Nov. 4, 1924. 1,514,485

P. S. WARD

CHANGE SPEED MECHANISM

Filed Oct. 20, 1922 4 Sheets-Sheet 1

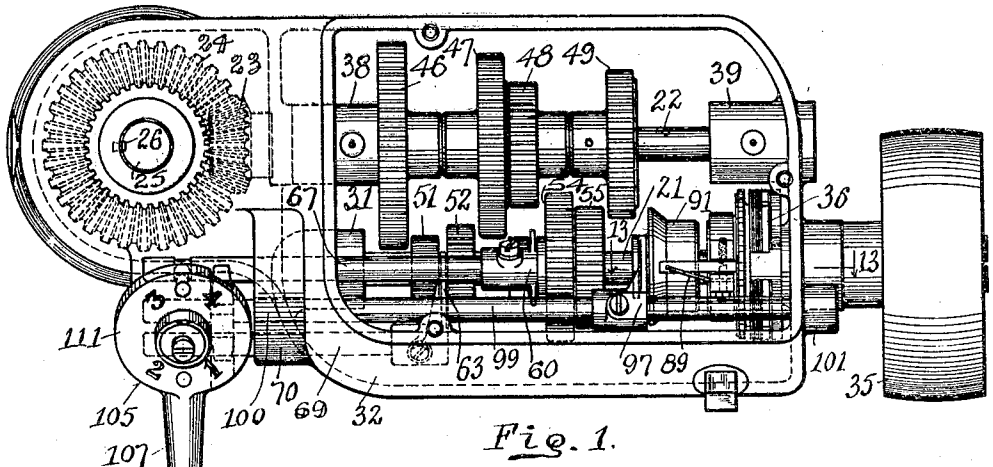



Fig. 1.

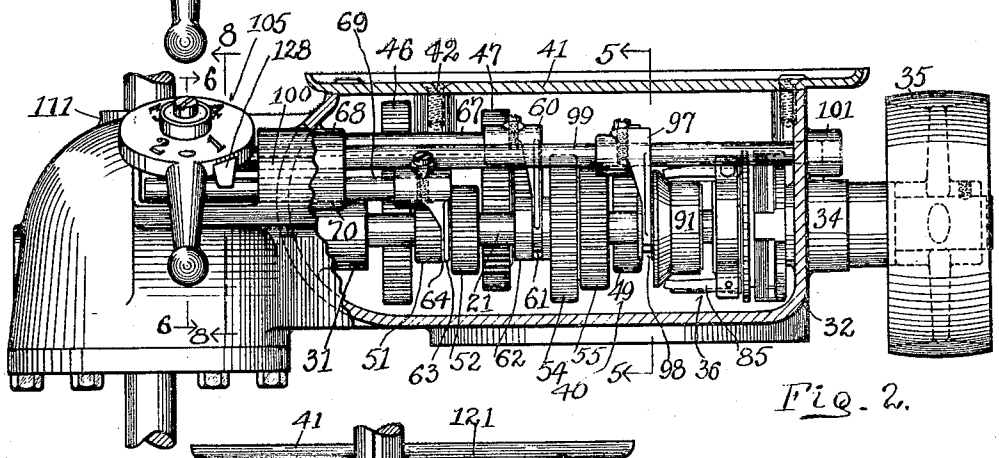



Fig. 2.

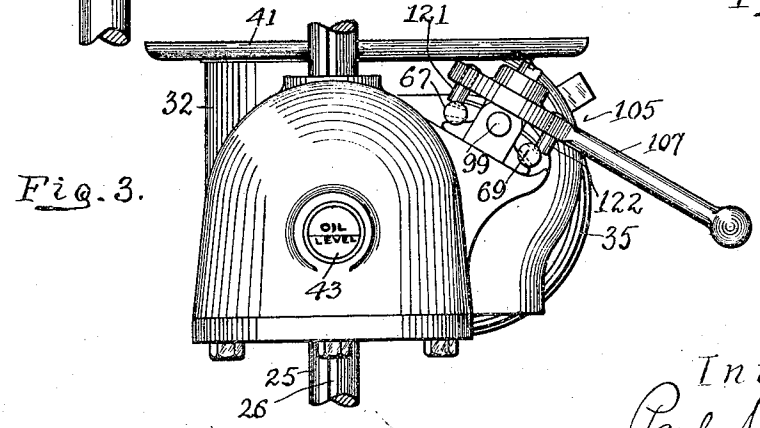



Fig. 3.

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CHANGE SPEED MECHANISM

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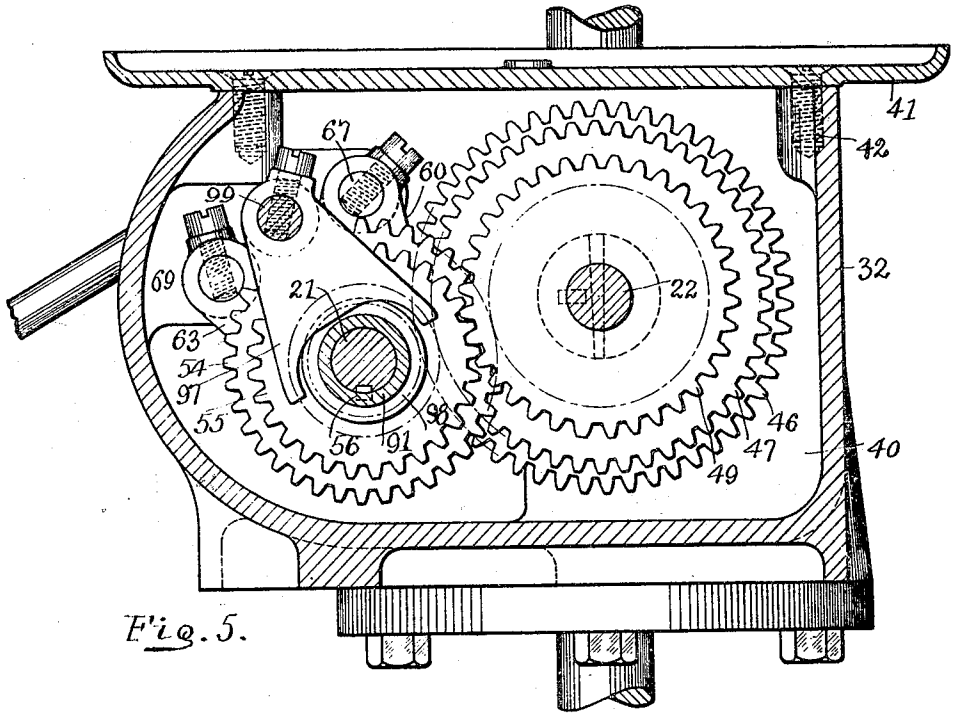



Fig. 5.

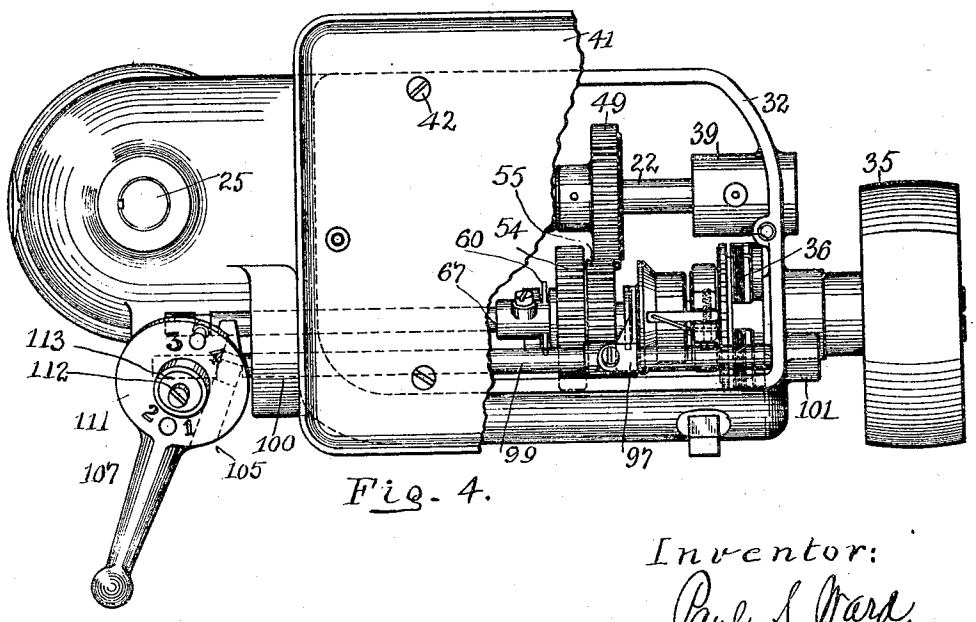



Fig. 4.

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CHANGE SPEED MECHANISM

Filed Oct. 20, 1922 4 Sheets-Sheet 3

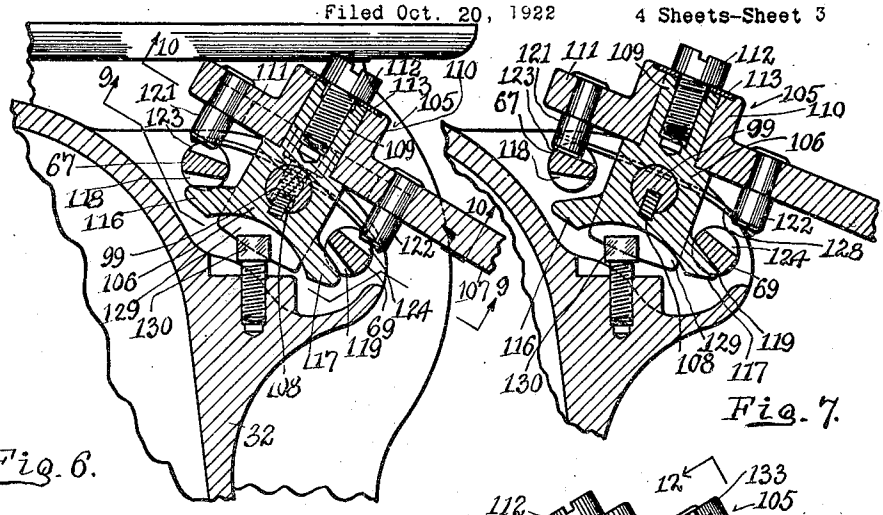



Fig. 6.




Fig. 7.

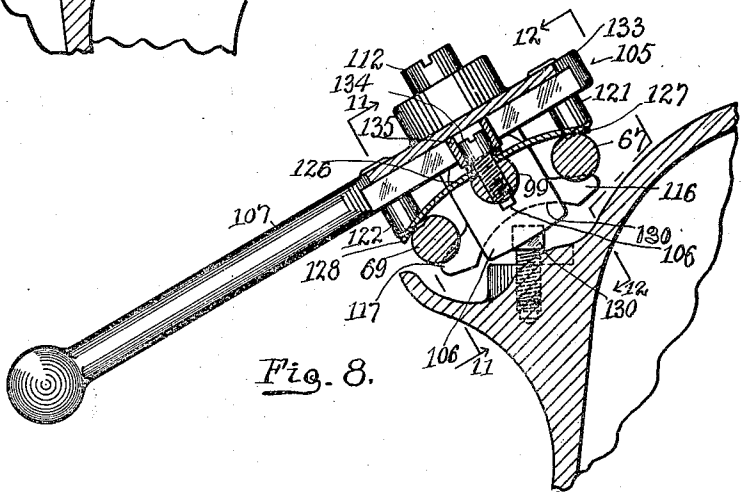



Fig. 8.

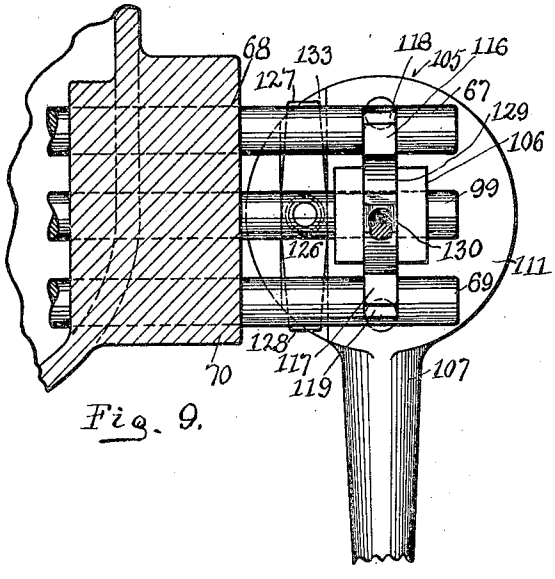



Fig. 9.

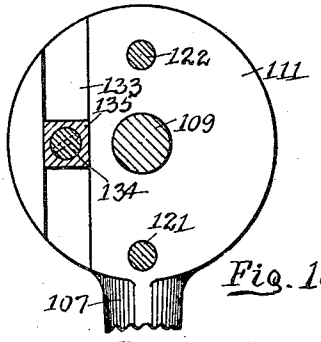



Fig. 10.

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Nov. 4, 1924. 1,514,485

P. S. WARD

CHANGE SPEED MECHANISM

Filed Oct. 20, 1922 4 Sheets-Sheet 4.

Fig. 13.

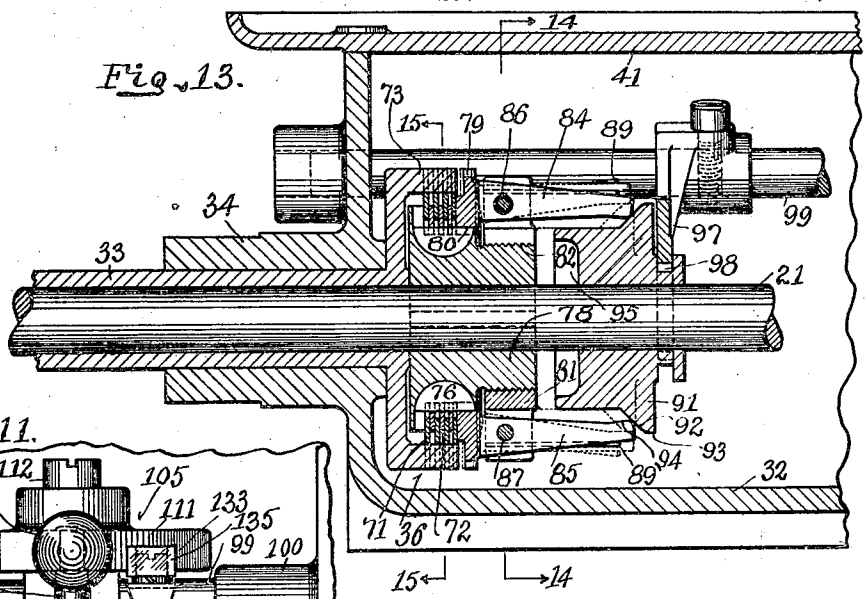



Fig. 11.

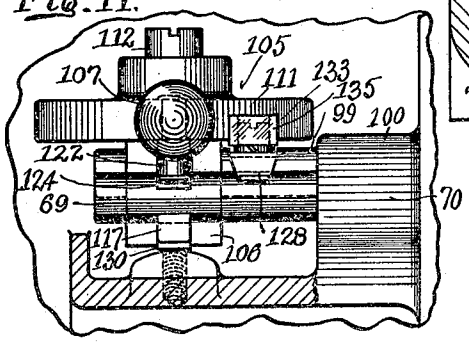
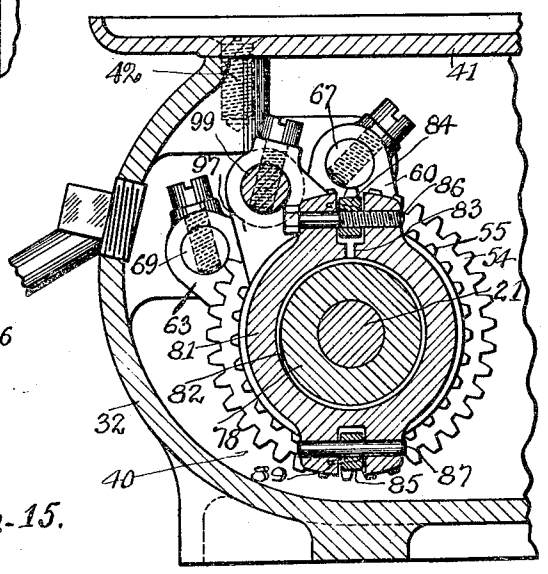



Fig. 14.



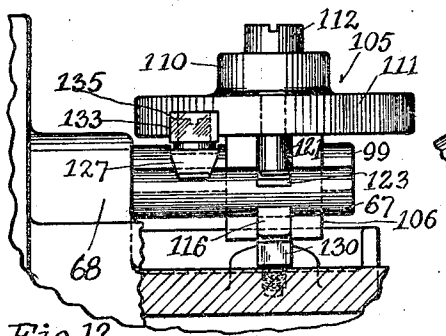
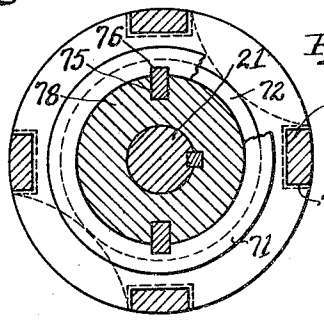




Fig. 12.

Fig. 15.




Inventor:
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Patented Nov. 4, 1924. 1,514,485

# UNITED STATES PATENT OFFICE.

PAUL S. WARD, OF CINCINNATI, OHIO, ASSIGNOR TO THE TRIUMPH MANUFACTURING COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

## CHANGE-SPEED MECHANISM.

Application filed October 20, 1922. Serial No. 595,759.

*To all whom it may concern:*

Be it known that I, PAUL S. WARD, 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 Speed-Changing Mechanism, of which the following is a specification.

It is the object of my invention to provide speed changing mechanism comprising novel actuating means for effecting speed changes so arranged that various changes in gear relations may be obtained without interference in the gearing; further, to provide novel means whereby the gearing is normally locked in neutral relation; further, to provide novel means whereby the gearing is returned to neutral relation between gear changes; further, to provide novel means for clutch actuation in connection with the gear changes so that the clutch is actuated by the actuating means for effecting speed changes; further, to provide novel means whereby, upon making a change of speed, speed change is first effected, followed by clutch actuation by a continuous movement of the actuating means for effecting speed change; and, further, to provide novel means whereby, when changing from one speed to another, the clutch is released, the gears are placed in neutral relation, the speed change is made, and the clutch again actuated, in the sequence named.

The invention will be further readily understood by the following description and claims, and from the drawings, in which latter:

Fig. 1 is a plan view of my improved device, with the cover of the gear casing removed.

Fig. 2 is a side elevation of the same, with the gear casing partly in section.

Fig. 3 is an end view of my improved device.

Fig. 4 is a plan view of my improved device, with the cover of the gear casing partly broken away, and showing a speed change relation just prior to the moment of clutch actuation.

Fig. 5 is a cross-section of my improved device, taken in the plane of the line 5—5, of Fig. 2.

Fig. 6 is a cross-section of the operating means of my improved device, taken on the line 6—6, of Fig. 2, showing the parts in neutral relation.

Fig. 7 is a similar cross-section, showing the parts in relation for shifting one of the shifting rods.

Fig. 8 is a cross-section, taken on the line 8—8, of Fig. 2, showing the operative connection of the operating means for clutch operation.

Fig. 9 is a cross-section of the operating means, taken on the irregular line 9—9, of Fig. 6.

Fig. 10 is a cross-section of the same, taken on the line 10—10, of Fig. 6.

Fig. 11 is a front elevation of the same, with the frame partly in section in the plane of the line 11—11, of Fig. 8.

Fig. 12 is a rear elevation of the same, with the frame partly in section in the plane of the irregular line 12—12, of Fig. 8.

Fig. 13 is an axial section of the exemplified clutch mechanism, taken on the section line 13—13, of Fig. 1.

Fig. 14 is a cross-section of the same, taken in the plane of the line 14—14, of Fig. 13; and,

Fig. 15 is a cross-section of the same, taken in the plane of the line 15—15, of Fig. 13.

I do not herein claim the clutch mechanism herein shown and described, having shown, described and claimed the same in a copending application for patent on improvements in friction clutches, filed by me August 26, 1922, Serial No. 584,409.

The speed changing mechanism exemplified comprises a shaft 21 and a shaft 22, either of which may be the driving shaft and the other of which may be the driven shaft. The shaft 21 is represented as the driving shaft and the shaft 22 as the driven

shaft. The shaft 22 is shown provided with a bevel-pinion 23 fast thereon, meshing with a bevel-gear 24 about an upright shaft 25, with which the bevel-gear may have spline-key and groove connection 26 for maintaining drive-connection with said shaft during axial movements of the shaft. This shaft may for instance be the upright axially movable drive-shaft for the whip of a cake mixing machine, or may be employed for other purposes.

The shaft 21 is journaled in a bearing 31 of a suitable casing 32 and a hub 33, in turn journaled in a bearing 34 of said casing, a pulley 35 being shown attached to said hub for driving said shaft through the medium of a clutch 36 hereinafter more fully described. The shaft 22 is journaled in bearings 38, 39, of the casing. The lower portion of the casing may be an oil-reservoir 40 accessible through the removable cover 41 secured to the body of the casing by screws 42. A viewing lens 43 in the casing shows the level of lubricant in the reservoir A set of gears 46, 47, and a set of gears 48, 49, are fast on the shaft 22. A nest of gears 51, 52, fixed together, has suitable spline-key and groove connection with the shaft 21, and a nest of gears 54, 55, fixed together, has spline-key and groove connection 56 with the shaft 21, the spline-key and groove connection for the nest of gears 51, 52, being similar to this last-named connection. The gears 51, 52, are of different diameters, and are arranged to be placed by axial movement in mesh or out of mesh with the respective gears 46, 47, also of different diameters, or to be placed out of mesh with both said last-named gears for neutral relation, shown between said last-named gears in Fig. 1. The gears 54, 55, are of different diameters and are arranged to be placed, by axial movement, in mesh or out of mesh with the respective gears 48, 49, also of different diameters, or to be placed out of mesh with both said last-named gears for neutral relation, shown between said last-named gears in Fig. 1.

A fork 60 is arranged to shift the nest of gears 54, 55, being shown received in an annular groove 61 in the hub 62 of said nest of gears. A fork 63 is arranged to shift the nest of gears 51, 52, being shown received in an annular groove 64 in said nest of gears.

The fork 60 is fixed to a rod 67 slidable axially in a bearing 68 of the casing, and the fork 63 is fixed to a rod 69 slidable axially in a bearing 70 of the casing.

The clutch 36 is exemplified as a friction clutch comprising friction plates 71, 72. The hub is provided with lugs 73 received in slots 74 in the outer peripheries of the friction plates 71 for driving said friction plates. The friction plates 72 have slots 75 at their inner peripheries, in which keys 76 in a hub 78 are received. A collar 79 has slots 80 in which the keys 76 are also received. The friction plates and the collar have relative axial movements on the hub for release relation or actuated relation in the clutch.

A collar 81 is threaded on a threaded portion 82 of the hub 78, exemplified as a split collar, having a split 83 therein. Cam-levers 84, 85, are pivoted to the collar, respectively on a bolt 86 and a pin 87. The bolt is arranged to clamp the split collar about the hub 78 by drawing together its split ends after adjustment of the collar 81 on the hub, adjusting the distance between said collar and an annular flange 88 on said hub, and thereby adjusting the pressure on the friction plates and the collar 79 located between said annular flange and the cam-ends of the levers pivoted on the collar 81. The cam-levers are normally retracted by springs 89 fixed in the collar 81.

A frusto-conical collar 91 is axially slidable on the shaft 21, and has a frusto-conical face 92 for coaction with the outer ends of the cam lever 84, 85, and an annular resting face 93 with which the inner faces 94 on the outer ends of the cam-levers coact. Said inner faces are parallel with each other when the cam-levers are in actuated relation, shown in dotted lines in Fig. 13, to permit actuation of the frusto-conical collar after actuated relation in the clutch is obtained without affecting such actuated relation.

The inner end of the frusto-conical collar is arranged to strike the collar 81 when in fully actuated relation, regardless of the adjustments of the latter, the frusto-conical collar being provided with an end recess 95 in which the threaded end of the hub 78 is received when the adjustment of the threaded collar is such as to cause the hub to extend beyond the threaded collar.

A fork 97 is received in an annular groove 98 in the frusto-conical collar for actuating the latter. The fork 97 is fixed to a rod 99 slidable axially in a bearing 100, 101, of the casing.

Means are provided to shift the rods 67, 69 and 99 axially in such manner that speed change is effected in advance of clutch actuation. Thus a rockable member 105 is pivoted about the axis of the rod 99, and comprises a rockable part 106 and a lever 107. The rod 99 is exemplified as slidable in the rockable member by means of a spline-key and groove connection 108. The rockable lever 107 is pivoted on a stud 109 of the rockable part, extending at substantially right angles to the rod 99, by means of a bearing 110 in a head 111 of said lever, the lever being held to said stud by a screw 112 and washer 113.

The rockable part is provided with locking lugs 116, 117, arranged to be received in slots 118, 119, with which the rods 67 and 69 are respectively provided. The lever 107 is provided with shifting pins 121, 122, received in slots 123, 124, with which the rods 67 and 69 are respectively provided. The rockable member is shown pivoted between the rods 67 and 69 and the slots 118, 119, and 123, 124, are respectively at opposite sides of said rods, being shown respectively in the lower faces and upper faces of said rods.

The lugs and pins are normally located in said slots for locking the shiftable rods in neutral positions, the slots being sufficiently deep for permitting each of the lugs and pins to be received in their slots to sufficient extent to free the opposite lug and pin by rocking of the rockable member for endwise shifting of each rod of said pair of rods while the other of said pair of rods is locked in neutral position. A spring 126 is fixed to the rockable member, being shown as a leaf-spring comprising the wings 127, 128, respectively bearing upon the rods 67 and 69, for holding said rods in actuated relations, and urging the rockable member toward neutral relation.

The rockable member is provided with a slot 129 in which the head of a bolt 130 is received for endwise positioning of the rockable member, the bolt being threaded into the casing.

The head of the lever 107 is provided with a slot 133 in which a pin shown as a screw-head of a screw 134 is received, a slide 135 being received in said slot about said pin. The screw is threaded into the rod 99 and clamps the spring 126 to said rod, which in turn rocks with said rockable member. The slot 133 is a cam-slot, extending crosswise of the rods, the pin being normally in the middle of the slot so that endwise movement of the rod for clutch operation takes place upon movement of the lever in either direction.

Explaining the operation, it will be assumed that it is desired to effect speed change to speed No. 4, and that the parts are in neutral relations, as shown in Figs. 1, 6 and 8, in which relations the speed changing gears are out of mesh, as shown in Fig. 1, and the shifting parts are in locked relation, as shown in Fig. 6. The rockable member is rocked to cause the locking lug 117 to sink into slot 119 of rod 69 and the locking lug 116 to move out of slot 118 of rod 67 to release rod 67. At the same time the shifting pin 122 moves out of slot 124 in rod 69 and the shifting pin 121 sinks into slot 123 in rod 67. Such relations are shown in Fig. 7.

Upon movement of the swinging end of the operating lever toward the left, the rod 67 moves toward the right, for moving the nest of gears 54, 55, toward the right and causes the gear 55 to move into meshing relation with the gear 49, as shown in Fig. 4.

Owing to the relations of the shifting pins 121 and 122 to the pivoted axis of the lever 107, these pins being normally distanced from said axis in directions at substantial right angles to the directions of movement of the rods 67, 69, the initial movement of said rods is a quick movement, the speed of which decreases as the swinging movement of the lever progresses at a constant speed.

The movement of the operating lever will also cause actuation in the clutch after the meshing relation between the gears 55 and 49 has been effected. The pin 134 of rod 99 is distanced from the pivot of the lever 107 in a direction in line with the rod 99, and the slot 133 extends in a direction at substantial right angles to said last-named direction. During the initial part of the movement of the lever 107 the movement of the rod 99, which affects the clutch, is therefore slight, the movement of the rod accelerating as the movement of the lever progresses.

The actuation in the clutch sufficiently for transmission of power takes place during the latter portion of the movement of the lever, for permitting the speed change to be effected prior to power transmission, as exemplified in Fig. 4, although there may be an initial idle rotation of the gears just sufficient to permit ready meshing between the gears. Further movement of the lever causes the meshing gears to be brought into line with each other and movement of the riding face 93 along the coacting faces 94 in the clutch.

The parts are held in actuated relation by pressure of the spring 126 upon the shifted rod, the rockable member remaining in rocked relation by contact of the lug 116 with the periphery of the rod 67, the lug 117 remaining in the slot 119 for holding the rod 69 in neutral position.

When it is desired to bring the meshing gears out of mesh for a further speed change or for cessation of operation, the lever is moved in the opposite direction. The first effect is to release the clutch by an initial accelerated movement of the pin 134, followed by a movement of the shifting rod which has connection with the meshing gear to move said meshing gear out of meshing relation, to again cause neutral relation in the gearing and clutch.

Either rod 67, 69, may be moved in either direction for different change of speed in similar manner, the clutch rod being similarly actuated for each change of speed.

It is obvious that changes may be made in the structure I have preferred to show,

without departing from the spirit of my invention within the scope of the appended claims.

My improved device is simple and compact, locks the parts in neutral relation as well as in shifted relations, insures cessation of driving force during neutral relation in the gearing and while making speed changes until meshing relation in the gears has been obtained, and insures cessation of driving force prior to disengagement of the gearing when disconnecting the gearing.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for effecting speed change in said gearing, a rockable member rockable in planes substantially parallel to and substantially at right angles to the shifting movement of said shiftable elements, and a pair of shifting parts and a pair of locking parts respectively having connection with opposite ones of said shiftable elements for shifting movement of one of said shiftable elements and locking of the other of said shiftable elements.

2. In speed changing mechanism, the combination of gearing, shiftable elements for effecting speed change in said gearing, a rockable member comprising a rockable locking part and a rockable element-shifting part, means whereby rocking of said rockable member effects locking connection of said rockable locking part with one of said shiftable elements and release of another of said shiftable elements and shifting connection of said element-shifting part with said other of said shiftable elements and release of said one of said shiftable elements, means for maintaining said relations during shifted condition of said element-shifting part, and spring means between said rockable members and said respective shiftable elements for maintaining said shifted condition.

3. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for effecting speed change in said gearing, and a rockable member having a pivot between said shiftable elements, said rockable member comprising a pair of locking parts at one side of said shiftable elements and a pair of shifting parts at the other side of said shiftable elements constructed and arranged for selective locking and shifting relation with opposite ones of said shiftable elements.

4. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for effecting speed change in said gearing, and a rockable member having a pivot between said shiftable elements, said rockable member comprising a pair of locking parts at one side of said shiftable elements and a pair of shifting parts at the other side of said shiftable elements constructed and arranged for selective locking and shifting relation with opposite ones of said shiftable elements, and said parts so formed as to maintain said relations during shifted relation of one of said shiftable elements.

5. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, and a rockable member comprising a rockable locking part and a rockable shifting part, said rockable locking part and said rockable shifting part rockable on an axis substantially parallel with the directions of movement of said endwise shiftable elements, said endwise shiftable elements and said rockable locking part provided with coacting locking faces, said endwise shiftable elements and said rockable shifting part provided with coacting shifting faces, and said coacting locking faces and said coacting shifting faces for opposite ones of endwise shiftable elements brought into coacting relation by rocking of said rockable member on said first-named axis.

6. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, and a rockable member comprising a rockable locking part and a rockable shifting part, said rockable locking part and said rockable shifting part rockable on an axis substantially parallel with the directions of movement of said endwise shiftable elements, said rockable shifting part rockable on an axis substantially at right angles to said directions, said endwise shiftable elements and said rockable locking part provided with coacting locking faces, said endwise shiftable elements and said rockable shifting part provided with coacting shifting faces, said coacting locking faces and said coacting shifting faces for opposite ones of said endwise shiftable elements brought into coacting relation by rocking of said rockable member on said first-named axis, and said endwise shiftable elements shiftable endwise by rocking of said shifting part on said second-named axis.

7. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, and a rockable member comprising a rockable locking part and a rockable shifting part, said rockable locking part and said rockable shifting part rockable on an axis substantially parallel with the directions of movement of said endwise shiftable elements, said rockable shifting part rockable on an axis substantially at

right angles to said directions, said endwise shiftable elements and said rockable locking part provided with coacting locking faces and said endwise shiftable elements and said rockable shifting part provided with coacting shifting faces, said coacting locking faces and said coacting shifting faces for opposite ones of endwise shiftable elements brought into coacting relation by rocking of said rockable member on said first-named axis, said endwise shiftable elements shiftable endwise by rocking of said shifting part on said second-named axis, and said endwise shiftable elements and said rockable locking part provided with coacting faces for maintaining said locked relation during said endwise shifted relation.

8. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, a rockable member pivoted between said endwise shiftable elements on an axis substantially parallel with the endwise movements of said elements, a lever pivoted on said rockable member on an axis substantially at right angles to said first-named axis and coacting locking parts between one side of said endwise shiftable elements and said rockable member, coacting shifting parts between the other side of said endwise shiftable elements and said lever, constructed and arranged for simultaneous engagement between opposite ones of said locking parts and shifting parts for locking of one of said shiftable elements and shifting of the other of said shiftable elements.

9. In speed changing mechanism, the combination of a gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, a rockable member pivoted between said endwise shiftable elements on an axis substantially parallel to the endwise movements of said elements, a lever pivoted on said rockable member on an axis substantially at right angles to said first-named axis, coacting locking parts between one side of said endwise shiftable elements and said rockable member, coacting shifting parts between the other side of said endwise shiftable elements and said lever, constructed and arranged for simultaneous engagement between opposite ones of said locking parts and shifting parts for locking of one of said shiftable elements and shifting of the other of said shiftable elements, and means for stationarily positioning said rockable member endwise.

10. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, a rockable member pivoted between said endwise shiftable elements on an axis substantially parallel to the endwise movements of said elements, a lever pivoted on said rockable member on an axis substantially at right angles to said first-named axis, coacting locking parts between one side of said endwise shiftable elements and said rockable member, coacting shifting parts between the other side of said endwise shiftable elements and said lever, constructed and arranged for simultaneous engagement between opposite ones of said locking parts and shifting parts for locking of one of said shiftable elements and shifting of the other of said shiftable elements, and spring means for urging normal relation between said rockable member and said endwise shiftable elements.

11. In speed changing mechanism, the combination of gearing, a pair of endwise movable rods provided with slots at their respective sides, said rods having connections with said gearing for speed change in said gearing, a rockable locking member pivoted between said rods on an axis substantially parallel with said rods, said rockable locking member provided with locking lugs coacting with said slots at one side of said rods, and a lever pivoted to said rockable member on an axis substantially at right angles to said first-named axis, said lever provided with lugs coacting with said slots at the other side of said rods, all said lugs normally coacting with all said slots for normal endwise neutral locked relation of said rods, and constructed and arranged whereby rocking of said rockable locking member causes locked relation of one of said rods and unlocked relation of the other of said rods and freed relation between said lever and said one of said rods and engaged relation between said lever and said other of said rods for shifting movement of said other of said rods.

12. In speed changing mechanism, the combination of gearing, a pair of endwise movable rods provided with slots at their respective sides, said rods having connections with said gearing for speed change in said gearing, a rockable locking member pivoted between said rods on an axis substantially parallel with said rods, said rockable locking member provided with locking lugs coacting with said slots at one side of said rods, and a lever pivoted to said rockable member on an axis substantially at right angles to said first-named axis, said lever provided with lugs coacting with said slots at the other side of said rods, all said lugs normally coacting with all said slots for normal endwise neutral locked relation of said rods, constructed and arranged whereby rocking of said rockable locking member causes locked relation of one of said rods and unlocked relation of the other of said rods and freed relation between said lever and said one of said rods and engaged

relation between said lever and said other of said rods for shifting movement of said other of said rods, and said other of said rods provided with an engaging face for said locking member to maintain said locking member in rocked relation.

13. In speed changing mechanism, the combination of gearing, a pair of endwise movable rods provided with slots at their respective sides, said rods having connnections with said gearing for speed change in said gearing, a rockable locking member pivoted between said rods on an axis substantially parallel with said rods, said rockable locking member provided with locking lugs coacting with said slots at one side of said rods, a lever pivoted to said rockable member on an axis substantially at right angles to said first-named axis, said lever provided with lugs coacting with said slots at the other side of said rods, all said lugs normally coacting with all said slots for normal endwise neutral locked relation of said rods, constructed and arranged whereby rocking of said rockable locking member causes locked relation of one of said rods and unlocked relation of the other of said rods and freed relation between said lever and said one of said rods and engaged relation between said lever and said other of said rods, for shifting movement of said other of said rods, and spring means to normally urge said lugs and slots into coacting relation.

14. In speed changing mechanism, the combination of gearing, a pair of endwise movable rods provided with slots at their respective sides, said rods having connections with said gearing for speed change in said gearing, a rockable locking member pivoted between said rods on an axis substantially parallel with said rods, said rockable locking member provided with locking lugs coacting with said slots at one side of said rods, a lever pivoted to said rockable member on an axis substantially at right angles to said first-named axis, said lever provided with lugs coacting with said slots at the other side of said rods, all said rods normally coacting with all said slots for normal endwise neutral locked relation of said rods, constructed and arranged whereby rocking of said rockable locking member causes locked relation of one of said rods and unlocked relation of the other of said rods and freed relation between said lever and said one of said rods and engaged relation between said lever and said other of said rods for shifting movement of said other of said rods, and means for holding said rocking member endwise.

15. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable rods for effecting speed change in said gearing, a rockable member, a shifting lever, said rods provided with slots on opposite sides, said rockable member and said lever provided with lugs coacting with said slots respectively on said opposite sides, means for pivoting said rockable member and said lever on an axis substantially parallel to said rods for respective coaction and release of said respective lugs with said respective slots, and means for pivoting said lever at substantial right angles to said last-named pivot for shifting movement of the rod released by said locking lug and engaged by said shifting lug.

16. In speed changing mechanism, the combination of gearing, an endwise shiftable element for speed change in said gearing, a clutch, an endwise shiftable element for clutch actuation, and a rockable member located in a plane parallel to the plane in which said endwise shiftable elements are located, said rockable member having operative connection with said first-named endwise shiftable element and operative connection with said second-named endwise shiftable element, a right line between said second-named operative connection and the pivot of said rockable member being substantially parallel with the directions of movement of said endwise shiftable elements, and a right line between said first-named operative connection and said pivot being at substantial right angles to said first-named right line.

17. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for speed change in said gearing, a clutch, a shiftable element for clutch actuation, a rockable member, said shiftable elements extending to one side of said rockable member, an operative connection between said shiftable element for clutch actuation and said rockable member at said side of said rockable member, and operative connections between said pair of shiftable elements and said rockable member located at the respective sides of the pivot of said rockable member at substantial right angles to said first-named side.

18. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for speed change in said gearing, a clutch, a shiftable element for clutch actuation, a rockable member, said shiftable elements extending to one side of said rockable member, an operative connection between said shiftable element for clutch actuation and said rockable member at said side of said rockable member, and operative connections between said pair of shiftable elements and said rockable member located at the respective sides of the pivot of said rockable member at substantial right angles to said first-named side, said first-named operative connection including a guide eccentric to said pivot.

19. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for speed change in said gearing, a clutch, a shiftable element for clutch actuation, a rockable member, operative connections between said rockable member and the shiftable elements of said pair of shiftable elements, and operative connection between said rockable member and said shiftable element for clutch actuation, said first-named operative connections arranged for initial increased and gradually retarding movement, and said last-named operative connection arranged for initial retarded and gradually increasing movement.

20. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for speed change in said gearing, a clutch, an endwise shiftable element for clutch actuation, said last-named endwise shiftable element located between said first-named shiftable elements, a rockable member having a pivot substantially intersecting said endwise shiftable element for clutch-actuation, operative connections between said rockable member and said pair of endwise shiftable elements located in directions from said pivot at substantial right angles to said second-named endwise shiftable element, and an operative connection between said rockable member and said second-named endwise shiftable element located in a direction from said pivot substantially in line with said second-named endwise shiftable element.

21. In speed changing mechanism, the combination of gearing, an endwise shiftable rod for speed change in said gearing, a clutch, an endwise shiftable rod for clutch actuation, a rockable member pivoted about the axis of said last-named rod, locking means between said rockable member and said first-named endwise shiftable rod, a rockable part on said rockable member, and shifting means between said rockable part and said endwise shiftable rods.

22. In speed changing mechanism, the combination of gearing, an endwise shiftable rod for speed change in said gearing, a clutch, an endwise shiftable rod for clutch actuation, a rockable member pivoted about the axis of said last-named rod, said last-named rod movable axially, a rockable part on said rockable member, and shifting means between said rockable part and said endwise shiftable rods.

23. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for speed change in said gearing, a clutch, a shiftable element for actuation in said clutch, and a rockable member rockable in two planes substantially at right angles to each other, said rockable element normally in shifting relation with said pair of shiftable elements and with said second-named shiftable element by movement in substantially one of said planes, and arranged for release of one of said elements of said pair of elements by movement in substantially the other of said planes.

24. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for speed change in said gearing, a clutch, a shiftable element for actuation in said clutch, a rockable member rockable in two planes substantially at right angles to each other, said rockable element normally in shifting relation with said pair of shiftable elements and with said second-named shiftable element by movement in substantially one of said planes, locking means for normally locking said pair of shiftable elements, and means whereby to release one of said elements of said pair of elements from said rockable member and to release the other of said elements of said pair of elements from said locking means, by movement of said rockable element in substantially the other of said planes.

25. In speed changing mechanism, the combination of gearing, a pair of shiftable elements for effecting speed change in said gearing, a clutch, a shiftable element for actuation in said clutch, a rockable member comprising a rockable locking part and a rockable element-shifting part, and means whereby rocking of said rockable member effects locking connection of said rockable locking part with one of said elements of said pair of shiftable elements and release of the other of said shiftable elements of said pair and shifting connection of said element-shifting part with said other of said shiftable elements and release of said one of said shiftable elements, and said element-shifting part having operative connection with said shiftable element for actuation in said clutch.

26. In speed changing mechanism, the combination of gearing, a pair of endwise shiftable elements for effecting speed change in said gearing, a clutch, an endwise shiftable element for effecting actuation in said clutch, a rockable member comprising a rockable locking part and a rockable shifting part, said rockable member rockable about the axis of said last-named endwise shiftable element, said endwise shiftable elements of said pair and said rockable locking part provided with coacting locking faces, said endwise shiftable elements of said pair and said rockable shifting part provided with coacting shifting faces, and said coacting locking faces and said coacting shifting faces for opposite ones of said endwise shiftable elements of said pair brought into coacting relation by rocking of said rockable member, and a cam connection between said rockable shifting part and said second-named endwise shiftable element, constructed and arranged for movement of said

respective shiftable elements of said pair for effecting speed change in advance of said movement of said second-named shiftable element for effecting clutch actuation.

27. In speed changing mechanism, the combination of gearing, a pair of rods having connections for speed change in said gearing, a rockable member having a pivot between said rods substantially parallel with said rods, a clutch, a third rod having connection with said clutch for actuating the same, and a lever pivoted on said rockable member on an axis substantially at right angles to said first-named pivot, said rockable member provided with locking parts for said pair of rods, and said lever provided with shifting parts for said pair of rods and with a shifting part for said third rod.

28. In speed changing mechanism, the combination of gearing, a pair of rods having connections for speed change in said gearing, a rockable member having a pivot between said rods substantially parallel with said rods, a clutch, a third rod having connection with said clutch for actuating the same, and a lever pivoted on said rockable member on an axis substantially at right angles to said first-named pivot, said rockable member provided with locking parts for said pair of rods, said lever provided with shifting parts for said pair of rods and with a shifting connection with said third rod, and said shifting connection comprising a cam-face extending in a line substantially parallel in general direction with a right line between said shifting parts.

29. In speed changing mechanism, the combination of gearing, a pair of rods having connections for speed change in said gearing, a clutch, a third rod having connection with said clutch for actuating the same, said third rod located between said first-named rods, a rockable member pivoted about said third rod, a lever pivoted on said rockable member on an axis substantially at right angles to said third rod, said rockable member provided with locking parts for said pair of rods, said lever provided with shifting parts for said pair of rods and with a shifting connection with said third rod, said shifting connection comprising a cam-face extending in a line substantially parallel in general direction with a right line between said shifting parts, and a pin and slot guide for endwise positioning of said rockable member throughout the rocking positions of said rockable member.

30. In speed changing mechanism, the combination of gearing, a pair of rods having connections for speed change in said gearing, a rockable member having a pivot between said rods substantially parallel with said rods, a clutch, a third rod having connection with said clutch for actuating the same, a lever pivoted on said rockable member on an axis substantially at right angles to said first-named pivot, said rockable member provided with locking parts for said pair of rods, said lever provided with shifting parts for said pair of rods and with a shifting connection with said third rod, and a spring mounted for movement with said rockable member and arranged for exerting pressure on said pair of rods.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

PAUL S. WARD.

In presence of—
PAUL V. CONNOLLY,
DELMA WERNSING.