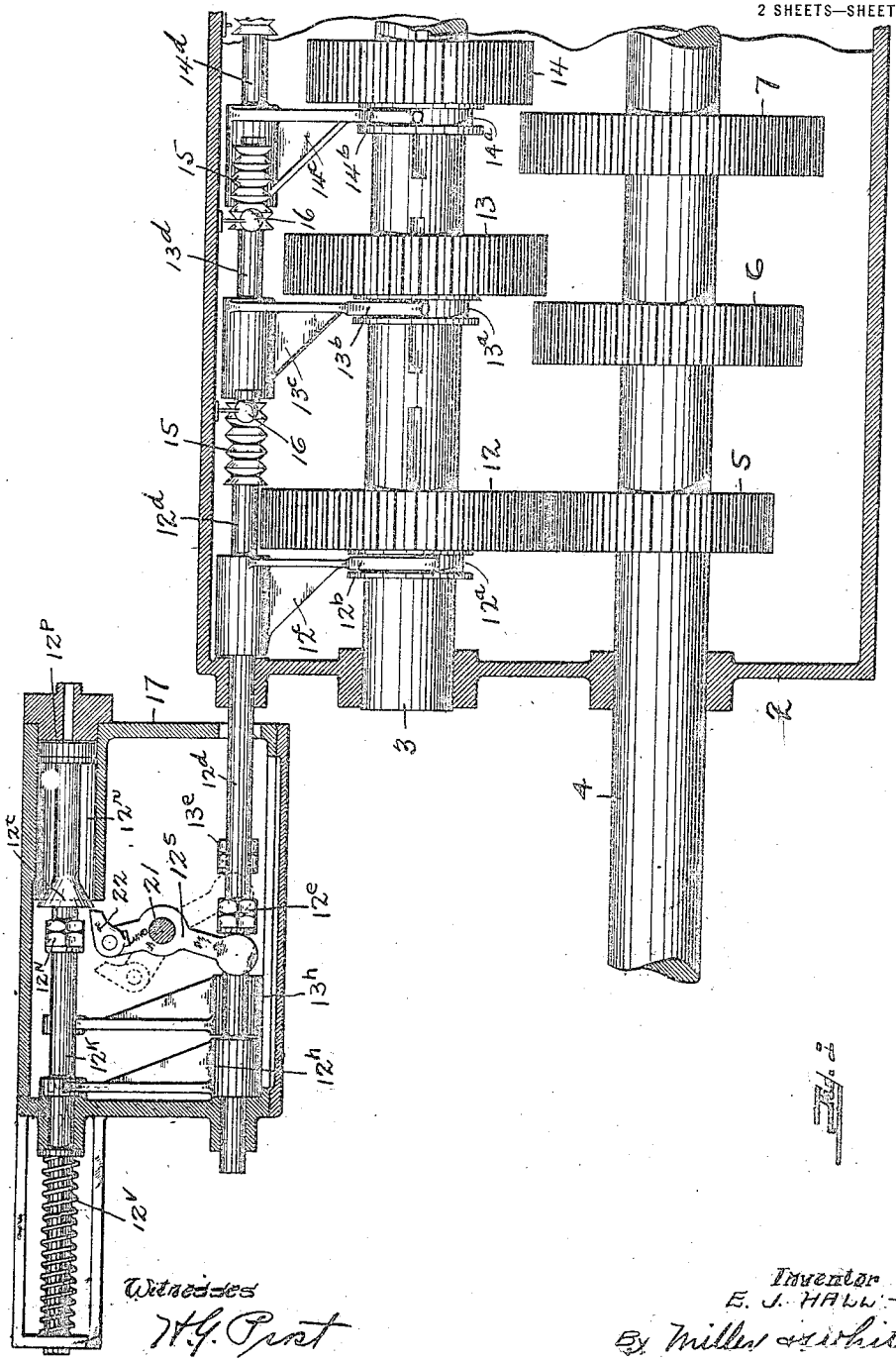
E. J. HALL.

VARIABLE SPEED GEARING.

APPLICATION FILED MAY 26, 1914.

1,212,346. Patented Jan. 16, 1917.

2 SHEETS—SHEET 1.



Witnesses

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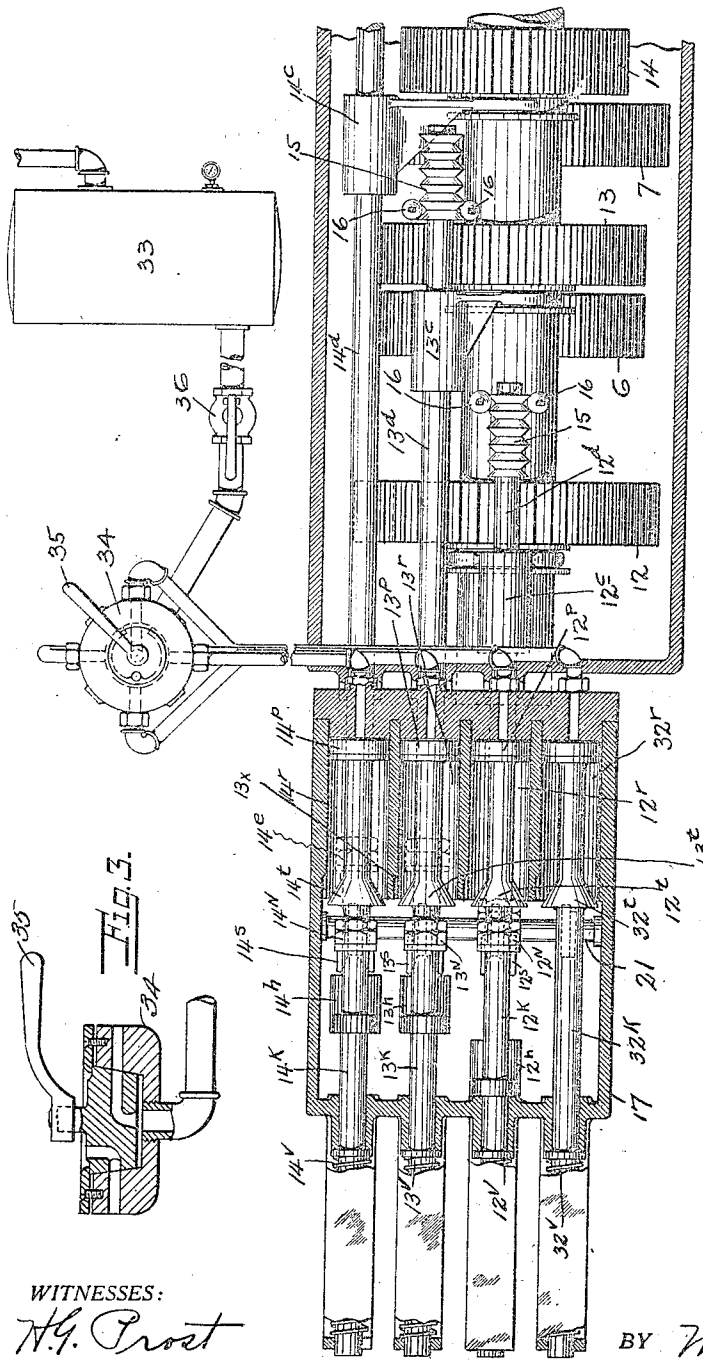


FIG. 2.

FIG. 3.

WITNESSES:

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UNITED STATES PATENT OFFICE.

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VARIABLE-SPEED GEARING.

1,212,346. Specification of Letters Patent. Patented Jan. 16, 1917.

Application filed May 26, 1914. Serial No. 841,017.

To all whom it may concern:

Be it known that I, ELBERT J. HALL, a citizen of the United States, and a resident of Berkeley, county of Alameda, and State of California, have invented certain new and useful Improvements in Variable-Speed Gearing, of which the following is a specification.

The invention relates to means for shifting the gears in a variable speed gear set.

The object of the invention is to provide means for shifting the gears in a variable speed gear set to obtain different speed ratios of the driving and driven elements.

Another object of the invention is to provide power operated means for shifting the gears.

A further object of the invention is to provide power operated means for shifting the gears, the initial movement of the means operating to disengage the enmeshed gears and the further movement of the means operating to enmesh other gears.

The invention possesses other advantageous features, some of which with the foregoing will be set forth at length in the following description where I shall outline in full that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In such drawings I have shown only one specific form of my generic invention, but it is to be understood that I do not limit myself to such form, because my invention may be embodied in a multiplicity of forms, each being a species of my said invention. It is also understood that by the claims succeeding the description of my invention, I desire to cover the invention in whatever form it may be embodied.

Referring to said drawings, Figure 1 is a vertical section of part of the apparatus of my invention, a part of the gear box being broken away to reduce the size of the figure. Fig. 2 is a longitudinal section of the apparatus of my invention, part of the gear box being broken away and the control mechanism being shown in full. Fig. 3 is a vertical section of the distributing valve.

The apparatus of my invention is particularly adapted for use in connection with automobiles, motor trucks, railway motor cars and the like, which are driven by internal combustion engines, and is used to vary the speed of rotation of the driven shaft or axle with relation to the speed of the motor. The gear shifting apparatus is power operated and is constructed so that the initial movement of an element moves the enmeshed gears out of mesh, or into neutral position, and the further movement of the element brings other gears into mesh. The power employed in the present instance is compressed air, but it is to be understood that other fluids may be employed.

In the present construction I have shown a gear set capable of producing three different speed ratios, but it is to be understood that the number of speed ratios may be increased or decreased according to the requirements of the service. The gear case 2 in the present construction contains two parallel rotatable shafts 3—4, either of which may be the driving shaft, but for the purpose of convenience I shall designate shaft 3 the driving shaft, and shaft 4 the driven shaft. The shaft 3 is connected to the engine or motor, preferably through the medium of a clutch, and when employed on vehicles, the shaft 4 is connected to the driving axle by suitable mechanism. Secured to the driven shaft 4 are a plurality of gears 5—6 and 7 of different diameters and splined to the driving shaft 3 are a plurality of gears 12—13—14 of different diameters. Gear 12 is adapted to be moved into and out of mesh with gear 5, gear 13 with gear 6, and gear 14 with gear 7, producing three sets of gears, each set being designed to produce a different speed ratio. The gears 12, 13 and 14 are provided with collars 12^a—13^a—14^a, which are engaged by yokes

12^b—13^b—14^b, which are preferably formed integral with the brackets 12^c—13^c—14^c, which are secured to rods or shafts 12^d—13^d—14^d, bearing in the casing 2 and slidable longitudinally therein, the movement of either rod serving to move the corresponding gear into or out of mesh with its mate.

The rods 12^d—13^d—14^d are preferably arranged above the shaft 3 and adjacent the top of the casing 2 and are arranged in a common plane. Secured to each rod, preferably at the end, is an irregular shaped element 15 having a plurality of depressions and elevations, which is engaged by spring pressed knobs or balls 16, secured to the casing. The balls or knobs seat in the depressions and hold the rods from accidental movement, but do not prevent the rods from being moved when the proper pressure is applied thereto. The elements 15 are of such length that the rods are held against accidental movement when the gears are in mesh or out of mesh.

I shall now describe the means which I have shown for moving the rods 12^d—13^d—14^d to move the gears into and out of mesh. The rods 12^d—13^d—14^d project from the casing 2 and extend into the casing 17, lying preferably adjacent the bottom thereof. Secured to each rod is an abutment 12^e—13^e—14^e which preferably consists of two nuts screwed into tight contact with each other so that they are locked against movement with relation to the rods. Normally the abutments are alined. Secured to each rod at an equal distance from the abutment are brackets 12^h—13^h—14^h which extend upward and which are provided on their upper ends with sleeves, slidably engaging rods 12^k—13^k—14^k respectively. The rods 12^k—13^k—14^k are provided with abutments 12^n—13^n—14^n which are adapted to engage the brackets 12^h—13^h—14^h respectively and move them to the left, thereby bringing the corresponding gears into engagement. In the present construction each rod 12^k—13^k—14^k is provided with a piston 12^p—13^p—14^p, which is disposed in the cylinder 12^r—13^r—14^r respectively, into which air or steam under pressure may be admitted. The admission of the fluid into any cylinder moves the corresponding rod 12^k—13^k—14^k to the left.

Rotatably mounted in the casing 17 between the rods 12^k—13^k—14^k and the rods 12^d—13^d—14^d is a transverse shaft 21, to which are secured a plurality of levers 12^s—13^s—14^s, the lower ends of which are preferably bifurcated and surround the rods 12^d—13^d—14^d respectively. Pivoted to the upper end of each lever 12^s—13^s—14^s is a spring held latch 22 which is adapted to be engaged by the abutments 12^t—13^t—14^t respectively on the rods 12^k—13^k—14^k as the rods are moved to the left. The abutments 12^t—13^t—14^t are preferably conical in shape so that upon the return of the rod the abutment will readily trip past the latch. The levers 12^s—13^s—14^s are secured together so that they move in unison. After being moved to the left by the compressed air or other power, the rods 12^k—13^k—14^k are returned to their normal position by the springs 12^v—13^v—14^v.

The initial movement of any rod 12^k—13^k—14^k toward the left, operates through the abutments 12^t—13^t—14^t, levers 12^s—13^s—14^s and abutments 12^n—13^n—14^n to move the rod 12^d—13^d—14^d which is in its left position, toward the right, disengaging the engaged gears, and the further movement of the rod moves the corresponding rod 12^d—13^d—14^d to the left engaging other gears. A fourth rod 32^k, having an abutment 32^t and engaging in a cylinder 32^r is employed for the purpose of moving the enmeshed gears into neutral or disengaged position only. A lever secured to shaft 21 is engaged by abutment 32^t, causing shaft 21 to rotate and thereby moving the engaged gear rod 12^d—13^d—14^d to the right and disengaging the gears. The rod 32^k is also returned to its normal position by means of a spring 32^v.

Air under pressure for moving the pistons is taken from the supply tank 33. Between the tank 33 and the cylinders is a distributing valve 34, which is provided with a handle 35 which may be readily set to place the tank in communication with one cylinder only. Between the distributing valve and the tank is a control valve 36 which controls the passage of air to the distributing valve. When it is desired to shift from one gear ratio to the other the distributing valve is set at the proper position, the clutch connecting the driving shaft with the motor, if a clutch is employed, is disengaged and the valve 36 opened. The engaged gears are thereby disengaged and a pair of disengaged gears engaged. The opening of the valve 36 is only for sufficient time to cause the piston to move for its full stroke and is usually but momentary.

The operation of the device is as follows: Assuming that gears 5 and 12 are in mesh and that it is desirable to change from the speed ratio of these gears to the speed ratio of gears 6 and 13. The distributing valve is set to place cylinder 13^r in communication with the pressure tank and valve 36 is opened. Rod 13^k is then moved toward the left, abutment 13^t contacts with latch 22 on the lever 13^s causing shaft 21 to be rocked. The movement of the shaft causes lever 12^s to engage abutment 12^e on rod 12^d and move that rod to the right, moving gear 12 out of mesh with gear 5, thereby placing all of the gears in the neutral position. The further movement of rod 13^k brings abutment 13^n in

contact with bracket 13^u and moves that bracket and the attached rod 13^d to the left, moving gear 13 into mesh with gear 6. When the valve 36 is closed, there is usually sufficient leakage in the system or a relief passage 13^x is provided for the air in cylinder 13^r to exhaust past the piston head 13^p, so that the rod 13^k is returned to its normal position by the action of the spring 13^v. On the return of the rod the abutment 13^t trips past the latch 22 on lever 13^s without moving the shaft 21.

When it is desired to place all of the gears in neutral position, the distributing valve is placed to permit the passage of the working fluid into cylinder 32^r. The movement of rod 32^k, rocks the shaft 21 and moves whatever gears are engaged out of engagement.

I claim:

1. In a variable speed gearing, a plurality of transversely movable gears, a plurality of complementary gears adapted to be singly engaged by said movable gears, and power operated means arranged to move said movable gears transversely, the initial portion of a continuous movement of said means operating to disengage the engaged gears, and the following portion of the movement of said means operating to engage a pair of disengaged gears.

2. The combination with a plurality of alined gears of different diameters and a plurality of transversely movable complementary gears each adapted to engage one of said first named gears, of power operated means adapted in the initial stage of a continuous movement to move the engaged gears out of mesh.

3. The combination with a shaft having a plurality of gears of different diameters secured thereto, and a parallel shaft having a plurality of gears of different diameters longitudinally movably mounted thereon, said gears being adapted to be engaged singly or in pairs, of power operated means for moving said movable gears into and out of mesh with the corresponding gears on the other shaft, said means being arranged to move the gears to neutral position in the initial stage of a continuous movement and to engage one set of gears in the second stage of said movement.

4. The combination with a variable speed gearing including complementary gears and other gears adapted to be moved transversely into and out of engagement with said complementary gears, of a rod attached to each of said movable gears, and power operated means for moving said movable gears into and out of engagement with said complementary gears, the initial movement of said means operating to move the engaged movable gear into neutral position, and the further movement of said means in the same direction operating to move another of said movable gears into engagement with its complementary gear.

5. The combination with a variable speed gearing including complementary gears and other gears adapted to be moved transversely into and out of engagement with said complementary gears, of a plurality of rods, each attached to one of said movable gears, an abutment on each of said rods, a rock shaft arranged transversely of said rods, a plurality of levers fixed to said rock shaft adapted to engage said abutments, and power operated means adapted in its initial movement to rock the rock shaft to move one of the rods in one direction, and by its further movement to move another rod in the opposite direction.

6. The combination with a variable speed gearing including complementary gears and other gears adapted to be moved transversely into and out of engagement with said complementary gears, of a plurality of rods, each attached to one of said movable gears, an abutment on each of said rods, a bracket on each of said rods spaced from said abutment and extending into juxtaposition with an operating rod, a rock shaft arranged between said rods and operating rods, a plurality of levers fixed to said rock shaft and extending at one end into juxtaposition with said rods and at the other end into juxtaposition with said operating rods, means for moving said operating rods and abutments on said operating rods arranged to engage said levers and brackets.

7. The combination with a variable speed gearing including complementary gears and other gears adapted to be moved transversely into and out of engagement with said complementary gears, of a plurality of rods, each attached to one of said movable gears, an abutment on each of said rods, a plurality of levers fixed together, each adapted to engage one of said abutments, a plurality of operating rods arranged parallel to said first named rods, means for moving said operating rods in one direction, an abutment on each of said rods adapted to engage said levers during the initial movement of the operating rod and thereby move the enmeshed gear into neutral position, and means operative by the further movement of the operating rod to move another gear into meshed position.

8. The combination with a variable speed gearing including complementary gears and other gears adapted to be moved transversely into and out of engagement with said complementary gears, of a plurality of rods, each attached to one of said gears, and power operated means operating by a movement in one direction to first move one of said rods in one direction and then another in the opposite direction, whereby the movable

gear which was previously in mesh is moved to the neutral position and another movable gear is then moved from the neutral position into mesh with its complementary gear.

9. In a variable speed gearing, a plurality of transversely movable gears, a plurality of complementary gears adapted to be singly engaged by said movable gears, power operated means arranged to move said movable gears transversely, the initial portion of a continuous movement of said means operating to disengage the engaged gears and the following portion of the movement of said means operating to engage a pair of disengaged gears and means for returning said power operated means to its normal position.

In testimony whereof, I have hereunto set my hand at San Francisco, California, this 18th day of May, 1914.

ELBERT J. HALL.

In presence of—
H. G. PROST,
P. S. PIDWELL.