No. 696,285. Patented Mar. 25, 1902.

E. M. & M. VRARD, H. VENDREDY, P. DUITTE & H. GAUTHIER.

SPEED CHANGING GEAR.

(Application filed Sept. 20, 1901.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 2.

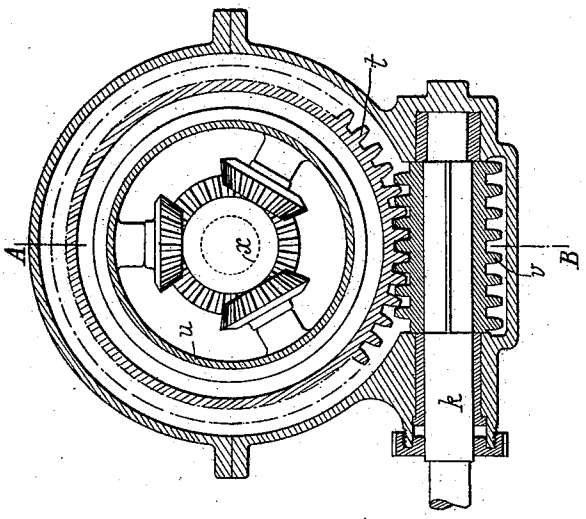
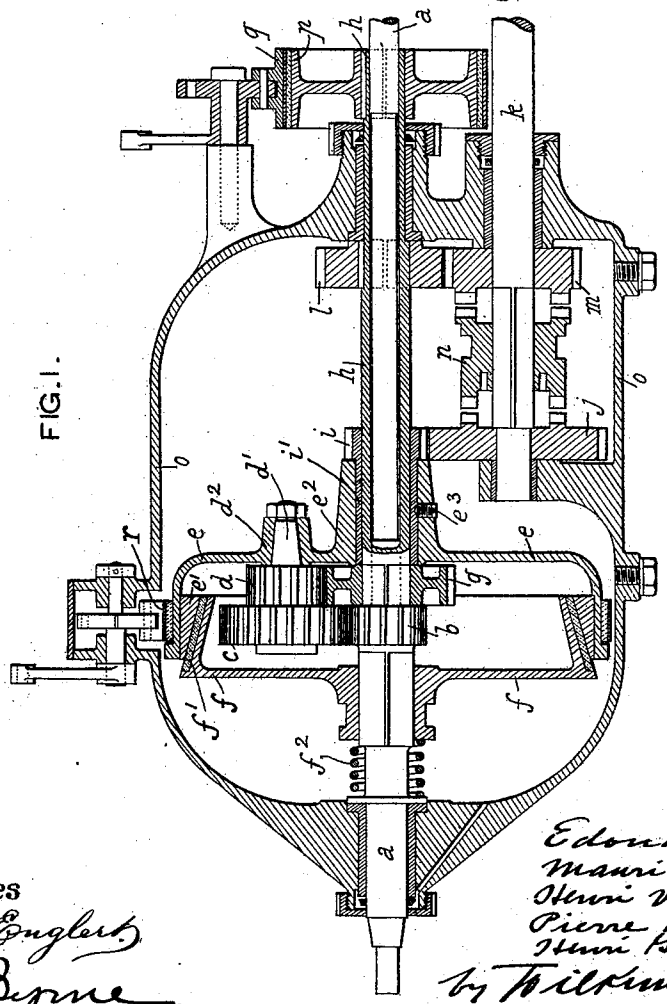


FIG. 1.



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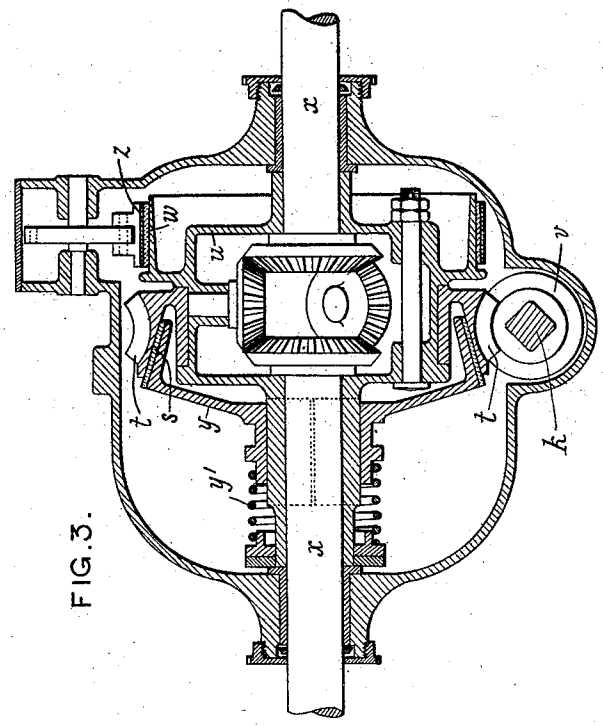


FIG. 3.

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UNITED STATES PATENT OFFICE.

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SPEED-CHANGING GEAR.

SPECIFICATION forming part of Letters Patent No. 696,285, dated March 25, 1902.

Application filed September 20, 1901. Serial No. 75,900. (No model.)

To all whom it may concern:

Be it known that we, EDOUARD M. VRARD and MAURICE VRARD, mechanical engineers, residing at 9 Rue Theophile Gautier, Neuilly-sur-Seine, HENRI VENDREDY, mechanical engineer, residing at 30 Rue des Pavillons, Puteaux, Seine, PIERRE DUITTE, mechanical engineer, residing at 22 Rue Robert Fleury, Paris, and HENRI GAUTHIER, mechanical draftsman, residing at 9 Rue Theophile Gautier, Neuilly-sur-Seine, France, all citizens of the Republic of France, have invented a certain new and useful Improvement in Speed-Changing Gears, (for which we have obtained Letters Patent of France under date of February 28, 1901, bearing No. 308,613;) and we do hereby declare that the following is a full, clear, and exact description of the same.

Our invention relates to that class of mechanisms known as "speed-changing" gears, which while more particularly intended for use on self-propelled vehicles is nevertheless capable of being employed with advantage in other cases where it is necessary to change the speed at which power is transmitted—such, for instance, as in lathes and other machine-tools.

Our invention belongs to that class of speed-changing gears wherein the tooth-wheels are always in gear with each other and wherein, as a consequence, the change from one speed to another can be made to take place without it being necessary to first disconnect one pair of tooth-wheels and then connect together another pair of tooth-wheels, the action being instantaneous and unattended by the noise and wear and tear resulting from putting tooth-wheels in and out of gear with each other.

Our speed-changing gear comprises a friction-clutch whereby the actuation of the gear may take place progressively without exerting any jerking or jarring on the parts thereof.

In the accompanying drawings the speed-changing gear is illustrated as especially intended for use in a self-propelled vehicle, and it is designed for enabling power to be transmitted to the vehicle at three different speeds and at the same time enable the vehicle to be propelled backward when necessary.

Figure 1 is a longitudinal sectional elevation of the gear. Fig. 2 is a cross-section taken through the driving-axle of a self-propelled vehicle to which the gear is applied. Fig. 3 is a section on the line A B of Fig. 2.

Referring to Fig. 1, a is the first-motion shaft or driving-shaft of the gear, which receives continuous rotary motion from a suitable source—such, for instance, as a gasolene-motor. It has fastened upon it a pinion b, meshing with a pinion c, which is integral with another pinion d, both pinions revolving loosely on an axis d', fitted in the boss d^2 of a casing e. The casing e is provided with a conical friction member e', coöperating with a conical pulley f, the periphery of which is likewise provided with a friction member f'. The friction-pulley f is splined or otherwise so mounted upon the shaft a that it is carried along by the latter while yet capable of longitudinal movement thereon, it being normally pressed into action by a spring f^2 and thrown out of action by a hand-lever or a pedal. (Not shown.) The periphery of the casing e is adapted to receive around it a brake-band r, which can be made to act upon the casing for the purpose of arresting its movement, as hereinafter explained, the brake-band r being operated by a hand-lever or a pedal-lever. (Not shown.) The intermediate pinion d meshes with a pinion g, fast upon the end of a sleeve h, surrounding the reduced portion of the driving-shaft a. The hub e^3 of the casing e is slipped over the hub i' of a pinion i, both being made fast to each other by a screw e^3 or otherwise, the hub i' being loose on the sleeve h. The pinion i meshes with a pinion j, which is likewise loose on the shaft k, which is the second motion or driven shaft of the gear and transmits movement to the differential shaft or axle of the vehicle to which the gear is applied. The sleeve h carries fast upon it a pinion l, meshing with a pinion m, likewise loose on the driving-shaft k. A

clutch n, splined to the shaft k and operated by a hand-lever or a pedal-lever, (not shown,) serves to make either pinion j or k at any time fast upon the driven shaft k. All the parts are inclosed in a liquid-tight case o, containing fluid lubricant, as usual.

On the sleeve h at the outside of the case o is fastened a pulley p, upon which can be made to act when required a brake-band q for the purpose of arresting its movement, as hereinafter explained, the brake-band q being operated by a hand-lever or a pedal-lever. (Not shown.)

The operation of the gear as so far described is as follows: Supposing the parts to assume the position shown in Fig. 1, the friction members f' and e' of the pulley f and casing being in engagement with each other, the casing e being free from the action of the brake-band r, the pulley p being also free from the grasp of the brake-band q, and the clutch n being in the position shown, wherein it does not engage either with j or with n, then the gear is in a condition to transmit a given speed from the first-motion shaft a to the second-motion shaft k—that is to say, both shafts will revolve at the same speed, as hereinafter explained. The pulley f and casing e being rigidly connected together, the pinions c d are locked with the pinion b and move around and around with the casing e without rotating on their axis d'. Rotary movement of such pinions c d being thus prevented the pinion d carries along with it the pinion g, which is fast upon the sleeve h, whereby the latter is made to revolve at the same speed as the driving-shaft a. If the clutch n be made to engage the pinion m, movement will be imparted to the driven shaft k by the pinion l. The diameter of the pinions l m being the same it follows that both shafts a and k will revolve at the same angular speed. In order to change speed, the clutch n is disconnected from the pinion m and made to engage the pinion j, the other parts remaining in the same condition, whereby movement will be transmitted at a slower speed, by means of the pinions i and j, to the driven shaft k. In order to again change speed, the clutch n is brought into engagement with the pinion m. The operator disconnects the pulley f from the casing e and applies the brake-band r to the casing e, thus arresting the movement of the casing e. These two actions preferably take place simultaneously by the combined action of, say, a single pedal. Movement will then be imparted by the pinion b to the pinion c, which will rotate around its axis d', along with the pinion d, and the latter will in turn impart movement to the pinion g, which being fast on the sleeve h will cause the latter to revolve, the pinions b, c, d, and g then forming a train of revolving tooth-wheels. The pinion i, with its hub i', being locked to the casing e by the screw e^3 will remain stationary with the said casing. The movement received by the sleeve h is imparted by the pinion l to the pinion m, and as the clutch n engages the latter the driven shaft k will be rotated at a still lower speed than the two former speeds. In order to propel the vehicle backward, retrograde motion is imparted to the driven shaft k, through the instrumentality of the brake-pulley p, in the following manner: The brake-band q being applied to the pulley p by the operator, the pulley f being disconnected from the casing e and the latter being free, the motion derived from the driving-shaft a will be imparted to the pinion b, then to the pinions c d, which will revolve on their axis d'; but as the pinion g is arrested on the sleeve h, together with the brake-pulley p, it follows that the casing e, together with its pinions c d, will be normally pressed to revolve in the reverse direction to that in which it revolved when the sleeve h was free. Consequently the casing e will carry along with it the pinion i, which in turn will transmit movement to the pinion j. By connecting the clutch n to the pinion j the driven shaft k will be rotated also in the reverse direction.

Referring to Figs. 2 and 3, it will be seen how the hereinbefore-described speed-changing gear is connected to a vehicle driving-axle x.

The driven shaft k, actuated as hereinbefore described, carries a worm v, meshing with a worm-wheel t, loosely fitted upon the rim of a casing u, which carries the differential gearing formed of the usual set of tooth-wheels, whereby rotary movement is transmitted to the two halves of the driving-axle x of the vehicle, upon which the wheels are mounted.

Between the driven shaft k and the vehicle-axle x is interposed a friction-clutch y, carrying a friction-surface s, engaging the worm-wheel t, the clutch being operated by hand or foot when it is desired to throw it out of action and being normally pressed into action by a spring y'. When it is desired to propel the vehicle, the clutch y should be thrown into action, and when it is desired to stop the vehicle the said clutch y or the clutch n of Fig. 1 may be thrown out of action.

On the casing u is formed a brake-pulley w, upon which may operate a brake z, operated in any suitable manner.

The hereinbefore-described device shown in Figs. 2 and 3 is only given as an illustration and need not necessarily be adopted, since any other mechanical contrivance may be used for receiving the movement from the driven shaft k and applying it, according to circumstances.

We claim and desire to secure by Letters Patent—

1. A speed-changing gear, comprising a driving-shaft, a clutch, a train of tooth-wheels interposed between the two members of the clutch, a sleeve loose on the driving-shaft adapted to receive motion from said gears, a

driven shaft, and means for transmitting motion from the sleeve to the driven shaft, substantially as herein described and shown.

2. A speed-changing gear, comprising a driving-shaft, a clutch, means for arresting one member of the clutch, a train of tooth-wheels interposed between the two members of the clutch, a sleeve loose on the driving-shaft adapted to receive motion from said gears, a pinion loose thereon and rigidly connected to one member of the clutch, a driven shaft, a pinion thereon engaging the last-named pinion and means for connecting the pinion on the driven shaft to the latter shaft, substantially as herein described and shown.

3. A speed-changing gear, comprising a driving-shaft, a clutch, means for arresting one member of the clutch, a train of tooth-wheels interposed between the two members of the clutch, a sleeve loose on the driving-shaft adapted to receive motion from the said gears, a pinion loose on the sleeve and fast with one member of the clutch, a pinion fast on the sleeve, a driven shaft, pinions thereon, and means for connecting one or the other of the said pinions to the said loose or fast pinions, substantially as herein described and shown.

4. A speed-changing gear, comprising a driving-shaft, a clutch, a train of tooth-wheels interposed between the two members of the clutch, a sleeve loose on the driving-shaft adapted to receive motion from said gears, a pinion loose on the sleeve and fast with one member of the clutch, a brake-pulley fast on the sleeve, means for arresting the movement of the brake-pulley, a driven shaft, a pinion loose thereon and means for connecting the said loose pinion and driven shaft, substantially as herein described and shown.

5. A speed-changing gear comprising a driving-shaft, a clutch, a train of tooth-wheels interposed between the two members of the clutch, a sleeve loose on the driving-shaft adapted to receive motion from said gears, a pinion loose on the sleeve and fast with one member of the clutch, a pinion fast on the sleeve, a brake-pulley fast on the sleeve, means for arresting the movement of the brake-pulley, a driven shaft, pinions loose thereon and means for connecting one pinion with the corresponding pinion loose on the sleeve and the other pinion with the corresponding pinion fast on the sleeve, substantially as described and shown.

6. A speed-changing gear, comprising a driving-shaft, a driven shaft and intermediate means for connecting or disconnecting the two shafts whereby the driven shaft will be made to revolve at different speeds, in combination with a vehicle-driving axle, a differential gear therein, means for operating the axle from the driven shaft and a clutch arranged between the two members of the driving-axle, substantially as described and shown.

7. A speed-changing gear, comprising a driving-shaft, a driven shaft and intermediate means for connecting or disconnecting the two shafts whereby the driven shaft will be made to revolve at different speeds, in combination with a vehicle-driving axle, a differential gear therein, means for operating the axle from the driven shaft, a clutch arranged between the two members of the driving-axle and a brake mechanism acting upon the axle, substantially as described and shown.

In witness whereof we have hereunto set our hands this 9th day of September, 1901, in the presence of two subscribing witnesses.

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HENRI VENDREDY.
PIERRE DUITTE.
HENRI GAUTHIER.

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