No. 626,445. Patented June 6, 1899.

H. SMITH.

VARIABLE SPEED GEARING.

(Application filed Mar. 14, 1899.)

(No Model.)

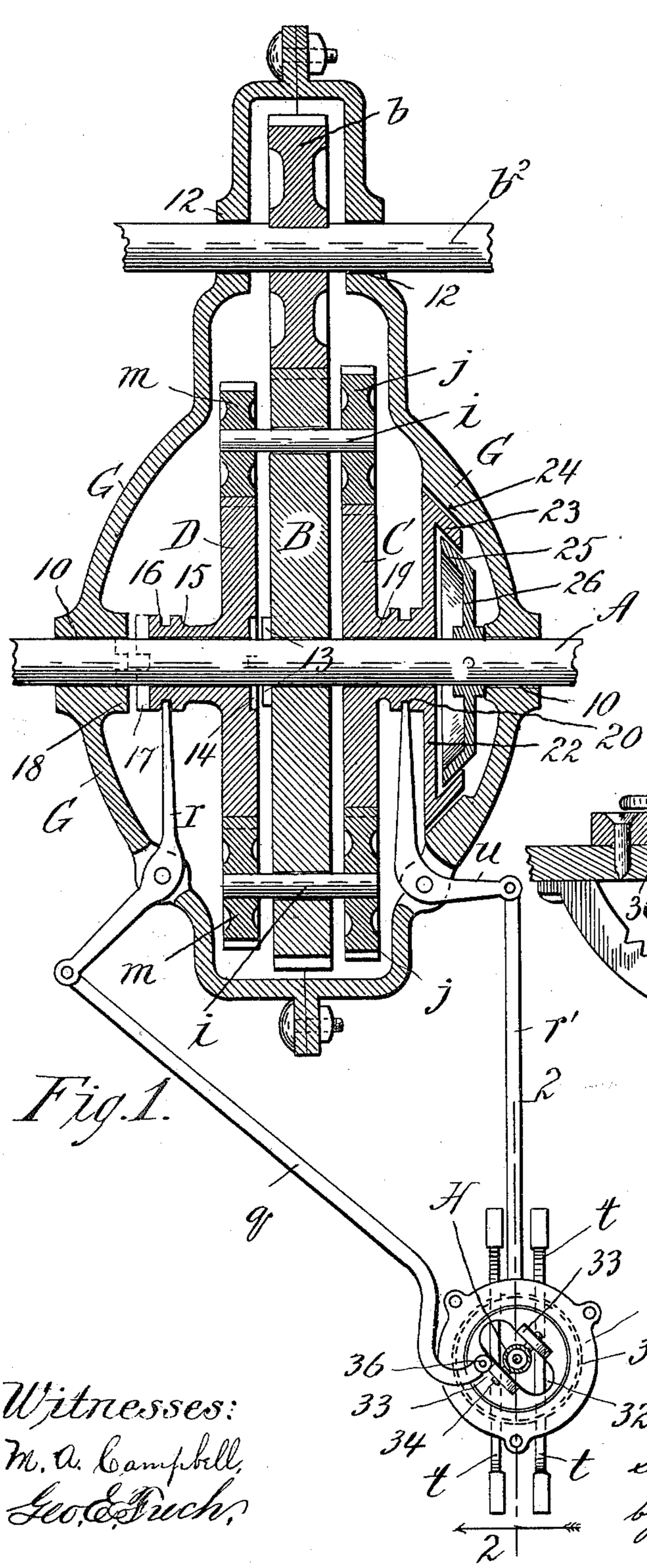

Fig. 1.

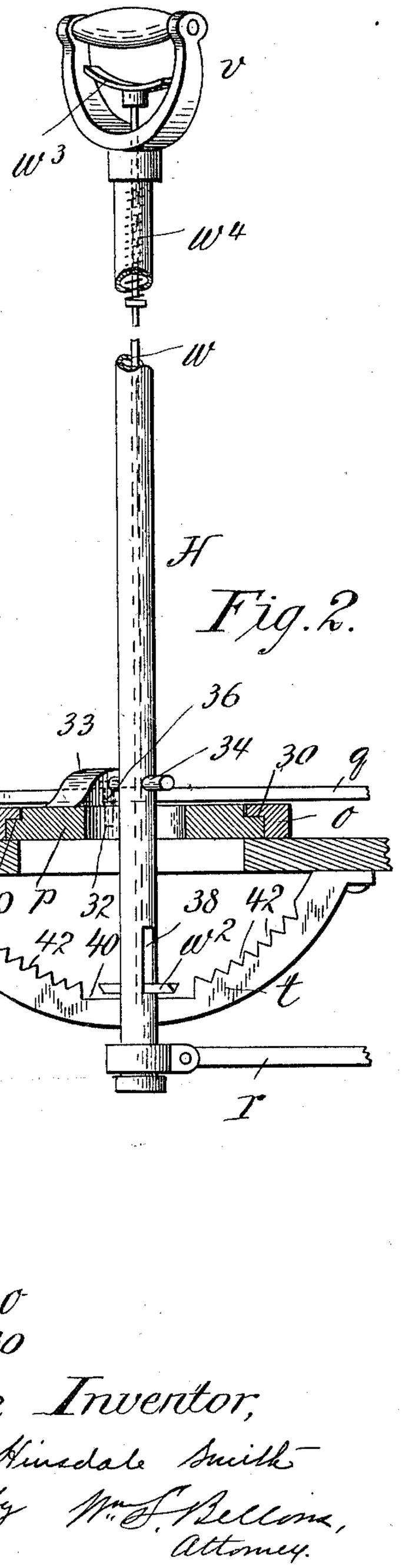

Fig. 2.

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UNITED STATES PATENT OFFICE.

HINSDALE SMITH, OF SPRINGFIELD, MASSACHUSETTS.

VARIABLE-SPEED GEARING.

SPECIFICATION forming part of Letters Patent No. 626,445, dated June 6, 1899.

Application filed March 14, 1899. Serial No. 709,003. (No model.)

To all whom it may concern:

Be it known that I, HINSDALE SMITH, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Variable-Speed Gearing, of which the following is a full, clear, and exact description.

This invention relates to improvements in variable speed and power gearing of the planetary type and in some respects resembles the mechanism described and shown in my application for Letters Patent of the United States, filed July 6, 1898, Serial No. 685,227.

This gearing is especially available for use in motor-propelled vehicles and launches.

The object of this invention is to provide a variable-speed gearing of the class indicated which is even simpler than that shown in my aforesaid application and which comprises as a part thereof novel operating means conducive to convenience and certainty of action and the avoidance of the possibility of inadvertently wrongly placing the parts in their several various connections for the different operative effects.

The invention consists, primarily, in a speed-gearing, of the combination of a shaft mounted for rotation, a main or carrier wheel mounted and freely rotatable upon and relatively to said shaft, a planet-axle carried by said main wheel parallel with said shaft, a pair of united planet-wheels on said planet-axle, a gear on said shaft meshing with one of said planet-wheels and means for locking said gear to the shaft, another gear loose on said shaft and meshing with the other of said planet-gears, and means for locking the last-named gear temporarily to the shaft or for locking it temporarily against rotation.

Reference is to be had to the accompanying drawings, in which the mechanism embodying my present improvements is illustrated.

Figure 1 is understood as a central horizontal section through the speed-gearing and a plan view of the gear-changing mechanism. Fig. 2 is a vertical sectional view and partial elevation as seen beyond the plane indicated by the line 2 2, Fig. 1, and viewed in the direction of the arrow.

In the drawings, A represents a shaft to be regarded usually as the driven shaft, and B represents a main or carrier wheel loosely mounted to rotate upon said shaft and constituting the driving element of the gearing, the same being driven by the gear b on the shaft b^2, although it will be manifest that this wheel B may be belt-driven or otherwise rotated.

G represents a casing, frame, or supporting structure for the shaft A and the gearing, suitable journal-bearings being provided at 10 10 for the shaft A and at 12 12 for the shaft b^2.

i represents a planet-axle loosely rotatable in and through the carrier-wheel B and ranging parallel with the axis of the latter and with the shaft A, its extremities being extended outwardly and receiving thereon the planet-gear wheel m at one end and the larger planet-gear wheel j at the other end, both of which are fast on the axle.

There is provided on the shaft A a gear-wheel D, (shown as at the left of the carrier-wheel B,) the same meshing with the planet-wheel m, while at the right of the carrier B is a second spur gear-wheel C, somewhat smaller in diameter than the one B and mounted loosely on the shaft A.

Means is shown for locking the gear-wheel D to the shaft, the same, as illustrated, being preferably a temporary and shiftable means—to wit, the clutch consisting of the projections or teeth on the shaft A near the face of the loose gear or carrier wheel B and the recesses 14 in the face or hub portion of the wheel D. The hub 15 on the opposite face of the gear-wheel D is circumferentially grooved, as shown at 16, and is provided with clutch-teeth and intermediate recesses, as indicated at 17, and the casing G, suitably adjacent the end of this hub, is similarly constituted a clutch member, as represented at 18. The opposite gear-wheel C has its outwardly-extending hub 19 formed with the annular groove 20 and also constructed with the enlargement 22, of circular form, provided marginally with the flange 23, which extends toward the adjacent side of the frame or casing G, said flange being constructed with its peripheral surfaces both internally and externally beveled to constitute a member of a double-acting clutch coacting with the internal beveled peripheral clutch-sur-

face 24, formed on the exterior of the stationary part G, when properly moved outwardly and with the externally-beveled flange 25 of the disk 26, keyed or otherwise affixed rigidly on the shaft A.

By clutching the gear-wheel D by throwing the portions 13 and 14 into engagement with the shaft A and by clutching the gear-wheel C also to the shaft by bringing the clutch member 23 into clutch with the clutch member 25, which is to be regarded as a fixed part of the shaft, the rotations of the carrier-wheel B will insure a movement of the shaft A in unison with the carrier-wheel B.

By leaving the gear-wheel D clutched to the shaft, but shifting the gear-wheel C so that its clutch member 23 is freed from the shaft-clutch 25 and comes into clutch with the stationary casing or frame G a rotation of the shaft A at a slower speed forward or in the same direction as the rotation of the carrier-wheel B is derived.

Throwing the left-hand gear D into clutch with the frame at the left and throwing the gear-wheel C into clutch with the shaft A, the rotation of the carrier-wheel B will drive the shaft A in the reverse direction from that of the rotation of the carrier-wheel, (and while the gears are of the proportionate diameters substantially as shown the backward rotation of the shaft A will be slower than the rotations of the carrier-wheel; but the rate of backward rotation might be the same or faster than that of the carrier-wheel if the proportionate sizes of the gear-wheels C D *m j* were varied to derive this result, as might be done in a manifest way by a skilled mechanic,) and, again, with the gear-wheel D clutched to the frame or casing G and the gear-wheel C slightly axially moved to bring the clutch portion 23 into frictional engagement with the frame-clutch 24 the rotational movement of the carrier-wheel B and of the shaft will be a retarded motion and more or less rapid, according to the degree of force with which the part 23 is brought frictionally against the part 24, and by leaving either the gear-wheel C or the gear-wheel D free or unclutched from the respectively adjacent clutch members the rotations of the carrier-wheel B will be without effect to turn the shaft A. I have therefore pointed out that this combination and arrangement of the gearing (comprising carrier-wheel B, gear-wheels D and C of different sizes, the planet-gears *m* and *j* of different sizes and double clutches for both the gears D and C, whereby they may be each clutched either to the frame or to the shaft and whereby at least one thereof may be left free at pleasure from both the frame and the shaft) are susceptible of utilization for five capabilities—viz., a driving of the shaft at full speed ahead, a driving of the shaft at a determined lessened speed ahead positively assured by the proportionate sizes of the gears, a driving of the shaft reversely, a driving of the shaft forwardly at a retarded speed variable in accordance with the pressure exerted between the friction-clutch members 23 and 24, and a non-rotation of the shaft A notwithstanding the continuation of the motion imparted to the carrier-wheel B.

I might in lieu of having the gear-wheel D constructed with a clutch, whereby it becomes as one with the shaft A only temporarily, key the said gear-wheel permanently to the shaft and still retain an operative gearing comprising novelty and invention and susceptible of several of the capabilities for operation set forth.

I will now describe my novel simplified gear-controlling appliances, which are constructed not only for facility in bringing the different clutch members into their relations for effecting the different operations of the gears described, but to prevent any such operations of the clutches in an improper manner as would bring undue strain upon the gearing or cause a breakage thereof. Suitably adjacent the casing, frame, or stationary support G, within which the gearing is inclosed and mounted, I provide an annular bearing or guide ring *o* having an undercut rabbet or inverted seat 30, said ring being fastened to the flooring, deck, or other available support of a vehicle or boat in which the gearing is used. Within this ring *o* is fitted to turn a plate *p*, provided centrally with the elongated slot 32, at the opposite longitudinal margins of which are the upstanding ear-pieces 33 33, in which is intermediately pivotally hung at 34 the hollow post or operating handle shaft or lever H. A connecting-rod *q* is pivotally connected at 36 with the said plate *p* at a point eccentrically of its axis, said rod *q* also having connection with the clutch-operating lever *r*, which is understood as forked at its inner end and engaged with the grooved clutch-hub of the gear D.

As shown in Fig. 1, with the gear D and its clutches disengaged both from the shaft and from the stationary support the plate *p* is turned so as to have the slot 32 arranged angular to the plane of swinging movement of the handle post or shaft H, which plane of swinging movement is constrained to be parallel with the depending opposed bowed guards *t t*.

The lower end of the operating-shaft H has the connecting-rod *r'* secured thereto, the same being also secured to the lever *u*, which operates the clutch of the spur gear-wheel C. The aforesaid shaft H, which is formed tubular for the greater portion of its length, is provided at its upper end with the spade-handle *v*. Extending down through the tubular shaft to near its lower end is the operating-rod *w*, having at its lower end the pawl-bar w^2, which extends transversely outwardly through the slot 38 therefor near the lower end of the tubular shaft. The said rod has at its upper end within the spade-handle the subhandle or upper end enlargement w^3. The spring w^4 is applied for imparting a down-

ward-yielding pressure on the rod. The semicircular or bowed guards or runners *t t* at the middle of their upper edges have the recesses 40, so that when the handle-shaft H is in an upright position it may be turned to impart either a forcing or a drawing movement on the connecting-rod *q* to operate the clutches of gear-wheel D.

When the gear-wheel D is out of clutch and the slot 32 is angular to the length of the space between the guards *t t*, the operating-shaft cannot be swung in either inclination forward or backward from its vertical position, because its lower end, which depends through the space between the guards, must necessarily swing in a direction angular to the sides of the guards, and the swinging motion would be resisted by coming to contact against the inner side of one or the other of the guards *t;* but by a rotational movement imparted through the handle *v* to the operating-shaft to bring clutch 17 of gear D into engagement with the clutch 18 of the fixed support or said gear-wheel reversely into clutch at 13 with the shaft the plate *p*, to which the shaft is articulated, will therefore have been given such a rotational movement that the slot 32 in the said plate *p* will range in line with the space between the guards *t t*, whereupon the shaft II may be then swung forwardly inclined or rearwardly inclined to throw the clutch member 23 for gear C into engagement with either the clutch 24 of the fixed support or the clutch 25, which is an adjunct of the shaft A.

In practice it is designed to lift the pawl w^2 through the handle w^3 at the upper end of the pawl-operating shaft H, then swing the shaft in the one direction or the other, as required, and then release the pressure in the upward direction on the part w^3, leaving the pawl to engage the teeth 42, provided at the upper edge of the guards, and to again lift the pawl through subhandle w^3 preparatory to restoring the handle to its upright intermediate position or to reverse its inclination.

By the engagement of the pawl with the teeth 42 it is insured that after the operating-shaft has been set in either of its inclined positions the parts consequently clutched will remain in clutch without the necessity of continuing the manual pressure on the handle.

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

1. In a variable-speed mechanism, a shaft mounted for rotation, a main or carrier wheel mounted upon and rotating freely on said shaft, a planet-axle carried by said main wheel parallel with said shaft, a pair of united planet-wheels on said planet-axle, a gear on said shaft and gearing with one of said planet-wheels, and means for locking said gear to the shaft, another gear loose on said shaft and engaging the other of said planet-gears and means for both locking the last-named gear to the shaft, and for locking it against rotation.

2. In a variable-speed mechanism, a shaft mounted for rotation, and a casing, frame or suitable stationary support, a carrier-wheel loosely mounted to rotate on said shaft and carrying at opposite sides thereof united planet-gear wheels rotatable thereon, a gear-wheel D, at one side of the carrier-wheel in mesh with one of said planet-gears, and means for locking it to the shaft, another gear-wheel C at the other side of the carrier-wheel in mesh with the other of said planet-gears, and provided with a hub extension having the rim or flange 23 with external and internal beveled faces, a clutch member fixed on the shaft outside of the hub of said gear-wheel C, and having the externally-beveled portion 25, and the internally-beveled friction-clutch portion 24 provided on said stationary support, the said clutch portion 23 of the gear-wheel D alternately engaging the beveled faces 24 and 25, and means for reversely moving said clutch member 23.

3. In a variable-speed mechanism, a shaft mounted for rotation, and a casing, frame or suitable stationary support, a carrier-wheel loosely mounted to rotate on said shaft and carrying at opposite sides thereof united planet-gearing rotatable thereon, a gear-wheel D at one side of the carrier-wheel in mesh with one said planet-gear provided with clutch members and coacting clutch members on the shaft and on the fixed support; another gear-wheel C at the other side of the carrier-wheel in mesh with the other said planet-gear and provided with a hub extension having the rim or flange 23 with external and internal beveled faces, a clutch member fixed on the shaft outside of the hub of said gear-wheel C, and having the externally-beveled portion 25 and the internally-beveled friction-clutch face 24 provided on said support, the said clutch portion 23 alternately engaging the beveled faces 24 and 25, and means for moving said gear D and its clutch member.

4. The combination with a speed-gearing having a clutch member and a clutch-operating arm therewith engaged, of a handle rod or post pivotally mounted and having a portion thereof movable alongside a guard, a pawl movably supported by said post and adapted to engage teeth which are provided in the adjacent guard, and a pawl-releasing rod carried by the handle-post, substantially as described.

5. The combination with a speed-gearing having a clutch member and a clutch-operating arm therewith engaged, of a tubular bar, provided at its upper end with the spade-handle, pivotally mounted, a curved guard *t* alongside which said bar moves, a pawl movably supported by said bar and adapted to engage teeth which are provided in the adjacent guard, and a pawl-releasing rod arranged

within the tubular bar, and having the handle w^3, and the spring w^4.

6. In a speed-gearing, the combination with double movable clutch members and operating-rods connecting therewith, of a rotatable part with which one of said clutch-operating rods is connected, a bar or lever pivotally mounted on said rotatable part, with which said other rod is connected, and means for permitting and preventing the swinging movement of the lever accordingly as the plate on which it is mounted is rotationally moved.

7. In a variable speed-gearing, the combination with double movable clutch members thereof, and operating-rods respectively connected therewith, of a rotatable plate p having the slot 32, and to which plate one of said clutch-operating rods is connected, an operating handle-lever H pivotally secured to said plate and adapted to have its portion adjacent the plate movable through said slot, the opposing guard-plates between which the extremity of said handle-lever is extended serving to prevent the swinging movement of the lever while the slot of the plate is angular thereto, and a connection between the other clutch-operating rod and the handle-lever, substantially as described.

8. The combination with the speed-gearing, consisting of a fixed support and oppositely-arranged clutch members thereto provided, the shaft A mounted for rotation within said support and having the clutch members 13 and 25, a carrier-wheel B loosely rotatable on and relative to the shaft and carrying the united planet-wheels m and j, the gear-wheel D adapted to be clutched to said shaft-clutch 13, or to one of the clutches of the stationary support, the gear-wheel C and the clutch member 23 thereof adapted to engage either the adjacent shaft-clutch or the fixed-support clutch, clutch-operating connections q and r, a rotatable plate having the slot 32 to which one of said connections is secured, the handle-bar H pivotally mounted to swing relatively to and through the slot of said rotatable plate, and the opposing guards between which said handle-lever is extended, and parallel with or angular to which the said slot of the plate may be brought by a rotational movement of the handle-lever, substantially as and for the purposes set forth.

Signed by me, at Springfield, Massachusetts, this 10th day of March, 1899.

HINSDALE SMITH.

Witnesses:
WM. S. BELLOWS,
M. A. CAMPBELL.