1,044,736.

G. E. BOWEN.

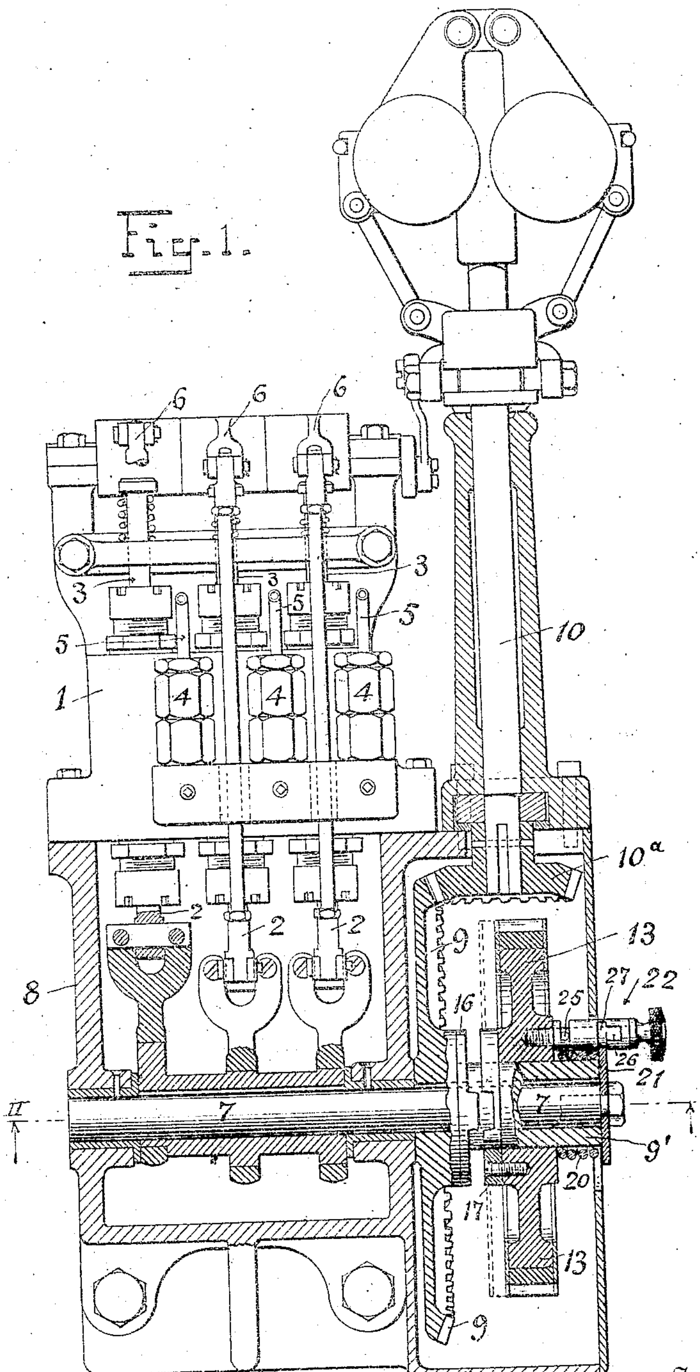
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 27, 1907.

Patented Nov. 19, 1912

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2

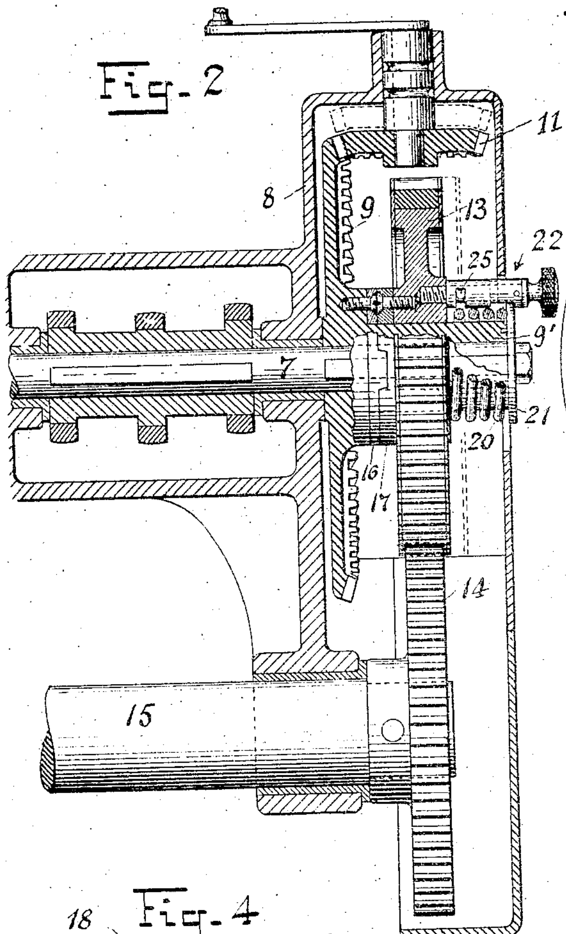


Fig. 3

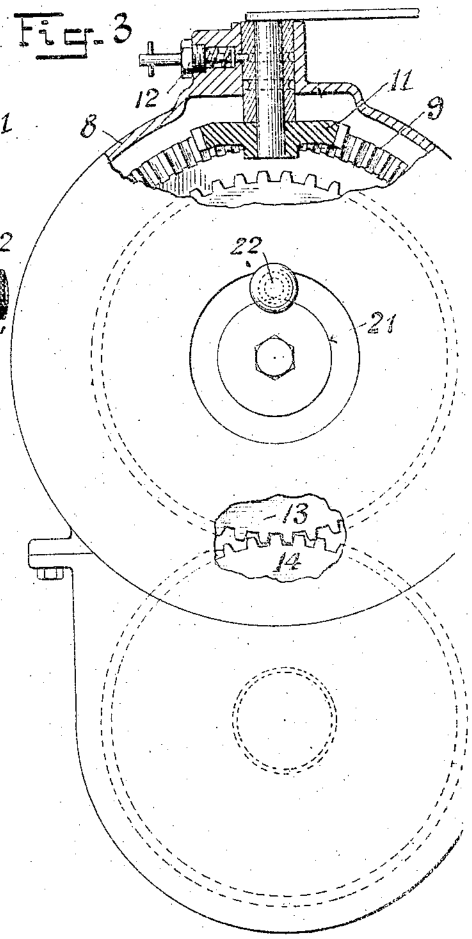


Fig. 4

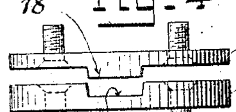


Fig. 5

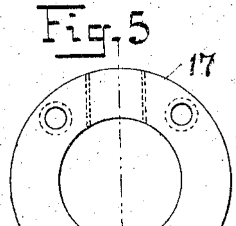


Fig. 8

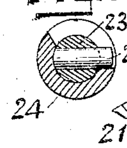


Fig. 9

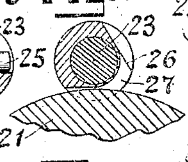


Fig. 6.

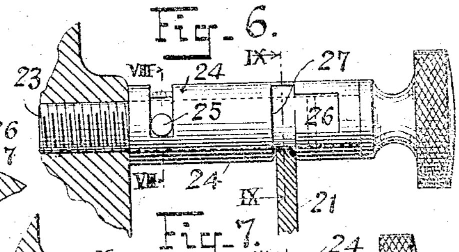


Fig. 10.

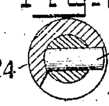


Fig. 11.

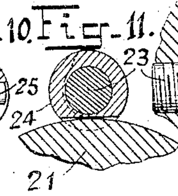
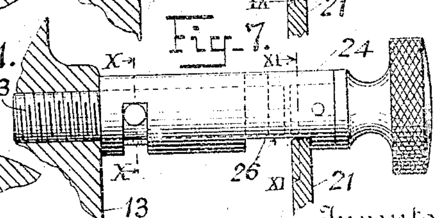


Fig. 7.



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UNITED STATES PATENT OFFICE.

GLENNA E. BOWEN, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO BUSCH-SULZER BROTHERS DIESEL ENGINE COMPANY, A CORPORATION OF MISSOURI.

INTERNAL-COMBUSTION ENGINE.

1,044,736. Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed July 27, 1907. Serial No. 385,903.

To all whom it may concern:

Be it known that I, GLENNA E. BOWEN, a citizen of the United States of America, residing at Milwaukee, county of Milwaukee, State of Wisconsin, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a full, clear, and concise specification.

My invention relates to internal combustion engines of the type wherein the fuel is forced into the combustion chamber under compression, such, for example, as the well known Diesel engine, and the invention consists in the gearing and connections through which the fuel forcing pump may be driven, either by the engine crank-shaft during its normal operation or by hand when the engine is being started, the special objects of the invention being to provide an effective means for such alternative connection which can be readily operated to connect the pump with the engine, which will automatically adjust itself in phase with the crank-shaft when so connected and which will drive the pump uniformly and positively in strict accordance with the variations of speed of the engine.

Figure 1 represents, partly in side elevation and partly in central section, a fuel-pump embodying my invention; Fig. 2 is an inverted horizontal section of Fig. 1 on line II II thereof, as indicated by the arrows, and showing also a portion of the engine countershaft and the drive-gear of said shaft in elevation; Fig. 3 is a side elevation of Fig. 2 with parts broken away; Fig. 4 is a side elevation of the complementary clutch members; Fig. 5 is a plan view thereof; Figs. 6 and 7 are respectively detail elevations enlarged of the locking handle in its locked and unlocked positions respectively; and Figs. 8 to 11 are cross sections of said locking handle taken on the corresponding section lines of Figs. 6 and 7 as thereon indicated.

The fuel pump shown herein for purposes of illustration, is of usual type and intended for use with triple cylinder engines. It comprises a single casting or forging 1 in which are bored three pumping chambers, each chamber being supplied with a pumping plunger 2, suction valve 3 and force valve 4. The force pipes 5 lead from the valves 3 to the fuel admission valves of their respective engine cylinders (not shown) and the amount of fuel delivered by them is regulated by means of an automatic adjustment of the suction valves 3 or their operating levers (shown in end view at 6) which adjustment is under the immediate control of the engine governor through appropriate connections of familiar arrangement, not necessary to be here described in detail. In operation the engine governor varies the time of closing of the suction valves so as to allow more or less back flow through them and according to the amount of fuel required to be forced into the engine fuel valve, the supply of fuel serving to control the work of the engine in familiar manner. The gear and crank casing 8 which supports the above mentioned apparatus, is divided into two compartments, one for containing the cranks or eccentrics of the plungers 2 and the other the gearing for driving the pumping shaft 7, which shaft is journaled in the side and central walls of the casing as clearly shown in Fig. 1 and carries fast upon it a large bevel gear 9 through which the governor shaft 10 is driven by pinion 10^a, permanently engaged with said gear. The crank and gear casing is intended to be bolted or otherwise supported on the main casing of the engine. The pump shaft is required to be driven from the countershaft of the engine or some equivalent part, in a certain definite relation to the angular position of the engine crank shaft; that is to say, it is necessary that the pumping strokes of fuel shall be timed in proper phase with the working strokes of the engine pistons. At the same time when starting the engine it is desirable to work the pump by hand, or otherwise independently of the engine and out of phase therewith, and for this purpose it is necessary to disconnect the pump shaft from the engine. When the parts have been thus uncoupled it is further necessary that they be restored again to proper relative positions quickly and as soon as the engine gets under way, so that the pump will thereafter work in proper phase with the engine.

The means for independently driving the pump comprises a crank-operated bevel pinion 11 (Figs. 2 and 3) slidingly journaled in the gear casing 8 and adapted to be pushed into engagement with the large bevel

9, the pinion being held in or out of engagement by means of the detent bolt 12 shown in Fig. 3.

The gearing whereby the pump shaft may be driven by the engine in its normal operation, uncoupled for manual operation, and then recoupled in proper phase with the crank shaft, constitutes the subject of this invention and such gearing comprises a sliding spur gear 13 permanently meshing with a gear 14 on the engine countershaft 15, by which it is constantly driven so long as the engine is running. The sliding gear is idly mounted on a long boss 9′ of the hub of the bevel gear 9, which gear is fast on the pump shaft as above stated, or the said sliding gear 13 may be mounted directly on the shaft 7 so as to slide thereon, if so desired. The proximate faces of the bevel gear 9, and sliding gear 13, are respectively formed or provided with complementary clutch faces 16 and 17 shown in Figs. 4 and 5. These clutch faces or members are formed in the present instance of flat circular disks, fastened by screws, to their respective gears, and one disk is provided with a transverse rib 18 which has its axis slightly off center, while the other has a corresponding groove 19 similarly disposed off center. The eccentric position of the rib and groove is indicated in Fig. 5. A coil spring 20 confined between the back side of the sliding gear 13 and the cap plate 21 which is secured to the end of shaft 7, tends to urge the clutch members together. The rib will not engage in the groove, however, until the two members are in a position, in which the rib and groove are both eccentric on the same side and parallel to each other, the eccentricity of the rib and groove causing the clutch members to engage always in the same relative position. When so engaged the bevel gear and the sliding gear are positively interlocked in that relation, that is to say, neither can be rotated independently of the other in either direction. In this condition the engine crank-shaft and the pumping-shaft are in their proper working relation, which relation is maintained under all conditions of operation, it being impossible for the fuel pump to lead or float ahead of the engine, as might otherwise be the case on such occasions, for example, as when the engine is slowed down under an increase of load. To facilitate the engagement of the rib and groove of the complementary clutch faces, the edges of each may be slightly sloped as indicated.

The clutch faces are disengaged by shifting the sliding gear 13 against the pressure of the spring and for this purpose the said gear is supplied with a swiveled handle 22 projecting to the exterior of the casing 8 and arranged to be grasped by the operator. In the form herein shown the swiveled handle is intended to be applied to existing machines and is therefore made for attachment to the sliding gears thereof with the least possible alteration of the same, but it will be apparent that the handle or its equivalent means may be embodied in different forms and serve as a shifting means for the gear in various manners. In the form shown, it comprises a bolt 23 tapped into the rear face of the gear near its center, and a sleeve 24 swiveled to the bolt by means of the pin 25, working in a slot in the sleeve. The free end of the sleeve is formed as a handle which overhangs the cap plate 21 and projects through an annular opening between the cap plate 21 and the surrounding wall of the casing, in which annular opening the handle revolves. The sleeve is also provided with a flat or cut away area which is so arrangd that it is adjacent to the edge of the cap plate when the clutch is locked, and at such time keeps the sleeve from turning on the bolt as shown in Figs. 7 and 11. The flattened area 26 communicates at its inward end with a transverse or arcuate slot 27 cut in the sleeve and extending about half way around the same. The slot is of sufficient width to accommodate the edge of the cap plate so that when the gear 13 has been withdrawn from driving position, it may be secured in that position by turning the sleeve until the slot passes over the edge of the plate, the outer margin of the slot forming a radial shoulder which engages the edge of the cap plate as a fixed abutment to hold the gear against the force of the spring 20, as clearly shown in Figs. 2, 6 and 9.

In the operation of the foregoing apparatus, when it is desired to start the engine, the clutch faces are separated by means of the handle in obvious manner, so that the pumping apparatus is thereby disconnected from the engine. A turn of the handle will then lock the parts in this condition. The pump-shaft is then operated forwardly, by means of the crank and pinion 11, until a proper charge of fuel has been thereby injected into one of the engine cylinders, and the engine has started up its own motion, whereupon the handle is released, and under the pressure of the spring the clutch members enter again into their interlocking engagement. Such engagement does not take place however until the sliding gear assumes a predetermined position with respect to the bevel gear of the pump shaft, in which position the engine and pump are in proper working phase with each other, as above described.

Having described my invention, what I claim and desire to secure by United States Letters Patent is:

1. The combination in an internal combustion engine having a fuel pump and

gearing through which said pump is normally driven by the engine, of means for independently driving said pump, a clutch included in said gearing comprising positively interlocking clutch members, adapted to interlock against movement in either direction, a spring for closing said members and means revolving with one of said members for holding said clutch members open.

2. In an internal combustion engine having a fuel pump and gearing whereby said pump is driven from the crank-shaft, the combination with a clutch included in said gearing, comprising clutch members adapted to form a driving connection interlocked against relative movement in either direction, between said pump and crank-shaft in a predetermined mutual relation, the movable clutch member being provided with a handle for separating it from the fixed clutch member and also with means for automatically restoring it to interlocking position, and independent means for driving said pump.

3. In an internal combustion engine having a fuel pump and gearing whereby the same is driven from the crank-shaft, the combination with a sliding gear included in said gearing and being shiftable into and out of driving engagement with said pump, the shifting gear being provided with manually operable means for shifting it out of driving engagement with the pump and also with means for automatically restoring it to driving engagement and means for driving said pump independently of said gear shifting means.

4. In an internal combustion engine having a fuel pump and gearing whereby the same is driven from the crank-shaft, the combination with a positively interlocking spring pressed clutch included in said gearing and automatically forming as it becomes engaged a positively interlocked driving connection for said pump in a predetermined invariable relation with respect to the said crank-shaft, means for holding said clutch in opened or disconnected condition, and means for independently driving said pump.

5. In an internal combustion engine having a fuel pump and gearing whereby the same is driven by the crank-shaft, the combination of a clutch included in said gearing, adapted for determining and maintaining a definite relative angular position of said pump and crank-shaft, a swiveled locking handle for opening said clutch, means coöperating therewith to lock said clutch in its opened condition, and means for independently driving said pump.

6. The combination in an internal combustion engine having a fuel pump and gearing through which said pump is normally driven by the engine, of means for independently driving said pump, a clutch included in said gearing comprising clutch members adapted to positively interlock against relative movement in either direction and in a single fixed relation only, a spring urging the movable clutch member toward the fixed member, means for separating and holding said clutch members disengaged, and manually operable means for releasing said holding means to permit said clutch members to automatically interlock in the said relation.

7. In an internal combustion engine having a fuel pump and gearing through which the same is normally driven by the engine, the combination of a clutch included in said gearing and formed of clutch members bearing eccentrically thereon an interlocking rib and groove respectively, a spring urging them toward clutching position, devices for locking them in open position, and gearing for independently driving the said pump.

In testimony whereof, I have signed my name to the specification in the presence of two subscribing witnesses.

GLENNA E. BOWEN.

Witnesses:

ROBERT O. KUHN,

C. B. GARRETT.