PUBLISHED
MAY 4, 1943.
BY A. P. C.

A. G. VON SODEN-FRAUNHOFEN ET AL
CHANGE SPEED GEARS WITH PAIRS OF CONSTANTLY MESHING GEAR WHEELS
Filed Feb. 14, 1941

Serial No. 378,984

2 Sheets-Sheet 1

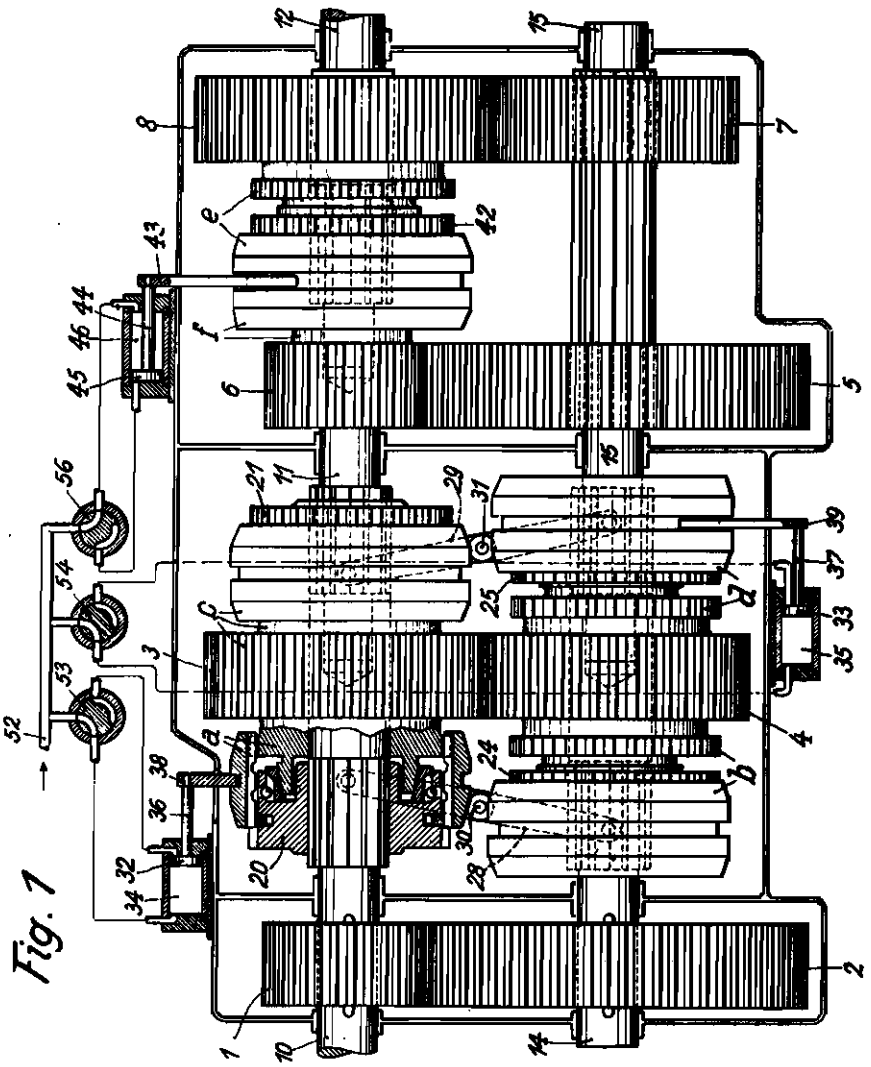

Fig. 1

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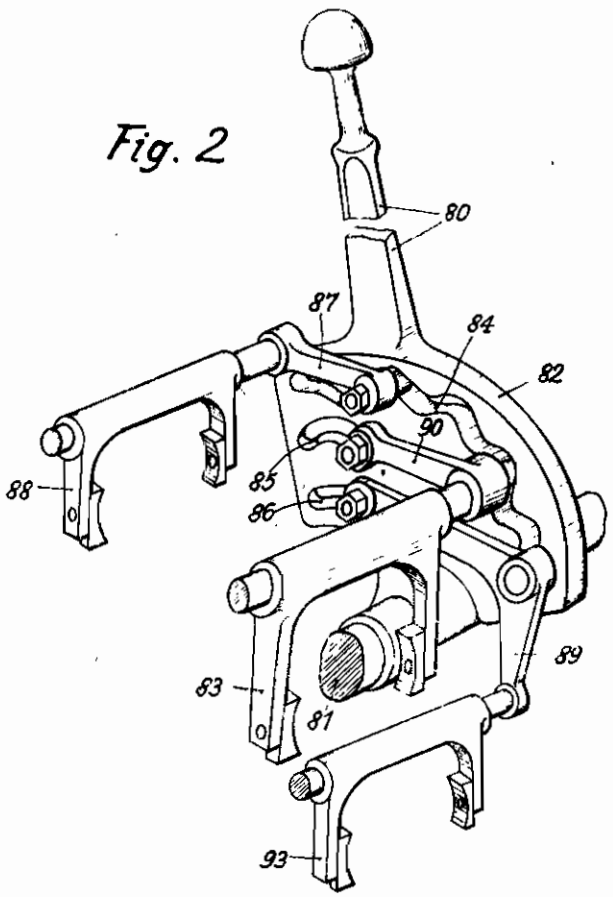
Fig. 2



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Published May 4, 1943 Serial No. 378,984

ALIEN PROPERTY CUSTODIAN

CHANGE SPEED GEARS WITH PAIRS OF CONSTANTLY MESHING GEAR WHEELS

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Application filed February 14, 1941

Our invention relates to change speed gears with pairs of constantly meshing gear wheels, especially in motor vehicles; and it has special reference to change speed gears of this kind in which there is a plurality of claw couplings to be operated for causing a gear change.

The main object of our invention is to attain soft and noiseless speed changes without shocks and to avoid complicated auxiliary devices which make the speed gear expensive and render its operation unsafe.

According to our invention we provide for each and every claw coupling a synchronizing device having friction members. And furthermore two or more couplings may be operated simultaneously, or nearly at the same time.

For the purpose of facilitating the operation the couplings may be provided with the type of synchronizing devices as disclosed in the co-pending application Serial Number 352,808 of August 15th, 1940.

It is advantageous to provide pressure means—as fluid pressure or vacuum—for causing the speed changes. But in certain cases we prefer to have a manually operated control device adapted to cause the necessary sequence in the synchronizing effect on the different coupling halves automatically.

Having given a general description of our invention we now want to point it out more in detail having reference to the drawings which represent an example embodying our invention.

Fig. 1 is a diagrammatic view of an open speed case showing the gear wheels, the claw couplings and the means for their operation.

Fig. 2 is a perspective view of a manually operated control device.

There are four pairs of constantly meshing gears, namely 1/2, 3/4, 5/6 and 7/8. The main shaft train is composed of shaft portions 10, 11 and 12; 10 is the incoming shaft and 12 the outgoing shaft. The shaft portions 14 and 15 form the lay shaft train. By means of gear pair 1/2 lay shaft portion 14 is constantly driven by the incoming main shaft portion 10, as gear 1 and 2 are fixed to their shaft portions 10 and 14, respectively. But gears 3 and 4 are loosely journaled on their shaft portions 11 and 15, respectively. Gear 6 is fixed to shaft portion 11, and gear 5 is fixed to shaft portion 15. On the outgoing main shaft portion gear 8 is loosely journaled whereas gear 7 is splined to lay shaft portion 15. It is shiftable for allowing driving connection with a reversing gear, not represented.

Gear 3 has claw coupling halves at both sides, the half at its left hand side adapted to co-operate with another half provided on sleeve 20 splined to shaft portion 10, and the right hand half being adapted to co-operate with a coupling half provided on sleeve 21 splined to shaft portion 11. The left hand coupling halves form the coupling *a* and the right hand ones coupling *c*.

In similar manner gear 4 has coupling *b* at its left hand side and coupling *d* at its right hand side, to which belong sleeves 24 and 25 splined to shaft portions 14 and 15, respectively.

By means of lever arrangements sleeves 20 and 24 and sleeevs 21 and 25 are made to operate alternately. Double armed lever 28 journaled on fixed pin 30 at one end connects to sleeve 20 and at its other end to sleeve 24; similarly lever 29 journaled on fixed pin 31 at its upper end is connected to sleeve 21 and at its lower end to sleeve 25.

There are fluid pressure operated pistons 32 and 33 inside in cylinders 34 and 35, respectively, which by means of rod 36 and fork 38, and rod 37 and fork 39, respectively, cause operation of the couplings.

To out-going shaft portion 12 a double-acting alternately engaging sleeve 42 is splined which when shifted to the left causes engagement of the left hand claw coupling *f* between gear 6 and sleeve 42, and when shifted to the right engagement of claw coupling *e* between sleeve 42 and gear 8, so that in the first case shaft portion 12 rotates together with gear 6 and in the second case together with gear 8. Piston 45 inside of cylinder 46 by means of rod 44 and fork 43 is adapted to shift sleeve 42 depending on the fluid pressure being fed to the left hand or to the right hand side of the piston.

The main fluid pressure line 52 connects to control cocks or valves 53, 54 and 56 by which the operation of sleeves 20/24, 21/25 and 42, respectively, is controlled. Thereby it is possible to set seven different speeds (the reverse speed being excepted). The different elements used for the different speeds are the following:

First speed: couplings *b*, *c* and *e*, gears 1–2–4–3–6–5–7–8;
2nd speed: couplings *b*, *d* and *e*, gears 1–2–7–8;
3rd speed: couplings *a*, *c* and *e*, gears 6–5–7–8;
4th speed: couplings *b*, c and *f*, gears 1–2–4–3;
5th speed: couplings *b*, *d* and *f*, gears 1–2–5–6;
6th speed: (direct speed) couplings *a*, *c* and *f*, no gears transmitting;
7th speed: (over speed) couplings *a*, *d* and *f*, gears 3–4–5–6.

The construction of the claw couplings in connection with the synchronising device is indicated in connection with coupling *a* and sleeve **20** which are represented in section. The details may be taken from the afore-mentioned prior application, serial number 352,808 of August 15, 1940. The main feature of such synchronized claw couplings is that they have means for preventing final engagement before synchronization of the coupling halves to be connected is attained but automatically allowing for such engagement as soon as they are synchronized.

In case of manual operation it is advantageous to make use of a control device as represented in Fig. 2. For the purpose of simultaneous operation of the different couplings concerned for setting the different speeds hand lever **80** adapted to be rotated around shaft **81** is provided with a disc-like member **82** having curved gates **84**, **85** and **86**. Shifting forks **88**, **83** and **93** are adapted to shift sleeves, as represented in Fig. 1, for instance sleeve **20**, **21** and **42**. Each of said forks is provided with a rod or lever, for example **87**, **90**, **89**, respectively, and to every lever or rod belongs a pin at its end fitting into curved gates **84**, **85** and **86**, respectively. The curves of these gates are so worked out that upon a certain angular movement of lever **80** the shifting forks are so dislocated that they cause the sleeve or sleeves concerned for the respective speed to be moved adequately. Thus, automatically the couplings to be disconnected and the others to be connected are operated.

We do not want to be limited to the details described or shown in the drawings as many variations will occur to those skilled in the art without deviating from the scope of our invention.

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