F. E. MILLER.

CHANGE SPEED DRIVING MECHANISM.

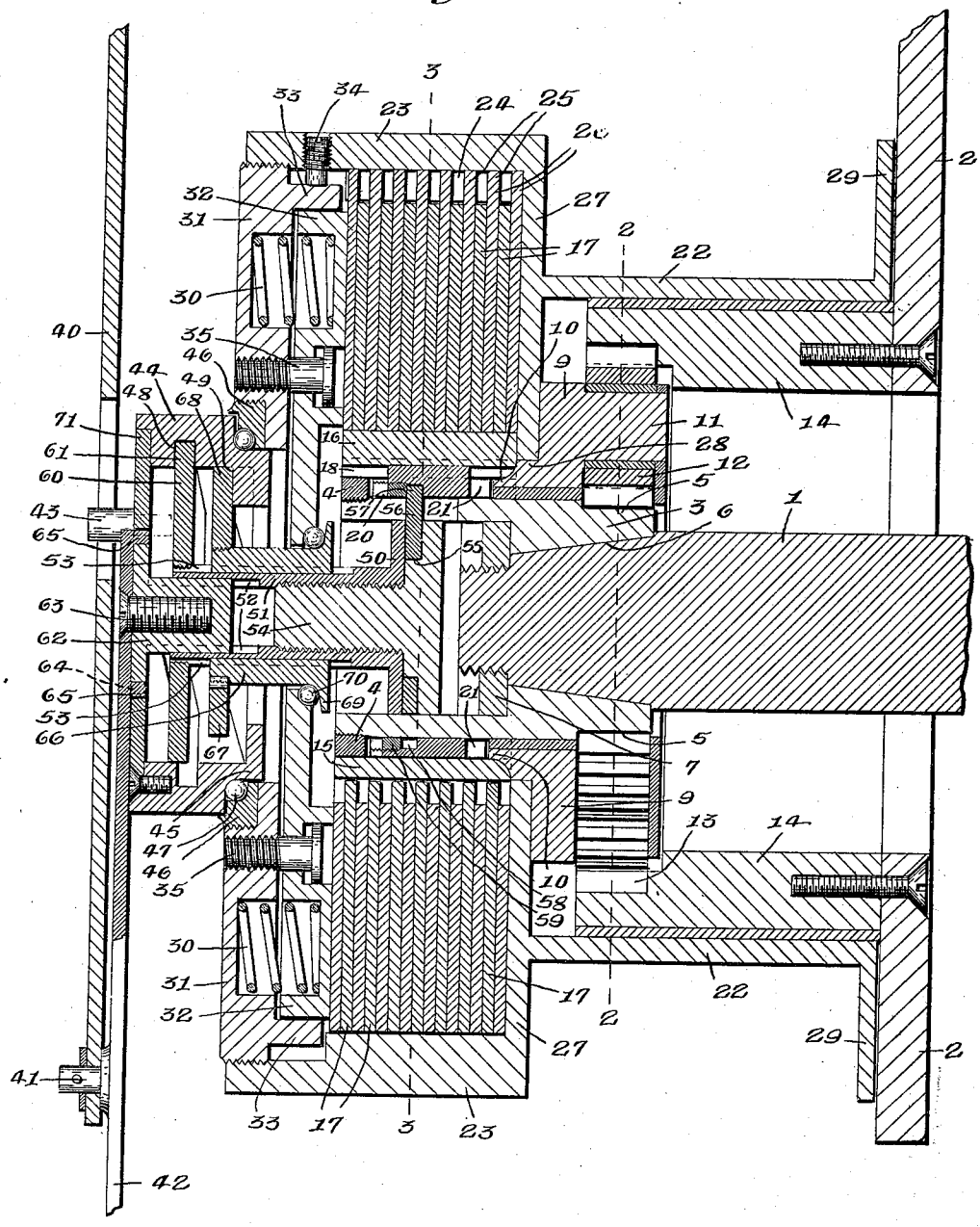
APPLICATION FILED OCT. 13, 1913.

1,156,848.

Patented Oct. 12, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Chas. H. Young.

L. B. Pickard.

INVENTOR.

Frank Edgar Miller

BY

Parsons Hall & Bodell

ATTORNEYS.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C

F. E. MILLER.

CHANGE SPEED DRIVING MECHANISM.

APPLICATION FILED OCT. 13, 1913.

1,156,848.

Patented Oct. 12, 1915.

3 SHEETS—SHEET 2.

Fig. 2.

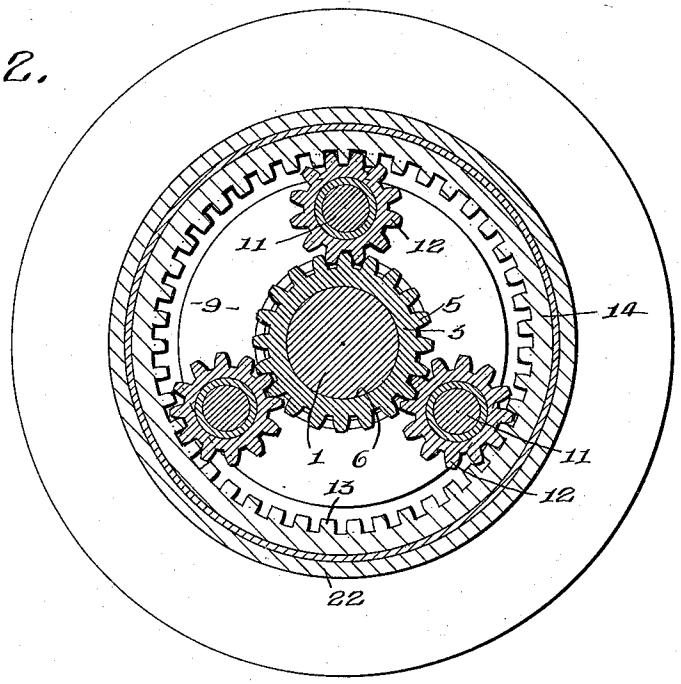
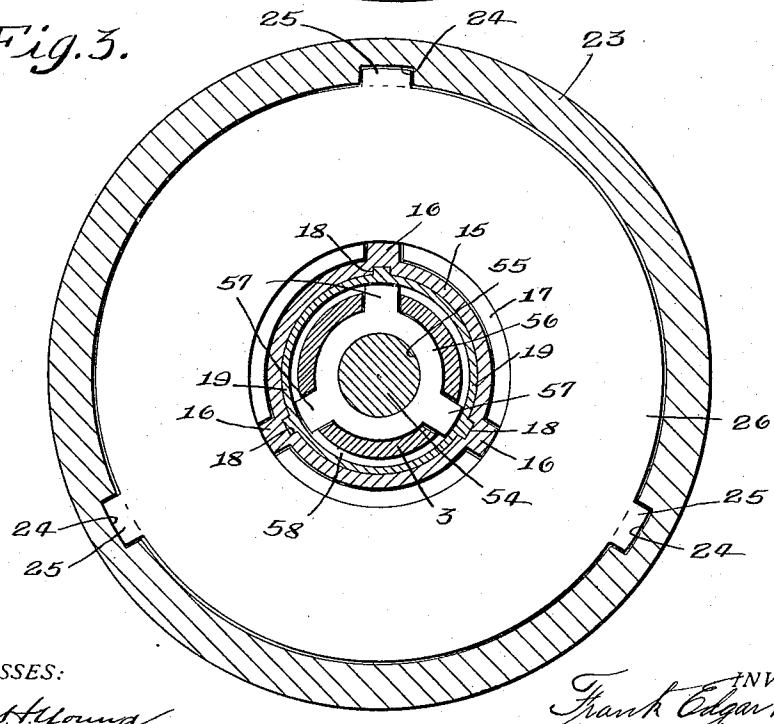


Fig. 3.



WITNESSES:

Chas. H. Young.

J. B. Pickard.

INVENTOR.

Frank Edgar Miller

BY

Parsons Hill & Bodell

ATTORNEYS.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

F. E. MILLER.

CHANGE SPEED DRIVING MECHANISM.

APPLICATION FILED OCT. 13, 1913.

1,156,848.

Patented Oct. 12, 1915.

3 SHEETS—SHEET 3.

Fig. 4.

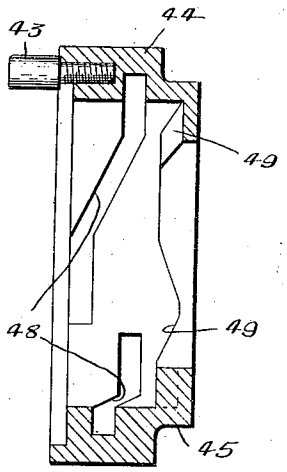


Fig. 5.

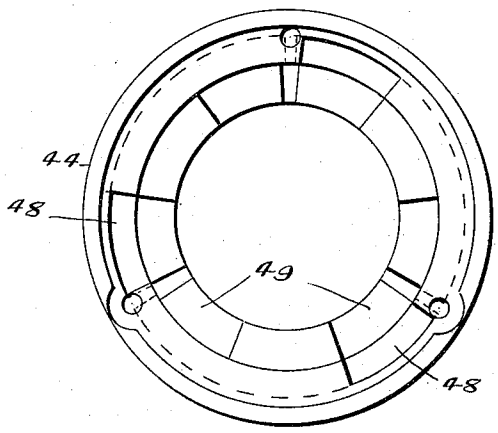


Fig. 6.

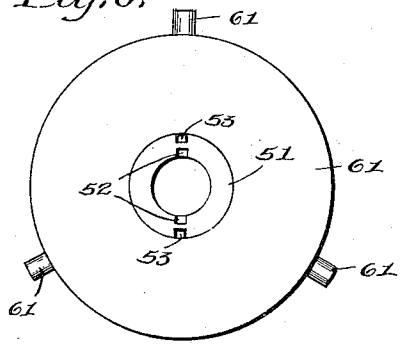


Fig. 7.

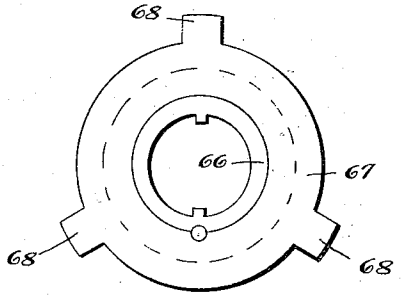


Fig. 8.

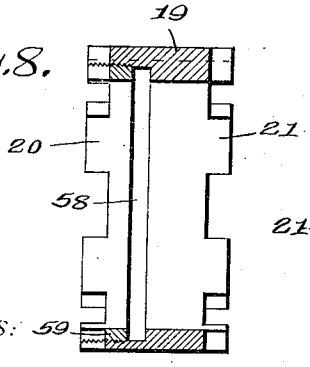
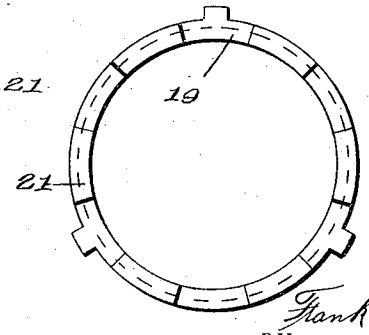


Fig. 9.



WITNESSES:

Chas. H. Young

J. B. Pickard.

INVENTOR.

Frank Edgar Miller

BY

Parsons Hall & Bodell

ATTORNEYS.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK EDGAR MILLER, OF SYRACUSE, NEW YORK.

CHANGE-SPEED DRIVING MECHANISM.

1,156,848. Specification of Letters Patent. Patented Oct. 12, 1915.

Application filed October 13, 1913. Serial No. 794,801.

To all whom it may concern:

Be it known that I, FRANK EDGAR MILLER, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Change-Speed Driving Mechanism, of which the following is a specification.

My invention relates to change speed driving mechanism and its object is to provide a particularly simple and highly efficient organization and one which may readily be embodied in a motor cycle.

The invention includes the parts and the combination and arrangement of parts to be hereinafter described and particularly pointed out in the claims.

One embodiment of the invention is illustrated in the accompanying drawings wherein:—

Figure 1 is a longitudinal sectional view of the mechanism as embodied in a motor cycle. Fig. 2 is a transverse sectional view on the line 2—2, Fig. 1. Fig. 3 is a transverse sectional view on the line 3—3, Fig. 1. Fig. 4 is a transverse sectional view through the cam ring. Fig. 5 is a front elevation of the cam ring. Fig. 6 is an end elevation of one shifting element. Fig. 7 is a corresponding view of another shifting element. Fig. 8 is a transverse sectional view of the clutch sleeve; and Fig. 9 is an end elevation of the same.

The invention includes, generally, a main driving element, a secondary driving element, a main driven element, a secondary driven element, a clutch for connecting and disconnecting the two driven elements, a second clutch for connecting and disconnecting the main driven element and either of the driving elements, a single actuating member and means operated thereby for actuating the described clutches in a predetermined order.

In the illustrated embodiment of my invention, the main driving element comprises the engine shaft and a member 3 carried thereby and provided at one end with a clutch ring 4, at its opposite end with gear teeth, constituting a sun gear 5, and axially with a tapering opening 6 for receiving a tapering end of the shaft 1. The ring 4 is preferably formed independently of the member 3 and is provided with internal threads for engaging complemental external threads thereon and is further provided at its inner end with a suitable clutch face, or with clutching surfaces. The member 3 is held upon the shaft 1 by a nut 7 mounted upon a threaded extension of the shaft and engaging with a shoulder at the inner end of the tapering opening.

The secondary driving element is designated 9 and is illustrated as a ring journaled upon the member 3 and provided at one end with a clutch face 10, or with clutching surfaces, and at its opposite end with axles 11 carrying planetary gears 12 permanently in mesh with the sun gear 5 and with a stationary annular rack 13 carried by a barrel 14 which is fixed to a frame member 2.

As will be understood, the described gearing drives the member 9 in the same direction as the shaft 1, but at a slower speed.

The main driven element is designated 15 and is shown as a sleeve having peripheral projections 16 for engaging with clutch disks 17 and having internally spaced apart longitudinally extending grooves 18 for engaging with complemental peripheral projections on an axially shiftable clutch sleeve 19 slidably mounted on the member 3 and operating between the clutch ring 4 and the clutch face 10 of the driving member 9.

The sleeve 19 has opposite ends thereof provided with clutching faces 20, 21, for interengaging, respectively, with the corresponding faces, or surfaces, of the ring 4 and member 9.

The secondary driven member may be of any desired form and is here illustrated as a double drum, one part 22, of which is journaled on the barrel 14 and preferably constitutes a pulley for receiving a driving belt. The other part includes an annular wall 23 having internal grooves 24 for receiving peripheral projections 25 on clutch disks 26 arranged alternately with the disks 17. The double drum also includes an intermediate wall 27 having an axial opening for receiving the hub 28 of element 9, and it further includes an outwardly extending flange 29 at the inner end of the part 22.

As will be understood, the driving member 15 is keyed to the disks 17 by the projections 16 and the secondary driven member is keyed to the alternate disks, or rings, 26 by the projections 25 so that when there is sufficient frictional contact between the respective disks, the double drum will be coupled to the part 15 and driven directly thereby.

The disks of the two sets are preferably normally forced into firm contact with one another by a series of springs 30 held in alining pockets in plates 31, 32.

The plate 31 is illustrated as a disk provided with an axial opening, a threaded periphery for engagement with an internal thread at the outer end of the wall 23, and with a rearwardly extending flange 33. A pin 34, threaded in an opening in the wall 23 and engaging the periphery of this flange, is preferably employed for retaining the plate 31 against accidental displacement.

The plate 32, which may be designated a pressure plate, is herein illustrated as a disk having an axial opening smaller in diam- plate 31, and having a portion of its rear face in contact with the adjacent clutch ring and having a channel for receiving the head of one or more screws 35 which extend into the plate 31 and serve to secure the two plates together and prevent relative turning movement of the same, while permitting the plate 32 to have a limited movement in an axial direction. The plate 32 preferably fits within the flange 33 of the plate 31.

My invention comprehends means operating on the actuation of a single member in one direction for shifting the clutch sleeve axially for disengaging it from one and engaging it with the other of the driving members, and for releasing the clutch between the two driven members prior to such reëngagement, and for permitting the reëngagement of the clutch between the two driven members after said reëngagement of the clutch sleeve.

In the illustrated embodiment of my invention the single actuating member is shown as a lever 40 preferably pivotally connected at 41 to a fixed part, as a frame member 42, and having an engagement intermediate of its length with a projection 43 extending from a cam ring 44 preferably provided at one end with a hub 45 extending into the axial opening in the plate 31 and provided with a ball race complemental to a race in a ring 46, secured in an annular recess in the plate 31 at the edge of its axial opening.

As herein illustrated, the ring 46 is provided with a flange overhanging the wall of the ring 44 from which the hub 45 projects. Suitable antifriction balls 47 are interposed between the described races.

As will be noted, the ring 44 is located in axial alinement with shaft 1 and is provided with two sets of cam surfaces 48, 49, one being formed by spaced apart grooves in the inner annular wall of the ring, and the other by the inner wall of an inwardly extending flange located at the inner edge of the hub of the ring.

Coöperating with the cam surfaces 48 is shifting means for moving the clutch sleeve 19 axially and coöperating with the cam surfaces 49 is shifting means for moving the plate 32 against the tension of the springs 30.

The cam surfaces 48, 49, are so arranged, or timed, relative to each other that they will operate on the shifting means at different periods, so that in the movement of the cam ring 44 in one direction about its axis the plate 32 will be shifted for releasing the clutch between the driving elements before any shifting movement is imparted to the clutch sleeve 19, and thereafter, and while the shifting means associated with the plate 32 is held against movement, the clutch sleeve 19 will be shifted, and thereafter, and upon the completion of the movement of the clutch sleeve, the plate 32 will be permitted to return to its initial position under the influence of the springs 30.

As herein illustrated, the shifting means associated with the cams 48 and clutch sleeve includes a member disposed in axial alinement with the shaft 1, and including a stem and head, and devices for engaging the cam surfaces 48 and the clutch sleeve, respectively. The illustrated member comprises two parts, one including a head 50 having an axial opening, and a stem 51, the bore of which forms a continuation of said opening. Adjacent one end the stem is provided with internal and external longitudinally extending grooves 52, 53, and adjacent its opposite end the bore of the stem is threaded. The other part of the member includes a stem 54 externally threaded for engaging the threaded portion of the first part, and a head having a marginal rabbet, or recess, coöperating with the head 50 for providing an annular channel 55 which receives a ring 56 having radial projections 57 extending through slots in the member 3 and into an annular channel 58, in the clutch sleeve. The channel 58 is preferably provided by a rabbeted or recessed portion of the sleeve and a ring 59 screwed into one end thereof. The outer end of the shifting member carries a disk or ring 60, preferably threaded thereon and provided with radial peripheral projections 61 for coacting directly with the cams 48. The head of the shifting member is guided in the bore of the member 3 and the stem portion thereof preferably is guided on a stationary stud 62 projecting inwardly from the fixed frame member 42 and provided with peripheral projections engaging the internal grooves in the stem for preventing rotation thereof.

As shown herein, the stud 62 is fastened to the member 42 by a screw 63 and is prevented from rotating by peripheral projections 64 interlocking with projections 65 on the inner face of the member 42.

The shifting means associated with the plate 32 and cams 49 preferably includes a

sleeve 66 slidably mounted on the stem of the first-named shifting member and having internal projections for engaging the external grooves in the latter for holding the sleeve against rotation. A disk 67 is mounted on one end of the member 66 and is provided with radial projections 68 for engaging the cams 49, and the opposite end of the sleeve is provided with an outwardly extending flange 69 opposed to the inner face of the plate 32. Opposing parts of the plate and flange are provided with suitable ball races between which antifriction balls 70 are interposed.

As will be noted, each of the axially shiftable members extends through the axial openings in the plates 31, 32 and the outer ends of said members extend within the cam ring axially thereof. A face plate 71 is provided at the outer end of the ring which fits within a rabbet, or recess, in said end and is provided with an axial opening for receiving the projections 65 of the frame member 42.

As will be understood, the ring 44 may be oscillated through short arcs and in reverse directions by actuating the lever 40 and the operation of the ring 44 in either direction through the described connections, shifts the clutch sleeve 19. In the same movement through the described connections, the pressure plate 32 will be automatically shifted for throwing out the clutch between the two driven elements.

It will be noted from the foregoing, that upon each complete movement in one direction of the cam ring 44 the shifting member associated with the clutch sleeve will be reciprocated in a single direction, and the shifting member associated with the pressure plate 32 will be reciprocated back and forth with an interval of rest, and that the movement of the first-named shifting member will occur in said interval of rest.

I am aware of several modifications of my invention, but deem it unnecessary to illustrate or describe the same, since it will be understood that except as indicated by the appended claims, I do not mean to limit myself to the particular arrangement shown and described, which has been selected for the purpose of disclosing the invention only because it is in my judgment the best embodiment thereof, of which I am now aware and permits the same to be readily understood by those skilled in the art.

What I claim is:

1. In a driving mechanism and in combination, a main driving element, a secondary driving element, a main driven element and a secondary driven element, all arranged in concentric relation, a clutch for connecting the main driven element with either of the driving elements, a second clutch for establishing a driving connection between the main driven element and the secondary driven element, a single actuating element and mechanism operated thereby for operating the clutches, substantially as and for the purpose described.

2. In a driving mechanism and in combination, a main driving element, a secondary driving element, a main driven element and a secondary driven element, all arranged in concentric relation, a clutch for connecting the main driven element with either of the driving elements, a second clutch for establishing a driving connection between the main driven element and the secondary driven element, a single actuating element and mechanism operating thereby for operating the clutches, the clutches and actuating element being also arranged concentric with the driving and driven elements, substantially as and for the purpose specified.

3. In a driving mechanism, a main driving element comprising an engine shaft and a member carried thereby and provided at one end with a clutch face and at its opposite end with a gear, a secondary driving element comprising a ring journaled on said member and provided at one end with a clutch face and at its other end with means for supporting a gear, an annular fixed rack, a gear carried by said supporting means and permanently in mesh with said rack and with the gear of the first-named member, a main driven member, a clutch sleeve keyed thereto and provided at opposite ends with clutch faces complemental to the clutch faces aforesaid, a secondary driven member, a clutch interposed between the same and the main driven member, and means for releasing the last-named clutch and for shifting the clutch sleeve comprising a cam ring having two sets of cams, and a lever connected to the ring for turning the same about its axis, substantially as and for the purpose described.

4. In a driving mechanism, a main driving element comprising an engine shaft and a member carried thereby and provided at one end with a clutch face and at its opposite end with a gear, a secondary driving element comprising a ring journaled on said member and provided at one end with a clutch face and at its other end with means for supporting a gear, an annular fixed rack, a gear carried by said supporting means and permanently in mesh with said rack and with the gear of the first-named member, a main driven member, a clutch sleeve keyed thereto and provided at opposite ends with clutch faces complemental to the clutch faces aforesaid, a secondary driven member, a clutch interposed between the same and the main driven member, and means for releasing the last-named clutch and for shifting the clutch sleeve, substantially as and for the purpose specified.

5. In a driving mechanism, a main driving element comprising an engine shaft and a member carried thereby and provided at one end with a clutch face and at its opposite end with a gear, a secondary driving element comprising a ring journaled on said member and provided at one end with a clutch face and at its other end with means for supporting a gear, an annular fixed rack, a gear carried by said supporting means and permanently in mesh with said rack and with the gear of the first-named member, a main driven member, a clutch sleeve keyed thereto and provided at opposite ends with clutch faces complemental to the clutch faces aforesaid, a secondary driven member, a clutch interposed between the same and the main driven member, and means for releasing the last-named clutch and for shifting the clutch sleeve comprising a cam ring movable about its axis, and means for oscillating said ring, substantially as and for the purpose set forth.

6. In a driving mechanism, a main driving element comprising an engine shaft and a member carried thereby and provided at one end with a clutch face and at its other end with a gear, a secondary driving element comprising a ring journaled on said member and provided at one end with a clutch face and at its other end with means for supporting a gear, an annular fixed rack, a gear carried by said supporting means and permanently in mesh with said rack and with the first-named gear, a main driven element, a clutch sleeve keyed thereto and provided at opposite ends with clutch faces complemental to the clutch faces aforesaid, a secondary driven element, a clutch interposed between the driven elements, means for releasing the last-named clutch and for shifting the clutch sleeve comprising a cam ring provided with two sets of cams, an axially movable shifting member coöperating with one set of cams and in engagement with the clutch sleeve, a second axially movable shifting member having means at one end for coöperating with the other clutch, and means at its other end for coöperating with the other set of cams, and means for moving the cam ring about its axis, said cams during the movement of the ring in one direction shifting the first-named shifting member in one direction only, and the second-named shifting member in reverse directions, substantially as and for the purpose described.

7. In a driving mechanism, a main driving element comprising an engine shaft and a member carried thereby and provided at one end with a clutch face and at its other end with a gear, a secondary driving element comprising a ring journaled on said member and provided at one end with a clutch face and at its other end with means for supporting a gear, an annular fixed rack, a gear carried by said supporting means and permanently in mesh with said rack and with the first-named gear, a main driven element, a clutch sleeve keyed thereto and provided at opposite ends with clutch faces complemental to the clutch faces aforesaid, a secondary driven element, a clutch interposed between the driven elements, means for releasing the last-named clutch and for shifting the clutch sleeve comprising, a cam ring provided with two sets of cams, an axially movable shifting member coöperating with one set of cams and in engagement with the clutch sleeve, and a second axially movable shifting member having means at one end for coöperating with the other clutch and means at its other end for coöperating with the other set of cams, and means for moving the cam ring about its axis, substantially as and for the purpose specified.

8. In a driving mechanism, main and secondary driving members, main and secondary driven members, a clutch for connecting the main driven member to either of the driving members, a second clutch for connecting the main driven member to the secondary driven member, a single actuating member, and means for operating the clutches upon the actuation of said member including, a cam ring adapted to be oscillated and provided with two sets of cams, an axially shiftable member having a part coöperating with one set of cams and another part coöperating with the first-named clutch, and a second axially shiftable member having a part coacting with the other set of cams, and another part for coöperating with the second clutch, said cams during the oscillation of the ring in one direction moving the second shifting member in reverse directions with an interval of rest, and the other shifting member in one direction during said interval of rest of the second shifting member, substantially as and for the purpose set forth.

9. In a driving mechanism and in combination, main and secondary driving members coaxially arranged, main and secondary driven members, a clutch for connecting the main driven member to either of the driving members, a clutch for connecting the main driven member to the secondary driven member, an actuating member and operating mechanism actuated thereby, including, a cam ring mounted to oscillate about its axis and provided with two sets of cams, an axially movable member having means at opposite ends for engaging, respectively, with one set of cams and the first-named clutch, and a second axially movable member mounted on the first-named member to move lengthwise thereof, and having means at opposite ends of the same for coöperating, respectively, with the second set of cams and

the second clutch, substantially as and for the purpose described.

10. In a driving mechanism, main and secondary driving members coaxially arranged, main and secondary driven members, a clutch sleeve for connecting the main driven member to either of the driving members, a clutch between the driven members, shifting means associated with the clutch sleeve, a second coaxially disposed shifting means associated with the clutch between the driven members, an oscillating cam ring arranged coaxially of said shifting means and in engagement with parts of said shifting means, and means for shifting the ring, substantially as and for the purpose specified.

11. In a driving mechanism, a main shaft, clutch surfaces associated therewith, a secondary driving element arranged coaxially of said shaft and driven therefrom and provided with clutch surfaces, coaxially arranged driven members, a clutch between the same, a clutch sleeve arranged coaxially of said shaft and provided with clutch surfaces complemental to the clutch surfaces aforesaid, a key connection between the sleeve and the main driven element, a shifting member arranged in alinement with, and in advance of, said shaft, a device carried thereby, for engaging the clutch sleeve, means for holding said member against rotation, a second shifting member for controlling the first-named clutch, the second shifting member being keyed to and slidably mounted upon the first-named shifting member, a ring arranged coaxially of said shifting members and having interior cam surfaces, devices on the ends of said shifting members for engaging said surfaces, and means for oscillating the ring, substantially as and for the purpose set forth.

12. In a driving mechanism and in combination, main and secondary driving elements, main and secondary driven elements, a clutch for coupling the main driven element to either of the driving elements, a second clutch between the driven elements, and means for controlling said clutches comprising an actuating element, a ring movable about its axis by the actuating element and provided with two sets of interior cams, a coaxially disposed shifting member including a stem having a bore and a head provided with an annular channel, a fixed stud extending into said bore and having a key connection with the stem, a device held in the annular channel and engaging a member of the first-named clutch, a device carried by the stem and engaging one set of cams, and a second axially shiftable member for controlling the second clutch and comprising a sleeve mounted on and keyed to said stem, and a device at one end of said sleeve for engaging the second set of cams on said ring, substantially as and for the purpose described.

13. In a driving mechanism and in combination, main and secondary driving elements, main and secondary driven elements, a clutch member for connecting the main driven element to either of the driving elements, a disk clutch interposed between the driven elements, controlling means therefor including a pressure plate having an axial opening, a plate carried by the secondary driven member and having an axial opening, springs interposed between the plates for pressing the first-named plate against the disk clutch, a cam ring journaled in the axial opening of the second plate, means for oscillating the ring, a fixed stud extending axially of the ring, an axially movable member keyed to the stud and having devices at opposite ends for engaging, respectively, with the cam ring and with the clutch member, said axially movable member extending through the openings in the two plates, a second axially shiftable member keyed to the first-named member and having means at opposite ends for engaging, respectively, with the cam ring and with the pressure plate, and means for shifting the cam ring, substantially as and for the purpose specified.

14. In a driving mechanism, main and secondary driving elements main and secondary driven elements, a clutch member for connecting the main driven element to either of the driving elements, a clutch between the driven elements, means for holding the same in driving position including a spring-pressed pressure plate, a cam ring provided with two sets of cams, an axially shiftable member having a head provided with an annular channel and a stem provided with internal and external longitudinal grooves, a device fixed to the end of the stem and engaging one set of cams, a device rotatable in said annular channel and engaging said clutch member, a fixed stud extending into the stem and having a projection for engaging the interior groove thereof for preventing rotation, means operated by the second set of cams for shifting the pressure plate, said means comprising a sleeve slidably mounted on said stem and having a projection for engaging the external groove therein, a device at one end of the sleeve for engaging the second set of cams, and means at the other end of the sleeve for engaging the pressure plate, and an actuating member for oscillating the cam ring, substantially as and for the purpose set forth.

15. In a driving mechanism, a main driving member, a secondary driving member, driven from the main driving member and at a different speed, said members being provided respectively with clutch surfaces dis-

posed opposite to each other, a main driven member comprising a coaxially arranged sleeve, a clutch sleeve within the first-named sleeve and keyed thereto, said clutch sleeve being provided at opposite ends with clutch surfaces complemental to the clutch surfaces aforesaid, clutch rings keyed to said driven member, a secondary driven member, clutch rings arranged alternately in reference to the first-named clutch rings, a key connection between the second-named clutch rings and the secondary driven member, means tending to hold the clutch rings in engagement with one another including a movable pressure plate, and means for shifting the plate and the clutch sleeve comprising, a cam ring having an oscillatory movement, coaxially arranged shifting devices coöperating at corresponding ends with the cam ring and at their opposite ends with the pressure plate and clutch sleeve respectively, and a member for shifting the ring, substantially as and for the purpose described.

16. In a driving mechanism and in combination, a main driving element including an engine shaft, a member fixed thereon having a clutch ring at one end and a gear at its other end, a secondary driving member including a ring journaled on the first-named member and having a clutch surface at one end and axles at its other end, a stationary barrel provided with an internal rack, gears carried by said axles and intermeshing with the rack and the first-named gear, a main driven member, a clutch sleeve keyed thereto and provided at opposite ends with clutch surfaces complemental to the clutch surfaces of said ring and the secondary driving element, said sleeve also being provided with an internal channel, a secondary driven member comprising a double drum, one of said drums being journaled on said fixed barrel and constituting a belt pulley, and the other drum including an annular wall, a plate removably mounted within the outer end of the annular wall and provided with an axial opening, a pressure plate carried by the first-named plate and provided with an axial opening of smaller diameter than the opening in the first-named plate, clutch disks located in the second drum and keyed, respectively, to the wall of said drum and the main driven element, springs interposed between the first and second plates for pressing the second plate against the outermost clutch disk for holding the clutch disks in contact with one another, a shifting device arranged in axial alinement with the shaft and including a head provided with an annular channel and a hollow stem, a device held in the channel and engaging the clutch sleeve, a fixed stud extending into the stem and keyed thereto, a second shifting device arranged on the stem and keyed to the same, means at the inner end of the second device for engaging the pressure plate, a cam ring arranged coaxially of the shifting devices and provided with two sets of cams, and devices on the outer ends of the respective shifting devices for engaging with said cams, and means for oscillating the ring, substantially as and for the purpose specified.

17. In a driving mechanism, main and secondary driving elements, main and secondary driven elements, a clutch member for connecting the main driven element to either of the driving elements, a clutch between the driven elements, means for holding the last-named clutch in driving position including a spring-pressed pressure plate provided with an axial opening equipped with a ball race, a cam ring, means for shifting the same, an axially movable member operatively connected at one end to the cam ring at its other end to the clutch member, a second axially shiftable member mounted on the first and operatively connected at one end to the cam ring and provided at its other end with a ball race, and antifriction balls interposed between the same and the race of the pressure plate, substantially as and for the purpose set forth.

18. In a driving mechanism, main and secondary driving elements, a main driven element, a clutch member keyed thereto and shiftable for engaging either of the driving elements, a secondary driven element including an annular wall, a disk clutch having members keyed to said wall and the main driven element, respectively, a plate secured to the annular wall at the outer end thereof and provided with an axial opening, a pressure plate carried by the first-named plate and provided with an axial opening, springs interposed between the plates for forcing the pressure plate into engagement with the disk clutch, an actuating member, a cam ring operated thereby and provided with a hub projecting into the axial opening in the first-named plate, an axially movable member extending through the openings in said plates and having one end projecting into the ring and coöperating with cam surfaces thereon and its other end engaging with the clutch member, means for retaining said axially movable member against rotation, a second axially movable member mounted on the first and having a key connection therewith, the second member projecting through the openings in said plates and having one end projecting into the cam ring and cooperating with cam surfaces therein and having its opposite end provided with a laterally extending surface opposed to and coöperating with the inner face of the pressure plate, substantially as and for the purpose described.

19. In a driving mechanism, main and secondary driving elements, a main driven

element, a clutch member keyed thereto and shiftable for engaging either of the driving elements, a secondary driven element comprising a drum constituting a belt pulley and an annular wall, a disk clutch having members keyed to said wall and the main driven element, respectively, a plate secured to the annular wall at the outer end thereof and provided with an axial opening equipped with a ball race, a pressure plate carried by the first-named plate and provided with an axial opening, springs interposed between the plates for forcing the pressure plate into engagement with the disk clutch, an actuating member, a cam ring operated thereby and provided with a hub projecting into the axial opening in the first-named plate and provided with a complemental ball race, antifriction balls located between said ball races, an axially movable member extending through the openings in said plates and having one end projecting into the ring and coöperating with cam surfaces therein and its other end engaging with the clutch member, means for retaining said axially movable member against rotation, a second axially movable member mounted on the first and having a key connection therewith, the second member projecting through the openings in said plates and having one end projecting into the cam ring and coöperating with cam surfaces therein and having its opposite end provided with a laterally extending surface opposed to and coöperating with the inner face of the pressure plate, substantially as and for the purpose specified.

20. In a driving mechanism, main and secondary driving elements, main and secondary driven elements, a clutch member for connecting the main driven element to either of the driving elements, a clutch between the driven elements, an axially movable shifting member associated with each of the clutches, said members being keyed to each other, a fixed frame member having interlocking projections on one face thereof, a stud secured to said face of the fixed frame member and provided with interlocking projections engaging the first-named interlocking projections, means on the stud for preventing rotation of one of said axially shiftable members, a cam ring arranged coaxially of said shiftable members and stud and having at one end an inwardly extending flange having its inner face provided with cam surfaces for coacting with one of said axially shiftable members, said ring also having an internal groove with walls providing other cam surfaces for coacting with the other axially shiftable member, a plate closing the outer end of the ring and provided with an axial opening for receiving the interlocking projections on the fixed frame member, a lever pivotally connected to the fixed frame member, and an abutment on the cam ring engaging said lever, substantially as and for the purpose set forth.

21. In a driving mechanism and in combination, main and secondary driving elements, main and secondary driven elements, a clutch member for connecting the main driven member to either of the driving members, a disk clutch interposed between the driven elements, a plate carried by the secondary driven element and provided with pockets, a pressure plate carried by the first-named plate and provided with alining pockets, springs in companion pockets for pressing the second plate against the disk clutch, said plates being provided with axial openings, one of smaller diameter than the other, axially movable clutch operating members extending through the openings in said plates, one of said members engaging the clutch member and the other the pressure plate, a cam ring arranged coaxially of said axially movable members and provided with two sets of cams, one set coöperating with one of said members and the other set with the other of said members, and means for oscillating said ring, substantially as and for the purpose described.

22. In a driving mechanism, a main driving element, a secondary driving element, main and secondary driven elements, a clutch between the driven elements, a clutch member associated with the main driven element for connecting the same to either of the driving elements, a cam ring arranged in axial alinement with the main driving element and provided with two sets of internal cams, a lever for oscillating the cam ring, and two axially movable shifting members having means at corresponding ends extending into the cam ring and coöperating with the cams thereof, and means at their opposite ends for coöperating with the clutch member and the clutch between the driven members, substantially as and for the purpose specified.

23. In a driving mechanism, a main driving element, comprising an engine shaft and a member carried thereby, provided at one end with a clutch face and at its opposite end with a gear, a secondary driving element comprising a ring journaled on said member and provided with a clutch face, planetary gears carried by the ring and meshing with the first-named gear, an annular rack meshing with the planetary gears, main and secondary driven members, a clutch between the same, a clutch sleeve keyed to the main driven member and provided at opposite ends with clutch faces complemental to the clutch faces of the driving members, and means for shifting the clutch sleeve and releasing the clutch between the driven elements comprising a cam

ring provided with two sets of cams, an axially movable member having means at one end for engaging one set of cams and means at its other end for engaging the clutch sleeve, and a second axially movable member keyed to the first and provided at one end with means for coöperating with the other set of cams and at its other end with means for effecting the release of the clutch between the driven members, substantially as and for the purpose set forth.

24. In a driving mechanism, coaxially arranged driving members, coaxially arranged driven members, a clutch sleeve arranged within the main driven member and keyed thereto and having means at opposite ends for engaging the respective driving members, a clutch between the driven members, axially movable shifting members arranged in axial alinement with and movable toward and from the main driving member, means at the inner end of one of said shifting members for coöperating with the clutch sleeve and at the inner end of the other shifting member for coöperating with the clutch between the driven members, a cam ring arranged coaxially of the axially shiftable members and having cams coöperating with the outer end of the latter, and means for oscillating the cam ring, substantially as and for the purpose described.

25. In a driving mechanism and in combination, a main driving member including a sun gear and a clutch face, a second driving member arranged coaxially of the main driving member and including planetary gears in mesh with the sun gear and a second clutch face, a fixed annular rack in engagement with the planetary gears, a part to be driven, and a clutch member keyed to said part and having clutch faces complemental to the aforesaid clutch faces, and means for shifting said member, substantially as and for the purpose specified.

26. In a driving mechanism and in combination, a drum, coaxially disposed driving members including an element provided with a sun gear and with a clutch face and a second element provided with planetary gears in mesh with said sun gear, and also provided with a clutch face, an annular rack in engagement with the planetary gears, a member arranged coaxially of the drum, friction clutch means between said member and the drum, a clutch sleeve arranged coaxially of the drum and provided with clutch faces complemental to the aforesaid clutch faces, and means for shifting the clutch sleeve, substantially as and for the purpose set forth.

27. In a driving mechanism and in combination, a drum, coaxially disposed driving members including an element provided with a sun gear and with a clutch face and a second element provided with planetary gears in mesh with said sun gear, and also provided with a clutch face, an annular rack in engagement with the planetary gears, a member arranged coaxially of the drum, friction clutch means between said member and the drum, a clutch sleeve arranged coaxially of the drum and provided with clutch faces complemental to the aforesaid clutch faces, and means for shifting the clutch sleeve, said means including a sliding member arranged axially of the drum and an oscillatory member arranged coaxially of the sliding member, substantially as and for the purpose described.

In testimony whereof, I have hereunto signed my name in the presence of two attesting witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 24th day of September, 1913.

FRANK EDGAR MILLER.

Witnesses:
S. DAVIS,
F. B. PICKARD.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

Corrections in Letters Patent No. 1,156,848.

It is hereby certified that in Letters Patent No. 1,156,848, granted October 12, 1915, upon the application of Frank Edgar Miller, of Syracuse, New York, for an improvement in "Change-Speed Driving Mechanism," errors appear in the printed specification requiring correction as follows: Page 2, following line 16, insert the syllables and words *eter than the corresponding opening in;* page 6, line 86, claim 17, after the word "ring" insert the word *and;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of November, A. D., 1915.

[SEAL.]

R. F. WHITEHEAD,

Acting Commissioner of Patents.