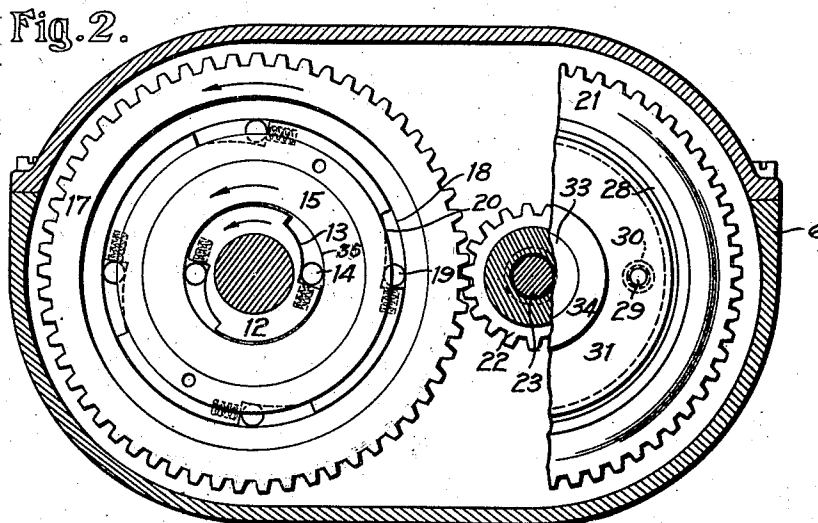
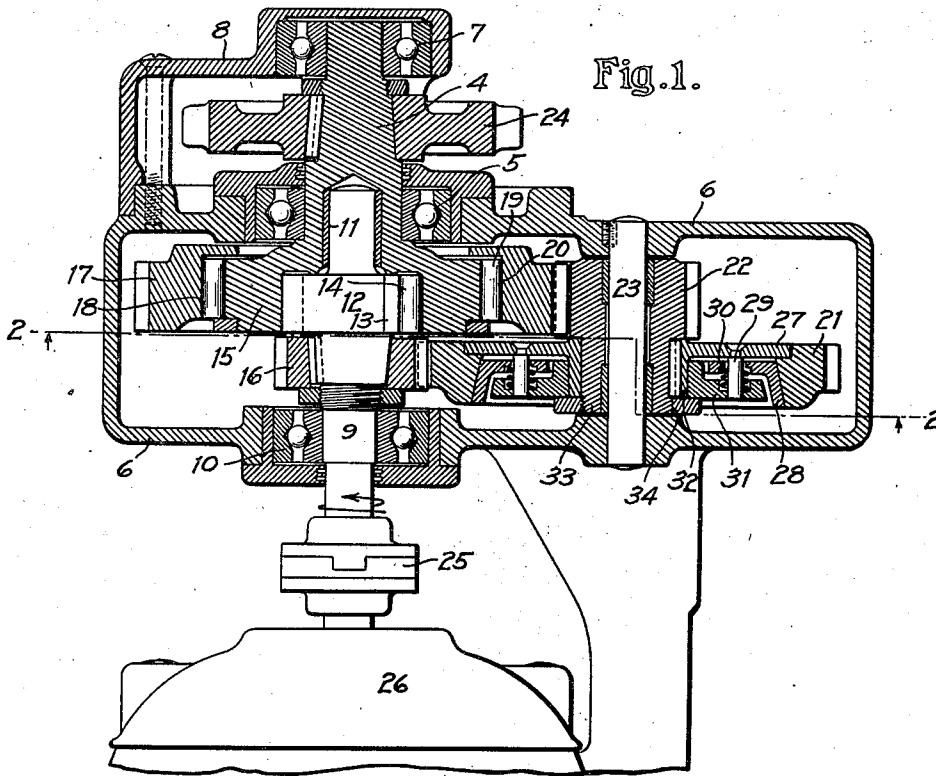


E. A. HALBLEIB.
GEARING.
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GEARING.

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To all whom it may concern:

Be it known that I, EDWARD A. HALBLEIB, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Gearing, of which the following is a specification.

This invention relates to gearing whereby two rotary shafts or elements may be connected in such a manner that either one of said elements may actuate the other, the gearing operating automatically so as to produce different speed-ratios between the elements, according as one or the other acts as the driving element.

In a pending application filed November 6, 1911, Serial No. 658,902, I have disclosed apparatus for starting internal-combustion engines, this apparatus comprising an electric device adapted to operate as a generator when actuated by power derived from the engine, and also adapted, when the engine is at rest, to operate as a motor and apply power to the engine to start the latter. In such an arrangement it is necessary to introduce gearing between the electric device and the engine so as to secure a considerable speed-reduction when the electric device operates in the latter manner, in order that it may produce sufficient torque to rotate the crank-shaft of the engine. On the other hand, when the engine is operating normally, at comparatively high speed, a much lower speed-ratio is required in order to actuate the electric device for generating purposes.

The present invention relates to a gearing which is particularly adapted for use in such a connection, but it will be apparent that the invention is applicable, in general, to purposes where the peculiar mode of operation in question is necessary.

The invention consists in a novel arrangement of speed-reducing gearing and one-direction clutches, the latter operating automatically to throw the speed-reducing gearing into or out of operation, according as one or the other element is the driver. As an incident to this arrangement the invention comprises also the use, in connection with the speed-reducing gearing, of a friction-coupling, or other yielding device, to prevent locking of the mechanism upon the oc-

currence of reverse rotation in one of the rotary elements.

Other objects and features of the invention will be set forth in connection with the following description of the illustrated embodiment of the invention.

In the accompanying drawings:—Figure 1 is a plan-view, partly in horizontal section, of gearing embodying the present invention; and Fig. 2 is a vertical section on the line 2—2 in Fig. 1.

The illustrated embodiment of the invention is a mechanism in which the normal direction of rotation of the two rotary elements is always the same. For convenience of description these two elements will be hereinafter referred to as the "primary element" and the "secondary element," although this designation is arbitrary in so far as any essential difference in their functions is concerned.

The primary element 4 is in the form of a short shaft journaled, at one end, in a ball-bearing 5 which is mounted in a casing 6 inclosing portions of the gearing. The other end of the primary element is journaled in a ball-bearing 7, which is carried by a shell or bracket 8 fixed to the casing 6. The secondary rotary element 9 is also in the form of a short shaft, which is journaled, near one end, in a ball-bearing 10 mounted in the casing 6. The other end of the secondary element is journaled in a bearing 11 inclosed within, and concentric with, the recessed end of the primary element 4. The primary and secondary elements are thus coaxially rotatable.

The secondary element is provided with an enlarged portion 12 which constitutes the inner member of a one-direction clutch of well-known form. This member 12 is provided with inclined recesses 13, in which are located spring-pressed rollers 14, and these rollers are in frictional engagement with a cylindrical surface 35 on an enlarged end or shell 15 which is integral with the primary element 4, and which constitutes the outer member of the clutch. When the element 4 and the shell 15 are rotated in the direction indicated by the arrow in Fig. 2 the clutch operates, in a well-known manner, to produce a corresponding rotation of the inner member 12 and the secondary ele-

ment 9, so that the primary element drives the secondary element directly, that is, without any difference in speed of rotation.

When the secondary element 9 rotates in the same direction but operates as the driving member, however, the clutch just described is idle, as the rollers 14 move to the deeper parts of the recesses 13 so as to drag with little friction on the surface 35. The power is transmitted at this time from the secondary element through speed-reducing gearing. The first member of this gearing is a pinion 16 fixed to the element 9. The last member of the gearing is a toothed ring or annular gear 17, which rotates about the shell 15. The shell 15, in addition to constituting the outer clutch-member above described, constitutes also the inner clutch-member of a second one-direction clutch connecting the primary element 4 with the gear 17. To this end the member 15 is provided with peripheral inclined recesses 20 and spring-pressed rollers 19, and these rollers engage a cylindrical surface 18 on the gear 17, the inner part of this gear thus constituting the outer member of the second clutch.

The pinion 16 and gear 17 are connected by speed-reducing gearing comprising a gear 21 and a pinion 22 which are connected together and rotate freely about a countershaft 23 fixed in the casing 6. Accordingly, when the secondary element 9 constitutes the driving-element and rotates in the same direction as before, and as indicated by arrows in the figures, the pinion 16 rotates the gear 21, the latter rotates the pinion 22, and the pinion rotates the gear 17. The one-direction clutch last described then operates to cause the member 15 and the primary element 4 to rotate in the same direction as the secondary element, but at a substantially lower speed.

The gearing is illustrated as arranged for use in connection with an electric device and an engine, as above described. For this purpose a sprocket-wheel 24 is keyed to the primary element 4, and this may be connected, by a suitable chain, with a sprocket-wheel on the engine-shaft. The secondary element 9 is connected, by a coupling 25, with an electric device indicated at 26 in Fig. 1.

When the gearing is used for the purpose just referred to there is danger, under certain circumstances, that a reverse rotation may be produced in the primary element 4, owing to a "back-kick" or reverse rotation in the engine-shaft. Upon the occurrence of such reverse rotation the inner member of the outer clutch will act to drive the outer member and the gear 17, and the latter, through the pinion 22, the gear 21 and the pinion 16, will tend to rotate the secondary element 9 at a higher speed than

the member 15 and the primary element, and in the same direction. This tendency is opposed, however, by the inner clutch, which tends to rotate the member 15 as fast as the member 12. Accordingly, the gearing will act to lock itself against such reverse rotation. As this locking action, if positive, might result in injury to the gearing, I have made provision for a yielding action within the gearing, by employing a frictional slip-connection in the speed-reducing gearing. To this end the rim of the gear 21 is not fixed to the web 27 of the gear, but is provided with a conical inner surface which is in frictional engagement with a friction-plate 28 having a conical rim. This plate is fixed to rotate with the web 27, by means of posts 29 projecting from the latter through openings in the plate, and the frictional engagement is yieldingly maintained by springs 30 surrounding these posts. One end of each spring engages the friction-plate, and the other end is seated against a flange 31 loosely surrounding the hub 32 of the gear, the flange being held in place thereon by a nut 34 threaded on the end of a sleeve 33 which projects integrally from the pinion 22. In case of reverse movement, as above described, the rim of the gear 21 can rotate with respect to the web 27 and the friction-plate, and the resistance to such rotation is so adjusted that injury to the gearing is prevented, while at the same time the operation of the gearing is sufficiently positive during normal operation.

My invention is not limited to the embodiment thereof hereinbefore described and illustrated in the accompanying drawings, but may be embodied in various forms within the nature of the invention as it is defined in the following claims.

I claim:—

1. Gearing having, in combination, a primary rotary element and a secondary rotary element coaxially journaled, a one-direction clutch comprising an inner member on one element and an outer member on the other element, whereby the primary element may actuate the secondary element, and connections between said elements whereby the secondary element may actuate the primary element at a different speed-ratio, said connections comprising a gear rotatable about said outer clutch-member, a one-direction clutch connecting said gear and clutch-member, a pinion rotatable with the secondary element, and gears connecting said gear and pinion.

2. Gearing having, in combination, a primary rotary element, a secondary rotary element, a one-direction clutch for connecting said elements to permit the primary element to actuate the secondary element, and connections between said elements to permit the secondary element to actuate the primary

element, said connections including speed-reducing gears, a second one-direction clutch, and a yielding device to permit the primary and secondary element to rotate in unison in a reverse direction.

3. Gearing having, in combination, a primary rotary element provided, at one end, with a shell constituting the outer member of a one-direction clutch and the inner member of a second one-direction clutch, a secondary rotary element journaled coaxially with the primary rotary element and provided with a clutch-member located within said shell and constituting the inner member of said clutch, whereby the primary element may rotate the secondary element without speed reduction in a given direction of rotation, said shell constituting also the inner member of a second one-direction clutch, a ring surrounding said shell and constituting both a gear and an outer member for said second clutch, a pinion engaging said gear and journaled on an axis parallel with the axis of said rotary elements, a gear rotatably connected with said pinion, and a pinion rotatable with the secondary element and meshing with said gear, said second one-direction clutch being adapted to rotate the primary element in the given direction by power derived, through the speed-reducing gearing, from the secondary element.

4. Gearing having, in combination, a pri-

mary rotary element and a secondary rotary element coaxially journaled, a one-direction clutch comprising an inner member on one element and an outer member on the other element, whereby the primary element may actuate the secondary element, and connections between said elements whereby the secondary element may actuate the primary element at a different speed-ratio, said connections comprising a gear rotatable about said outer clutch-member, a one-direction clutch connecting said gear and clutch-member, a pinion rotatable with the secondary element, a countershaft parallel with the axis of said rotary elements, a pinion journaled upon the countershaft and meshing with said gear, a gear also journaled upon the countershaft and meshing with the pinion rotatable with the secondary element, and frictional connections between the gear and pinion on said countershaft, said connections being adapted to transmit power between said gear and pinion during operation of the gearing in the normal direction but to yield when the primary and secondary element tend to rotate in unison in a reverse direction.

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