meeting edges of the loose-gear bores and the clutch having a tapered relation adapted to make a gradual engagement in either direction of clutch movement, substantially as specified.

19. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels through which the second shaft passes each of said last-named gears having a keyway, a support adapted to normally hold said second gear-wheels out of mesh with the opposite fixed gears and out of engagement with the second shaft, a clutch on the second shaft, movable in either direction, a key adapted to engage said keyways and seated on a spring in said clutch, whereby it may be depressed flush with the face of the clutch, the loose-gear bores, key-seats, clutch and key presenting inclined meeting surfaces in either direction of the clutch movement whereby a gradual engagement is effected, substantially as specified.

20. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, a plurality of different-diameter gear-wheels, through which the second shaft passes, a support holding the last-named gear-wheels normally out of mesh with the opposite fixed gear-wheels and normally out of engagement with the second shaft, a clutch mounted on the second shaft movable in either direction, adapted to lift any selected one of the loose gears into mesh with the opposite fixed gear and also to fix it to its shaft, a rack connected to the clutch having notches for the loose gears and a lever provided with a latch adapted to engage into the rack-notches for shifting the clutch, substantially as specified.

21. In a counter-shaft-speed-changing device, a shaft, a clutch thereon, a clutch-shifting mechanism comprising a rack-bar attached to and movable with the clutch, and having notches in its face, a lever pivoted to a support, a latch on the lever adapted to engage into said notches, and means for engaging the latch into the notches for shifting said rack-bar and clutch in step movements in either direction, substantially as specified.

22. The combination with oppositely-disposed loose and fixed gear-wheels of different diameter, a clutch for the loose gear-wheels having inclined surfaces at its ends, said clutch having a key member countersunk in the face thereof, a spring for actuating the key, the end surfaces of said key being inclined, and means for shifting the said clutch with its key in either direction whereby en-

gagement or disengagement is made with the respective loose gears through which the said clutch passes, substantially as specified.

23. In a variable-speed device, a shaft, a plurality of gear-wheels of different diameter each having a keyway and a bore greater in diameter than the diameter of the shaft, and a clutch slidable within the bores of the gears adapted to fit said bores, said clutch having a spring-controlled key seated therein, substantially as specified.

24. In a variable-speed device, a plurality of gear-wheels of different diameter each having a central bore and keyway, a shaft of less diameter than the gear-bore passing through the same, a clutch comprising a spring-seated key member fixed to said shaft adapted to fit the gear-bores, and means for shifting the shaft and the clutch within the gear-bores, substantially as specified.

25. In a variable-speed device, a plurality of different-diameter gear-wheels, each having a bore, a support holding said gear-wheels with their bores in alinement, a shaft provided with a beveled clutch fitting the bore of each gear, and means for shifting said shaft whereby any selected gear-wheel may be mounted upon said hub, substantially as specified.

26. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, another series of different-diameter gear-wheels and collars through the bores of which said second shaft passes normally loosely, said loose gear-wheels being normally out of mesh with the respective oppositely-disposed fixed gear-wheels, a clutch on said second shaft adapted to fit the loose-gear-wheel bores, and means for shifting said clutch in either direction whereby any selected one of said loose gear-wheels may be lifted into engagement with its opposite fixed gear-wheel and also fixed to said second shaft, substantially as specified.

27. In a variable-speed device, a shaft, a plurality of different-diameter gear-wheels fixed to said shaft, a second shaft, another series of different-diameter gear-wheels and collars through the bores of which said second shaft passes normally loosely, a support holding the said loose gear-wheels normally out of mesh with their respective oppositely-disposed fixed gear-wheels, and with the bores of the said loose gear-wheels normally eccentric of said second shaft, the bores of the collars being concentric to said second shaft, and a clutch on said second shaft adapted to fit the loose-gear-wheel bores, and means for shifting said clutch in either direction whereby any selected one of said loose gear-wheels may be lifted into mesh with its opposite fixed gear-wheel and also fixed to said second shaft, substantially as specified.

In testimony whereof I have hereunto set my hand.

WILLIAM L. SCHELLENBACH.

Witnesses:
OLIVER B. KAISER,
PEARL MCMICHAEL.