Nov. 10 1925. 1,560,982

G. FORNACA

SPEED REDUCER AND REVERSE GEAR FOR INTERNAL COMBUSTION ENGINES

Filed Sept. 25, 1924

Fig. 1

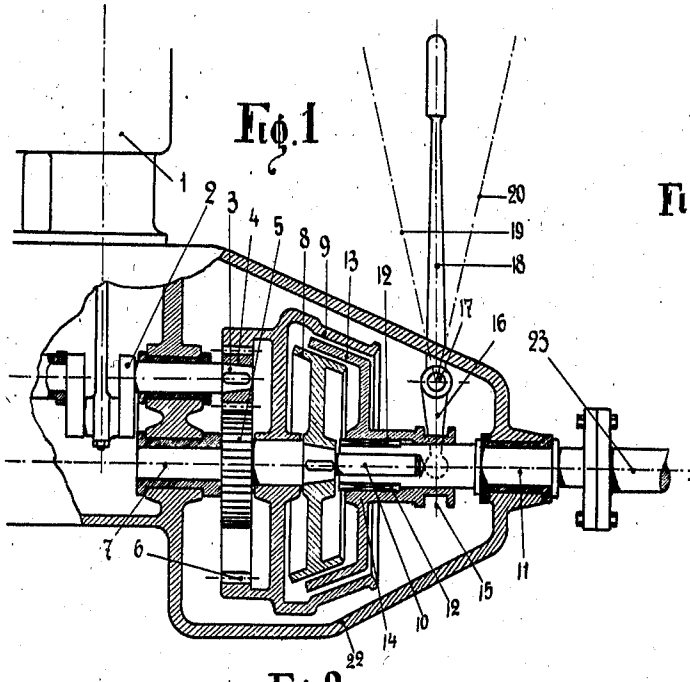


Fig. 5

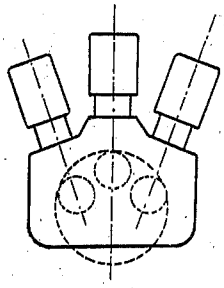


Fig. 4

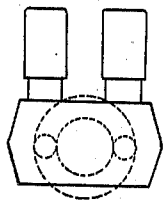


Fig. 2

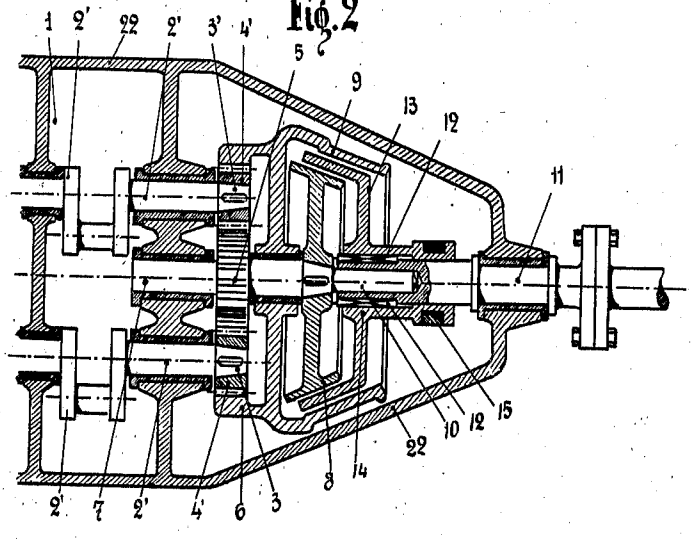
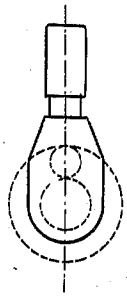


Fig. 3



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UNITED STATES PATENT OFFICE.

GUIDO FORNACA, OF TURIN, ITALY.

SPEED REDUCER AND REVERSE GEAR FOR INTERNAL-COMBUSTION ENGINES.

Application filed September 25, 1924. Serial No. 739,887.

To all whom it may concern:

Be it known that I, GUIDO FORNACA, a subject of the King of Italy, resident of Turin, in the Kingdom of Italy, have invented certain new and useful Improvements in Speed Reducers and Reverse Gears for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

It is known that in the construction of explosion engines for motor vehicles and boats, endeavours have been made to attain high angular speeds, which allow of high specific power to be obtained. The propeller speed corresponding to highest efficiency has, however, considerably lower limits than that of the engines, so that it is necessary to employ speed reducers between the engine and the propeller shaft.

Moreover, when high power is aimed at, it is necessary to increase the number of cylinders of each engine and to install on board several engines. Each engine has to be provided with a speed reducer and reverse gear, thus rendering the arrangement clumsy, heavy and difficult in operation.

The present invention considerably simplifies the installation and improves the working thereof, by combining into a single unit the speed reducer and the reverse gear, and serving by this unit several engines, which, through suitable means also forming the object of the invention, can be grouped into a single block so that several engines and a single reducer and reverse gear form a propelling unit.

The accompanying drawing shows by way of example some constructional forms of the object of this invention.

Figure 1 shows a constructional form for a single engine.

Figure 2 shows a constructional form for a double engine.

Figures 3, 4 and 5 are relative and diagrammatic front views of the single, double and triple engine, respectively.

1 denotes an internal combustion engine of any suitable type, the crank shaft 2 whereof is provided at its end 3 with a pinion 4, meshing simultaneously with a toothed wheel 5 having a larger diameter and with a rim 6 with inner teeth. The wheel 5 is secured on a shaft 7, on which is keyed a cone 8.

The shaft 7 also supports the rim 6 and the cone 9 fast with the said rim. The cone 9 as well as the rim 6 are loosely mounted on the shaft 7, which projects by its end 10 into a countershaft 11, on which it rests and within which it is free to rotate. The shaft 11 carries keys 12, projecting into corresponding keyways on the hub 14 of a cone 13.

The cone 13 is capable of longitudinal movement on the shaft 11 but the keys cause it to turn with this latter.

The hub 14 of the cone 13 carries at one end a circular groove 15 into which projects the forked end of a lever 16 secured to a shaft 17, on which is also fixed a lever 18 that can be brought into three different positions, namely two end positions 19—20 indicated in hatched lines, and an intermediate one shown in full line. A casing 22 encloses all the mechanisms.

The shaft 11 is rigidly connected with the propeller shaft 23.

The device works as follows:

The mechanisms are supposed to be in the position shown in Fig. 1. The shaft 2 meshes by means of the pinion 4 with the wheel 5 and rim 6, thus imparting rotation in the same direction to the crank shaft 2 and rim 6 and in opposite direction to the wheel 5. The wheel 5 having a larger diameter than the pinion 4, its revolution speed is less than that of the crank shaft 2. The rim 6 having a larger diameter than the wheel 5, also rotates at a lower speed.

The cone 8 secured on the same shaft 7 which carries the wheel 5 rotates in the same direction and at the same speed.

The cone 9 integral with the rim 6 rotates in the same direction and at the same speed as the rim. There are thus two cones 8 and 9 rotating in opposite directions and at different speeds.

The cone 13 being in the intermediate position between cones 8 and 9 and disengaged from both of them is stationary, and so are shaft 11 and propeller shaft 23. In such conditions a free run is realized as the engine is running while the propeller shaft is stationary.

By displacing the lever 18 to the position indicated at 20, by means of lever 16 which follows the motion of lever 18 and projects into the groove 15, the hub 14 is caused to slide and the cone 13 is forced into the cone 8 and carried along by this latter at a speed equal to that of the wheel 5.

The motor boat thus goes ahead and the number of turns is reduced between the crank shaft and the propeller shaft in accordance with the difference between the diameters of the pinions 4 and 5. By displacing the lever 18 to the position indicated at 19, by means of the lever 16 and hub 14 the cone 13 is disengaged from the cone 8 and is brought into engagement with the cone 9; this latter rotates in the direction opposite to the cone 8 and at a reduced speed with respect to this latter; it therefore carries along the cone 13 with the shaft 11 and the propeller shaft 23.

The motor boat thus goes astern at a reduced propeller speed.

The modified form shown in Figure 2 refers to a double engine, wherein two crank shafts 2′ are provided with a pinion 4′ meshing with the toothed rim 6 and gear 5.

The reducing and reverse gear serves in this case also for coupling the two engines. When it is desired to use one or both engines at will, provision will be made for connecting or disconnecting the pinion 4′ of each engine with or from the shaft by which it is supported.

Figure 5 shows a further modified form relating to a triple engine. The figure explains itself.

It is obvious that the object of the present invention can be used in connection with any type of boats or ships.

What I claim is:

1. The combination with a crank shaft, of a driven shaft, an internally toothed gear loose on the latter, a pinion fixed on the crank shaft in mesh with the internally toothed gear, a pinion fixed on the driven shaft in mesh with the pinion on the crank shaft, a conical clutch-member fixed on the driven shaft, a conical clutch member forming an integral extension of the internally toothed gear and surrounding the clutch member fixed on the driven shaft, a counter shaft arranged axially of the driven shaft, and an intermediate clutch member keyed to and movable axially on the counter shaft and having a conical portion interposed between the aforesaid clutch members adapted to be moved alternately into frictional engagement with the latter.

2. In a reversing mechanism for internal combustion engines, the combination with a crank shaft, of a driven shaft mounted parallel to the latter, a toothed gear fixed on the driven shaft, an internally toothed gear loose on the latter, a pinion fixed on the crank shaft in mesh with the aforesaid gears, a conical clutch member forming an integral extension of the internally toothed gear, a conical clutch member fixed on the driven-shaft within said extension, a counter shaft having an axial recess in which the driven shaft is journaled, an intermediate clutch member rotatable with the counter shaft and having a conical portion interposed between the aforesaid clutch members, and means to move the intermediate clutch member axially of the counter shaft whereby it is brought alternately into frictional engagement with the other clutch members.

3. In a reversing mechanism, for internal combustion engines, the combination of a plurality of crank-shafts, a single casing in which the shafts are mounted, a driven shaft mounted parallel to and at equal distance from the crank-shafts and extending into a chamber formed in an extension of the casing, a combined speed reduction and reversing gearing connecting the driven shaft with the crank shaft and comprising a gear fixed on the driven-shaft, a pinion fixed on each crank shaft in mesh with said gear, an internally toothed gear loosely mounted on the driven shaft and surrounding said gear and pinions and in mesh with the latter, a counter-shaft journaled in said extension and having an axial recess in one end forming a journal for one end of the driven shaft, a conical clutch member forming an integral extension of the externally toothed gear, a conical clutch member fixed on the driven shaft, and surrounded by said extension, an intermediate clutch member rotatable with the counter-shaft and having a conical portion extending between the aforesaid clutch members, and means for moving the intermediate clutch member axially of the latter, whereby it is brought alternately into frictional engagement with the other clutch members.

In testimony that I claim the foregoing as my invention, I have signed my name.

GUIDO FORNACA.