

May 29, 1923.

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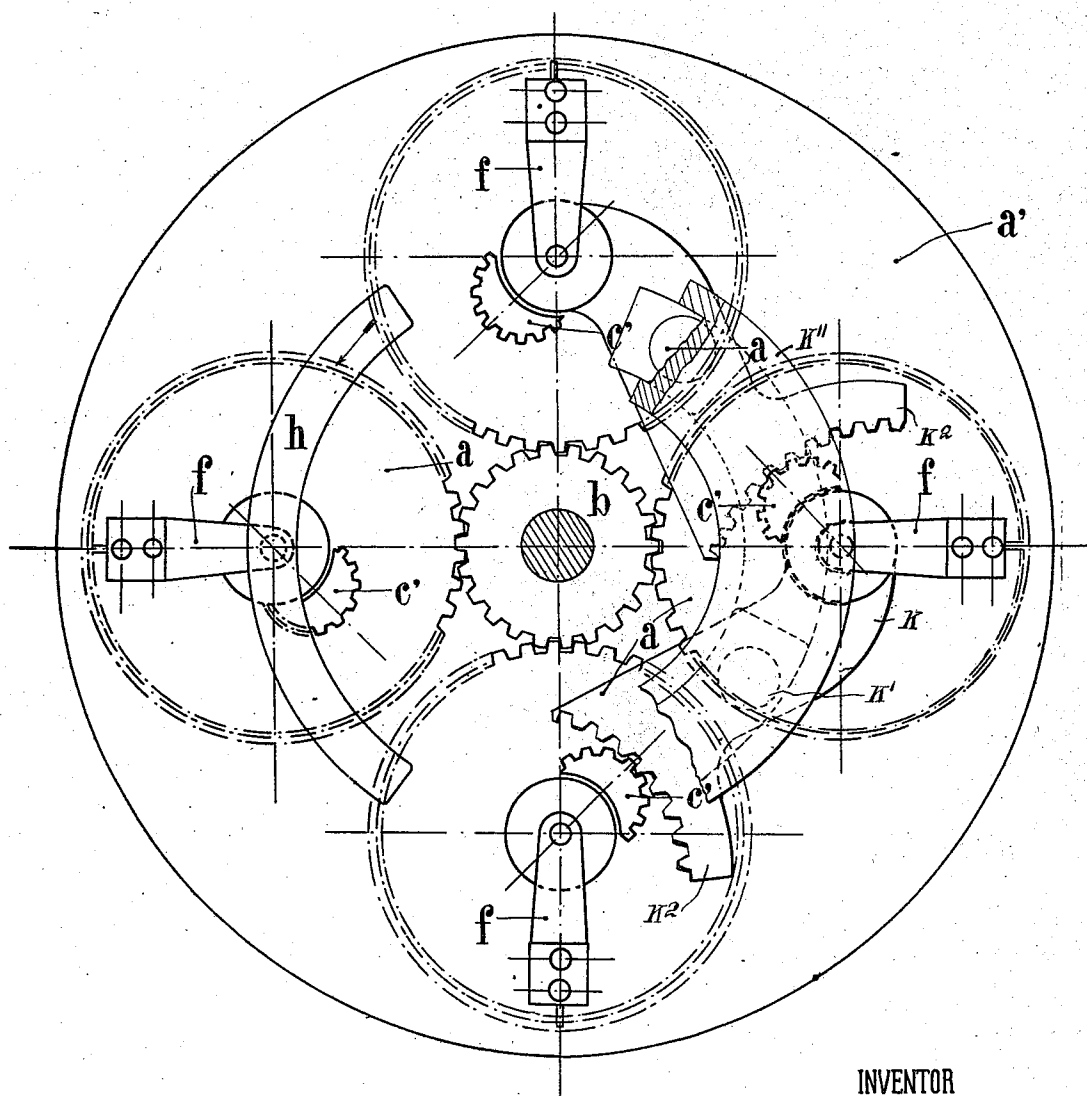
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PROGRESSIVE CHANGE SPEED GEAR

Filed March 23, 1921

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Fig.1.



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Fig. 2.

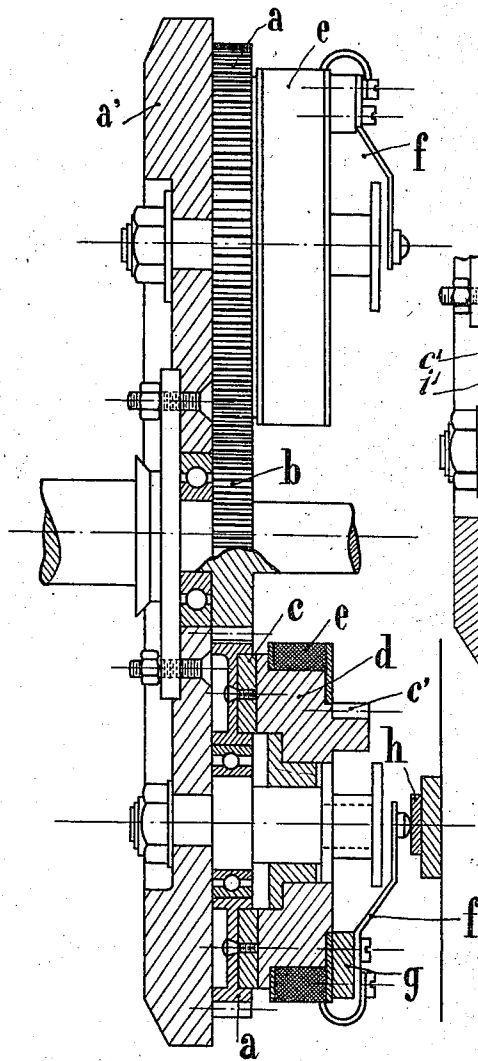
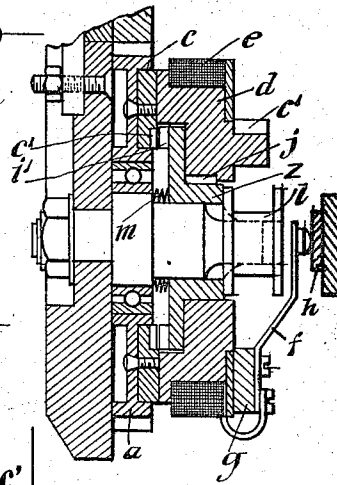


Fig. 3.



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CHARLES EDOUARD HENRIOD, OF NEUILLY-SUR-SEINE, FRANCE.

PROGRESSIVE CHANGE-SPEED GEAR.

Application filed March 23, 1921. Serial No. 454,831.

To all whom it may concern:

Be it known that I, CHARLES EDOUARD HENRIOD, a citizen of the Republic of Switzerland, and resident of Neuilly-sur-Seine, Seine, France (post-office address 11 Rue St. Pierre), have invented certain Improvements in Progressive Change-Speed Gears, which improvements are fully set forth in the following specification.

This invention relates to certain improvements in progressive change speed gear devices provided in an engine fly wheel.

Devices are already known, provided in an engine fly wheel, which can impart a movement of acceleration or retardation to one or more planetary or central wheels in order to give a central wheel constituting the resistance, all the forward and reverse speeds.

The characteristic feature of the present invention consists in arranging between the transmission parts secured to the engine fly wheel and the resistance, a non-reversible device working in normal times by electricity but operable mechanically when the electric current fails.

By "non-reversible device" must be understood a device owing to which the transmission part transmits its action to the resistance without being capable of being acted upon by the latter.

There are already in existence engine fly wheels in which non-reversible devices have been utilized (see more particularly my companion application filed 16th November, 1920, Serial No. 424,534).

The present invention relates to the utilization of electric current for operating the non-reversible device.

In order to make the following description as clear as possible, the accompanying drawing shows by way of example a fly wheel engine with planetary or satellite pinions driven electrically.

Figure 1 is a front elevation of the engine fly wheel.

Figure 2 is a cross-section of the same through the central plane.

Figure 3 is a fragmental view generally similar to Figure 2, but showing an auxiliary mechanical clutch which may be employed.

It will be seen that the engine fly wheel a' is provided with pins or spindles a'' on which are mounted loose planetary or satellite pinions a . The number of these pinions

can vary in practice; in the construction illustrated, there are four of these pinions. As will be seen, said pinions engage with a central pinion b which constitutes the resistance.

On a fixed support i , opposite the engine fly wheel, is mounted a blade h playing the part of a conductor of electricity, to which current is supplied. This blade h has, as will be seen, a development equal to one-quarter of the circumference.

On each planetary gear a is mounted an electro-magnet d , the winding of which is seen at e . On the said electro-magnet d is secured a spring contact f supplying the current to the electro-magnet d when the said spring f , owing to the rotation of the fly wheel, touches the fixed blade h . When the current passes into the electro-magnet, the magnetic field produced in the electro-magnet presses the said electro-magnet against the part c (Fig. 2) of the planetary gear a which serves as an armature for the magnet, the latter and the planetary gear being coupled or clutched together.

Each planetary gear a has associated with it an elliptical gear sector c' which, in the present instance, is rigidly connected to the corresponding magnet d ; these sectors being designed for coaction with the elliptical racks k^* formed on the adjacent ends of a set of oscillatory levers k , one for each gear a , the other end of each lever turning around the axis a'' of the gear next to the one which it operates. Intermediate its ends, each lever k has pivoted to it a lug or projection k' which is adapted to slide along an annular groove or track formed in a relatively-stationary guide member k'' located exteriorly of the fly wheel; and this member is normally so disposed that its groove or track is concentric with the axis of the fly wheel and, hence, with the shaft on which the resistance gear b is mounted, but may be shifted by means of a suitable adjusting device (not shown) to bring the track into eccentric relation to said parts and to vary the degree of such eccentricity. The said guide member is shown and described more fully in my prior application No. 424,534, filed November 16, 1920, to which reference may be had; it forms per se no part of the present invention.

In operation, and assuming that the fly wheel is rotating at a constant speed, and

that the track in the guide member k'' occupies its concentric position, the planetary gears and their connected magnets will be carried around with the fly wheel; and as each gear and magnet come opposite the conductor blade h , the magnet will become energized, due to the engagement of its brush f with said conductor, such action effecting a magnetic coupling of the gear and magnet. Now the levers k will not be rocked or oscillated at this time, because their projections k' will travel idly along the track in guide k'' , due to the then concentric position of said track, so that no movement will be imparted thereby to the gear sectors c' . Consequently, the coupled magnet and planetary gear will be held against axial rotation. Under these conditions, the planetary gears, since they mesh with the resistance gear b , will positively drive the latter at the speed of the fly wheel, this action constituting what may be termed the "direct" drive; it being understood, of course, that before each planetary gear becomes unclutched from its magnet, due to the disengagement of the associated brush f from blade h , the latter is engaged by the brush carried by the next magnet, which is thereby energized and clutched to its planetary gear, and so on, so that the drive is continuous.

If, now, the guide member k'' is shifted to move its track into eccentric position, then each lever k , during one portion of its travel with the fly wheel, will be swung first in one direction and then in the other; such oscillation being transmitted through rack k^* to the associated sector c' and its carrier magnet, which are thereby rotated. The timing of the parts is such that the oscillation of each lever occurs after the magnet which it operates becomes clutched to the corresponding planetary gear a , so that the two are rotated axially as a unit during the initial stroke of the lever. Consequently, during this axial rotation the planetary gear will roll idly along the periphery of the resistance gear b at a speed which depends upon the amplitude of the stroke of the lever and the size of the resistance gear; and it follows, therefore, that as a result of such idle rotation of each successive planetary gear, the resistance gear is no longer driven at the speed of the fly wheel, but at a speed which is less than fly wheel speed. The greater the amplitude of oscillation becomes, the more the speed of the resistance gear will be reduced, until it finally reaches zero, at which time the gears a will roll around gear b at a speed so fast as not to drive it at all; and when such speed is exceeded, then the reverse drive will commence, and the resistance gear will begin to be rotated backward by the planetary gears.

It will be understood from the foregoing that the magnetic clutch devices, when coupled to the planetary gears and rotated by the operating levers, turn said planetary gears in one direction only about their axes. There is, of course, one operating lever k associated with each magnet, as has already been stated; but to facilitate understanding of the drawing, only two of these levers are represented in Fig. 1, and they are entirely omitted from Fig. 2. The arcuate conductor blade h is so arranged that each magnet a becomes energized just before the initial swinging movement of the associated lever; during which time the magnet is clutched to the planetary gear and rotates it axially, as above explained. When the operating lever swings in the opposite direction, and the magnet is turned backward, this movement is not imparted to the planetary gear because it only commences after the brush f has left the conductor blade and the magnet has become deenergized and has unclutched the planetary gear.

The above applies, of course, to the case in which the guide track is eccentric to the fly wheel and produces the oscillation of the operating levers. When said track is concentric, then the levers have no oscillation and, hence, lock the magnets against axial rotation, so that the planetary gears are likewise locked during the time that they are clutched to the magnets, thus enabling the direct drive to be effected.

As already stated, the mechanism must be capable of operating even if the electric current should fail from any cause. This may be effected by interposing a mechanical clutch of any desired type between the armature c of the planetary gear a and the adjacent face of the magnet d ; the slight movement necessary to bring the two parts together to enable the driving being effected by the spring brush f when the latter rubs against a suitable ramp or cam member. Fig. 3 shows one form which this clutch device may take in practice, the construction being otherwise identical with that represented in Fig. 2.

Referring to Fig. 3, the armature c is provided on its outer face with teeth c' for engagement with similar teeth i' formed on the adjacent face of a disk or collar i which fits in a seat provided for it in the magnet d and which is keyed to said magnet to rotate therewith, as indicated at j . This clutch collar i loosely encircles the axis or spindle a'' of the planetary gear and is capable of a lateral sliding movement with relation thereto, as well as to the magnet, due to its aforementioned key connection j ; said collar being normally held in retracted position, with its teeth disengaged from the armature teeth, by means of a spring m which is interposed between the armature

and collar and which likewise encircles the spindle or axis a'' . To effect the coupling of the two sets of clutch teeth c' and i' , the collar is moved inwardly, or to the left in Fig. 3, by a sliding sleeve l , which bears against it and which is itself forced inward along spindle a'' by the action of brush f when the latter engages an actuating ramp or the like (not shown). Hence, in normal operation, when the current is "on," the mechanical clutch parts will remain uncoupled; but if the current fails for any reason, then each planetary gear in succession, as it comes into the zone of action, will be clutched mechanically to its magnet by the inward movement of its respective clutch sleeve, as will be understood. The precise form of actuating ramp or cam is immaterial to the invention, and constitutes no part thereof; nor is its exact location material, beyond the fact that it must lie in the path traveled by the enlarged or headed free end of the spring brush.

It will be apparent from the foregoing that there is, in effect, a double clutch associated with each planetary gear to temporarily lock it against rotation during a portion of its revolution with the fly wheel. When the current is "on," this clutch is closed magnetically by the brush f which conducts the current from blade h to magnet d , which latter is thereby energized and becomes coupled to its armature and, hence, to the planetary gear to which the armature is fastened; the mechanical part of the clutch being inactive under such conditions. If the current fails, however, with the result that the magnetic coupling becomes ineffective, then the mechanical part comes into action, the spring brush f forcing sleeve l and collar i inward and engaging the coacting clutch teeth i' and c' ; the clutching action being accomplished in both cases by means of the brush.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a progressive change-speed mechanism, the combination, with a motor fly wheel adapted to turn at the speed of the motor, a resistance gear disposed concentric with the fly wheel, and a set of planetary gears carried by the fly wheel to revolve bodily therewith and constantly meshing with the resistance gear; of means, including a magnetic clutch, associated with each planetary gear to lock the same against axial rotation at a predetermined point in the revolution of the planetary gear with the fly wheel; and means for automatically energizing each clutch in succession as it reaches such point.

2. In a progressive change-speed mechanism, the combination, with a motor fly wheel adapted to turn at the speed of the motor, a resistance gear disposed concentric with the fly wheel, and a set of planetary

gears carried by the fly wheel to revolve bodily therewith and constantly meshing with the resistance gear; of means, including a magnetic clutch, associated with each planetary gear to lock the same against axial rotation at a predetermined point in the revolution of the planetary gear with the fly wheel; an arcuate current conductor of given length; and a brush carried by each clutch to engage and travel along said conductor and thereby energize the clutch during such travel.

3. In a progressive change-speed mechanism, the combination, with a motor fly wheel adapted to turn at the speed of the motor, a resistance gear disposed concentric with the fly wheel, and a set of planetary gears carried by the fly wheel to revolve bodily therewith and constantly meshing with the resistance gear; of means, including a clutch, associated with each planetary gear to lock the same against axial rotation at a predetermined point in the revolution of the planetary gear with the fly wheel; and means for automatically supplying electric current to magnetically close each clutch in succession as it reaches such point, said means also acting to mechanically close each clutch in succession in case the current supply fails.

4. In a progressive change-speed mechanism, the combination, with a motor fly wheel adapted to turn at the speed of the motor, a resistance gear disposed concentric with the fly wheel, and a set of planetary gears carried by the fly wheel to revolve bodily therewith and constantly meshing with the resistance gear; of means, including a clutch, associated with each planetary gear to lock the same against axial rotation at a predetermined point in the revolution of the planetary gear with the fly wheel; an arcuate current conductor; and a spring contact member carried by each clutch and adapted to wipe against said conductor and thereby conduct current to the clutch to close the same magnetically during its travel along the conductor, said member also acting to mechanically close the clutch in case the current supply fails.

5. In a progressive change-speed mechanism, the combination, with a motor fly wheel adapted to turn at the speed of the motor, a resistance gear disposed concentric with the fly wheel, and a set of planetary gears carried by the fly wheel to revolve bodily therewith and constantly meshing with the resistance gear; of a magnetic clutch associated with each planetary gear; means for energizing each clutch in succession to couple it to the corresponding planetary gear; and a part having a rocking movement of variable amplitude associated with each clutch to control the action of the clutch and its coupled planetary gear with relation to the resistance gear.

6. In a progressive change-speed mechanism, the combination, with a motor fly wheel, a set of pins thereon, a set of planetary gears loosely mounted on said pins to travel around with the fly wheel, and a resistance gear disposed concentric with the fly wheel and with which all of the planetary gears mesh; of an electro-magnet mounted on each pin; an annular member secured to each planetary gear and constituting the armature of the adjacent magnet; a brush carried by each magnet; an arcuate conductor of given length engageable by each brush in succession to energize the corresponding magnet and thereby couple it to the adjacent planetary gear; and means, independent of said conductor and brushes, for controlling the action of each magnet and its coupled planetary gear with relation to the resistance gear.

7. In a progressive change-speed mechanism, the combination, with a motor fly wheel, a set of pins thereon, a set of planetary gears loosely mounted on said pins to travel around with the fly wheel, and a resistance gear disposed concentric with the fly wheel and with which all of the planetary gears mesh; of an electro-magnet mounted on each pin; an annular member secured to each planetary gear and constituting the armature of the adjacent magnet; means for energizing each magnet in succession, to couple it to the adjacent planetary gear; and means for controlling the action of each magnet and its coupled planetary gear with relation to the resistance gear.

8. In a progressive change-speed mechanism, the combination, with a motor fly wheel, a set of pins thereon, a set of planetary gears loosely mounted on said pins to travel around with the fly wheel, and a re-

sistance gear disposed concentric with the fly wheel and with which all of the planetary gears mesh; of an electro-magnet mounted on each pin; an annular member secured to each planetary gear and constituting the armature of the adjacent magnet; a brush carried by each magnet; an arcuate conductor of given length engageable by each brush in succession to energize the corresponding magnet and thereby couple it to the adjacent planetary gear; and a part having a rocking movement of variable amplitude associated with each magnet to control the action of the magnet and its coupled planetary gear with relation to the resistance gear.

9. In a progressive change-speed mechanism, the combination, with a motor fly wheel, a set of pins thereon, a set of planetary gears loosely mounted on said pins to travel around with the fly wheel, and a resistance gear disposed concentric with the fly wheel and with which all of the planetary gears mesh; of an electro-magnet mounted on each pin; an annular member secured to each planetary gear and constituting the armature of the adjacent magnet; means for energizing each magnet in succession, to couple it to the adjacent planetary gear; and a part having a rocking movement of variable amplitude associated with each magnet to control the action of the magnet and its coupled planetary gear on the resistance gear.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES EDOUARD HENRIOD.

Witnesses:

GEORGES PASCAL CARRIÈRE,
GERMAINE MICHIELS.