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METHOD VIZ. A DEVICE OF CONTROLLING
CHANGE SPEED GEARS
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Fig. 1.

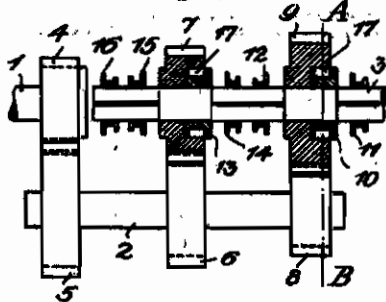


Fig. 2.

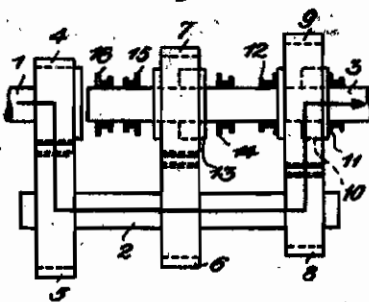


Fig. 3.

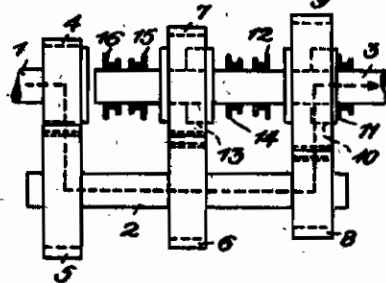


Fig. 4.

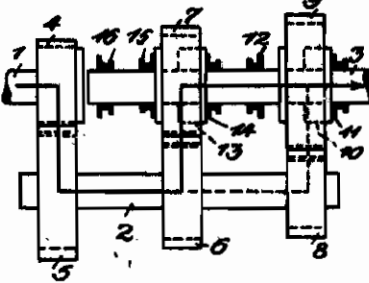


Fig. 5.

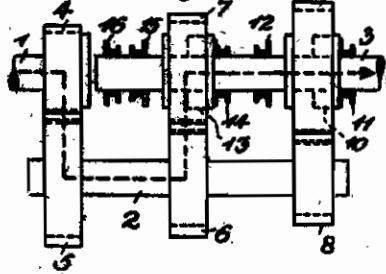


Fig. 6.

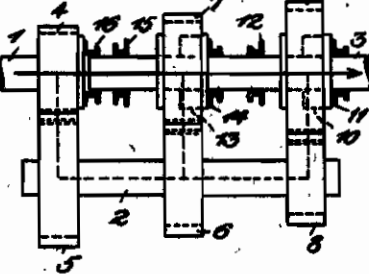


Fig. 7.



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METHOD VIZ. A DEVICE OF CONTROLLING CHANGE SPEED GEARS

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The present invention relates to a method viz. a device of controlling more easily change speed gears, preferably for motor vehicles. The purpose of the invention is to facilitate the control of change speed gears and to obviate the difficulties which are due to the fact that during effecting a change over from one speed to another the transmission of power between the driving and the driven elements is interrupted. According to the invention these difficulties are removed by first interrupting the driving transmission in both directions of rotation when changing over from a lower to a higher gear and by maintaining a driving transmission (freewheel), effective in one direction of rotation only, in the lower gear, whereupon the higher gear is put in. Moreover, for effecting a change over from a higher to a lower gear a free-wheel mechanism is put in or remains put in respectively in the lower gear before the driving transmission in the higher gear is thrown out. By the use of such a control method the interruption of the power transmission during changing over is obviated. Consequently the driving engine is prevented from racing, as running idle at interruption falls which otherwise occurs.

For carrying out the new method of effecting changing over, a gear is used in which at least one set of gears of the driving gear, particularly, however, all sets of gears resulting in forward speeds with the exception of the set of gears for the highest, i. e. the direct speed may act either by way of a disconnectable coupling effective in both directions of rotation (direct coupling), or by way of a disconnectable free-wheel mechanism arranged in parallel to the direct coupling.

In contradistinction to known gears having free-wheel mechanisms in the individual sets of gears the gear according to the present invention has the advantage that the free-wheel acts in the moment of changing over only remains, however, ineffective at other times. In the latter case the transmission of drive is effected by the direct coupling, for instance a claw coupling, acting in both directions of rotation. Thereby the disadvantage is obviated that for instance on driving down a hill or on descent the transmission of drive between the motor and the wheels is interrupted by the freewheel. It is, therefore, possible to brake the vehicle by the motor, because motor and driven wheels normally remain in positive driving connection in both directions of rotation.

In the accompanying drawing one construction of a device for carrying out the method of chang-

ing over according to the invention is shown by way of example.

In this drawing:

Figs. 1 to 6 diagrammatically show six different change over positions, and

Fig. 7 is a section through a freewheel mechanism on line A—B of Fig. 1.

In Figs. 1 to 6 the positive drive in both directions of rotation is indicated by a thick full line, whereas the driving transmission in one direction of rotation only effected by the clamping or locking action of the freewheel mechanism is indicated by a thick dotted line. The thin dotted line, furthermore, characterizes the set of gear in which the freewheel coupling is put in without, however, being effective in the corresponding position, i. e. without a clamping or locking action being liable to occur. The engaged couplings always are rendered conspicuous by thicker lines.

In Fig. 1 the driving shaft 1, leading from the motor, is permanently connected to the counter shaft 2 by the permanently engaged gear wheels 4 and 5. Fixed upon the counter shaft 2 are the gear wheels 6 and 8 with which the gear wheels 7 and 9 respectively, loosely mounted on the driven shaft 3, are permanently in engagement. The claw couplings 15 and 12 respectively, in the following called "direct couplings" on the one hand and the freewheel mechanisms 13 and 10 respectively on the other hand serve to couple or connect the gear wheels 7 and 8 with the shaft 3. The freewheel mechanisms 13 and 10 respectively cooperate with the gear wheels 7 and 8 respectively by means of clamping rollers 17 and may, moreover, be coupled to the shaft 3 by claw couplings 14 and 11 respectively which in the following are called "freewheel couplings". The freewheel mechanisms 13 and 10 respectively are so constructed that in the case of engagement of the freewheel couplings a drive of the gear wheels 7 and 8 respectively is transmitted to the shaft 3 by clamping or locking of the rollers 17, when the gear wheels are driven by the motor in such a manner that they tend to overtake the shaft 3. If, however, the shaft 3 leads the gear wheels 7 and 8 respectively the clamping or locking action of the freewheel mechanism is rendered ineffective and the shaft 3 may freely rotate within the gear wheels. For putting or throwing in the direct gear or speed, moreover, the claw coupling 16 is provided.

The changing over of the gear is effected in the following manner:

Fig. 1 shows the gear when running idle. The

direct couplings 12, 15 and 16 as well as the freewheel couplings 11 and 14 are disengaged.

To put in the first speed, the direct coupling 12 is put in. Simultaneously the freewheel coupling 11 may also be engaged. This change over position is shown in Fig. 2. In this case the drive is effected from the shaft 1 by way of the gear wheels 4, 5, the counter shaft 2, the gear wheels 8, 9 and the direct coupling 12 to the shaft 3. The freewheel mechanism 13 runs idle, because the power transmission is effected by the direct coupling 12.

For effecting changing over from the first to the second speed, the direct coupling 12 is, as shown in Figs. 3 and 4, disconnected, whereas the freewheel coupling 11 remains in engagement. The motor, therefore, continues to transmit the drive by way of the first speed upon the shaft 3 by means of the freewheel mechanism 13 and the freewheel coupling 11, until, as shown in Fig. 4, the direct coupling 15 and preferably simultaneously the freewheel coupling 14 for the second speed are engaged. The shaft 3 thereby is faster rotated by way of the gear wheels 6 and 7 so that it leads the gear wheel 9, whereby the freewheel mechanism 10 is rendered effective. The motor coupling may remain engaged during changing over or may be disconnected for a short period of time only to facilitate throwing out of the gear or speed. The changing over may be effected for instance by a lever provided at the steering wheel. By slightly returning the gas foot lever, the number of revolutions of the motor may be adapted to the higher gear ratio.

As shown in Figs. 5 and 6, the third or direct speed or gear may be put in in a corresponding manner by first disengaging the direct coupling 15 and thereupon engaging the coupling 16, the freewheel coupling 14 remaining in engagement.

As may be seen from Fig. 6, the freewheel couplings 11 as well as the freewheel mechanisms 10 and 13 respectively are engaged in the third speed or gear so that by interruption of the drive at 16 the drive transmission is taken over by the freewheel mechanism of the next lower set of

gears, i. e. at first by the freewheel mechanism 13 or the freewheel coupling 14 respectively. This change over from the third to the second gear or speed is effected in accordance with Figs. 5 and 4, whereby first of all the direct coupling 16 is disengaged (Fig. 5) and thereupon the direct coupling 15 is engaged as shown in Fig. 4. In the meantime between disengaging of the coupling 16 and engaging of the coupling 15 the drive is effected by the freewheel mechanism 13 coupled with the shaft 3.

On changing over from the second to the first speed or gear simultaneously the direct coupling 15 and the freewheel coupling 14 of the freewheel mechanism 13 are disengaged, as shown in Fig. 3, so that the speed of the shaft 3 may be reduced with regard to that of the gear wheel 7 and the clamping or locking effect of the freewheel mechanism 10 may be rendered effective. After the drive has been taken over by the freewheel mechanism 13 the direct coupling 12 also is engaged to positively couple the gear wheel 9 with the shaft 3.

As may be gathered from the above explanations, any interruption of the drive on effecting a change over from one speed to another is practically prevented, because in the intermediate time always the clamping or locking action of a freewheel mechanism is rendered effective.

The change over from a higher to a lower speed may be effected without the gas being shut off.

Instead of claw couplings for the direct couplings or for the freewheel couplings any other kinds of couplings, for instance mechanic, electromagnetic, hydraulic, or pneumatic couplings may be used. Furthermore, the couplings may be constructed preferably as friction clutches, as laminated disc couplings, cone or bevel couplings or in any other desired manner.

The invention may be applied to change speed gears with at least two speeds and it may be applied also in respect to at least one gear only. The maximum number of speeds is not limited.

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