

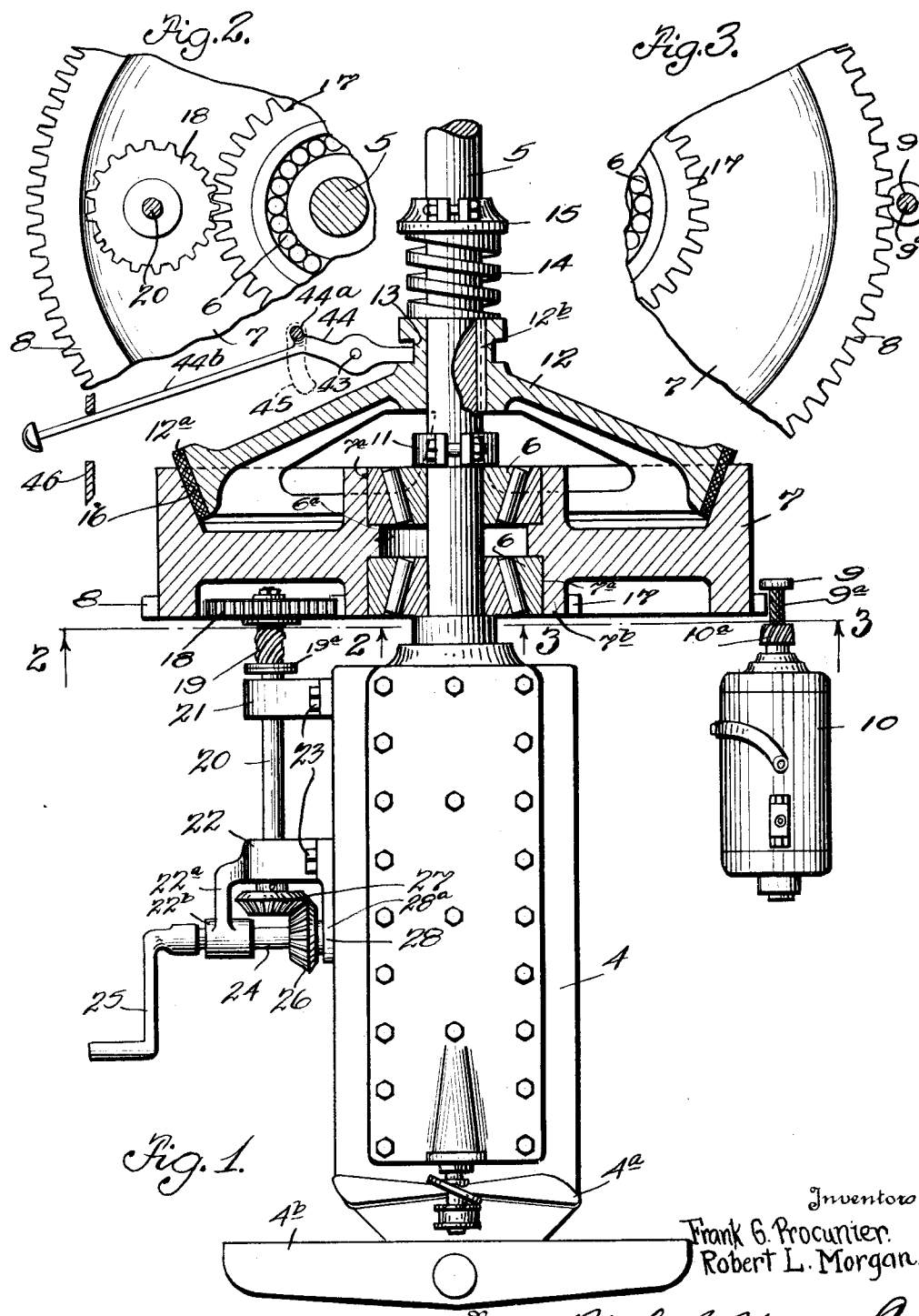
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ENGINE STARTING DEVICE

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# UNITED STATES PATENT OFFICE

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## ENGINE STARTING DEVICE

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This invention relates to starters for internal combustion engines, more particularly to engines having a high compression, as Diesel engines, though applicable to all other types of explosive engines.

An object of this invention is to provide means for starting internal combustion engines.

Another object is to provide means for starting internal combustion engines having a high compression.

Another object is to provide means for starting internal combustion engines in cold weather when the low temperature has increased the viscosity of the engine lubricants and caused the engine to be "stiff".

Still another object is to provide a starting means for internal combustion engines that subjects the starting motor to less strain.

A further object is to provide means for operating the starting motor of an internal combustion engine on a minimum amount of electrical current, thus permitting starting when the battery is in a "run down" state.

Another object is to provide means by which the labor of cranking an internal combustion engine by hand is reduced to the minimum.

Another object is to provide means for stopping the engine without cutting off the ignition or fuel.

These and other objects will be obtained by certain novel features of construction, combination and arrangement, and certain modes of operation can be readily seen and appreciated by those skilled in the art upon reference to the accompanying drawings in connection with the detailed description to follow.

In the drawings:

Figure 1 is a plan view of an internal combustion engine and starter assembly with a sectional view of the flywheel and clutch.

Figure 2 is a fragmentary view of the flywheel taken on line 2—2 of Figure 1, showing means by which said wheel engages the hand cranking mechanism.

Figure 3 is fragmentary view of the flywheel taken on line 3—3 of Figure 1 showing

the engagement of the starter motor with the flywheel.

The usual internal combustion engine 4, provided with the usual fan 4<sup>a</sup> and the radiator 4<sup>b</sup>, is shown in Figure 1. It is also provided with a crank shaft 5 which differs from the ordinary crank shaft as will be shown later. The flywheel 7 is rotatably mounted on the crank shaft 5 by two roller bearings 6,—said bearings 6 being seated in the enlarged axial bore 7<sup>a</sup> of the flywheel 7 on either side of a centrally located annular rib 6<sup>a</sup> of said bore 7<sup>a</sup>. The flywheel 7 is kept from reciprocating movement on the shaft 5 and the bearings 6 are held in place by means of a stop 11 which is in the form of an adjustable and removable collar. From the above it will be readily seen that the flywheel 7 is capable of free and easy rotation on the crank shaft 5 while at the same time it is incapable of any reciprocating movement.

The flywheel 7 is further equipped on its forward periphery with the usual ring gear 8 for engagement with the pinion gear 10<sup>a</sup> of the starter motor 10. Another ring gear 17 is mounted on the periphery of the forwardly located hub 7<sup>b</sup> of the flywheel 7 for engagement with the pinion gear 18 of the hand cranking means to be described later.

The rear of the flywheel 7 is concave in shape and forms a clutch receiving cup 16 which frictionally engages the leather or other frictional surface 12<sup>a</sup> of the clutch 12. The clutch 12 is of usual "spider" form and is slidably but non-rotatably mounted on the crank shaft 5 at 12<sup>b</sup>. A helical spring 14 normally holds the clutch 12 in engagement with the flywheel 7 although suitable lever control means 44, pivoted as at 43, and having an operating arm 44<sup>b</sup> extending laterally through the side wall 46 of the chassis and having a second operating arm 44<sup>a</sup> extending vertically through the arcual slot 45 of the floor board is provided for engagement in the circumferential groove 13 of the clutch 12 for disengaging the clutch 12 from the flywheel 7 by sliding said clutch 12 along the shaft 5 against the action of the spring 14. The tension of the spring 14 is regulated and the

spring 14 is held in its proper position by a stop 15 in the form of an adjustable collar which encircles the shaft 5. From the above it is readily seen that in its normal forward position the clutch 12 will be frictionally engaged with the flywheel 7 to cause said flywheel 7 to rotate as a part of the crank shaft 5.

The hand cranking means consist of a crank 25 removably mounted on the lateral shaft 24,—said shaft 24 being rotatably held in place by the bracket sleeve 22<sup>b</sup> of the frame 22<sup>a</sup> and the socketed extension 28<sup>a</sup> of the base plate 28 of said frame 22<sup>a</sup>. Rigidly mounted on said shaft 24 is a bevel gear 26 which engages the teeth of a corresponding bevel gear 27 which is keyed on the shaft 20. The shaft 20 is at right angles to the shaft 24 and is parallel to the crank shaft 5. Said shaft 20 is rotatably mounted near its forward extremity in the bearing 22 of the frame 22<sup>a</sup> and near its rear extremity in the bearing 21. Both the bushing frame 22<sup>a</sup> and the bushing 21 are securely fastened to the engine 4 by bolts 23.

Secured to the rear end of the shaft 20 is the pinion gear 18 which engages the ring gear 17 on the hub 7<sup>b</sup> of the flywheel 7.

Both the pinion gears 18 and 10<sup>a</sup>, of the hand crank and starter motor respectively, are arranged to operatively engage and drive flywheel 7 when crank 25 or motor 10 is actuated. For instance shaft 20 may have threaded means 19 for advancing its gear 18 into driving engagement with ring gear 17. The same applies to the gear 10<sup>a</sup> on motor operated shaft 9<sup>a</sup> having the end stop 9. Either gear 10<sup>a</sup>, 18 will be held in said contact with its flywheel ring gear until the speed of the flywheel 7 has been increased (by the starting of the engine 4) to a rate in excess of that of the particular gear 18 or 10<sup>a</sup>, at which time it is automatically forced back along the helical ribs 19 or 9<sup>a</sup> until out of mesh with the ring gear. Thus it is readily seen that the disengagement of the starting mediums is simultaneous with the starting of the engine 4.

In operation the clutch 12 is disengaged by being slid backward along the crank shaft 5 (means not shown) against the action of the spring 14. The starter motor 10 is then set in operation by any suitable means and the pinion gear 10<sup>a</sup> advances and engages the teeth of the ring gear 8 of the flywheel 7 in the usual manner. As the clutch 12 is disengaged the flywheel 7 is freely rotatable on the crank shaft 5 and under the influence of the starter motor 10 rotates very rapidly. When the operator has decided that the flywheel 7 has reached a high enough degree of momentum he releases the clutch 12 and the action of the spring 14 forces said clutch 12 into frictional contact with the clutch-receiving cup 16 of the flywheel 7. The momentum

of the flywheel 7 is now so great that, aided by the action of the starter motor 10, it easily "spins" the most refractory engine and insures the quick starting of the engine under all conditions,—the bulk of the "spinning" being borne by the momentum of the flywheel 7 and the action of the starter motor 10 being merely supplementary.

If, for any reason, the starter motor 10 is inoperative the engine 4 is cranked by hand in the following manner. The crank 25 is fitted over the end of the shaft 24,—the clutch 12 is disengaged as when the starter motor 10 is used and the crank 25 is turned rapidly,—an operation easy to perform on account of the freedom with which the flywheel 7 rotates on the crank shaft 5. When the right degree of momentum has been attained by the flywheel 7 the clutch 12 is thrown in as before and the impetus the flywheel 7 has attained serves to again rotate the crank shaft 5 and "spin" the engine 4 until said engine 4 starts. It will be noted that the pinion gear 18 of the hand-cranking means is of a larger size than the corresponding pinion 10<sup>a</sup> of the starter motor 10 and hence it is obvious that fewer revolutions of the crank 25 will be necessary to revolve the flywheel 7.

We claim:

1. In a device for starting an internal combustion engine, comprising a crank shaft, a flywheel rotatably mounted thereon, selective means operable for engaging the wheel to spin the latter, and a clutch engageable by one surface of the wheel, whereby the clutch may connect the flywheel with the shaft.

2. In a device for starting an internal combustion engine comprising a crank shaft, a flywheel having internal and external gears, rotatably mounted on the shaft, and means operable for selectively engaging one of the gears, and a clutch engageable by one surface of the wheel, whereby the clutch may connect the flywheel with the shaft.

3. In a device for starting an internal combustion engine, comprising a crank shaft, a flywheel having internal and external gears, rotatably mounted on the shaft, manual means for engaging said internal gear and motor means connectable with said external gearing, said manual and motor means being selectively operable for engaging the wheel to spin the latter, and a clutch engageable by one surface of the wheel, whereby the clutch may connect the flywheel with the shaft.

4. In a device for starting an internal combustion engine, comprising a crank shaft, a flywheel rotatably mounted thereon, selective means operable for engaging the wheel to spin the latter, one element of said means comprising an internal gear formed on the flywheel, an operating shaft having a pinion slidably mounted thereon interengageable

with said internal gear, a crank and pinion  
assembly for rotating said shaft, and a clutch  
engageable by the wheel, whereby the clutch  
may connect the flywheel with the shaft.

5 In testimony whereof we affix our signatures.

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