

Aug. 19, 1947.

A. LEE

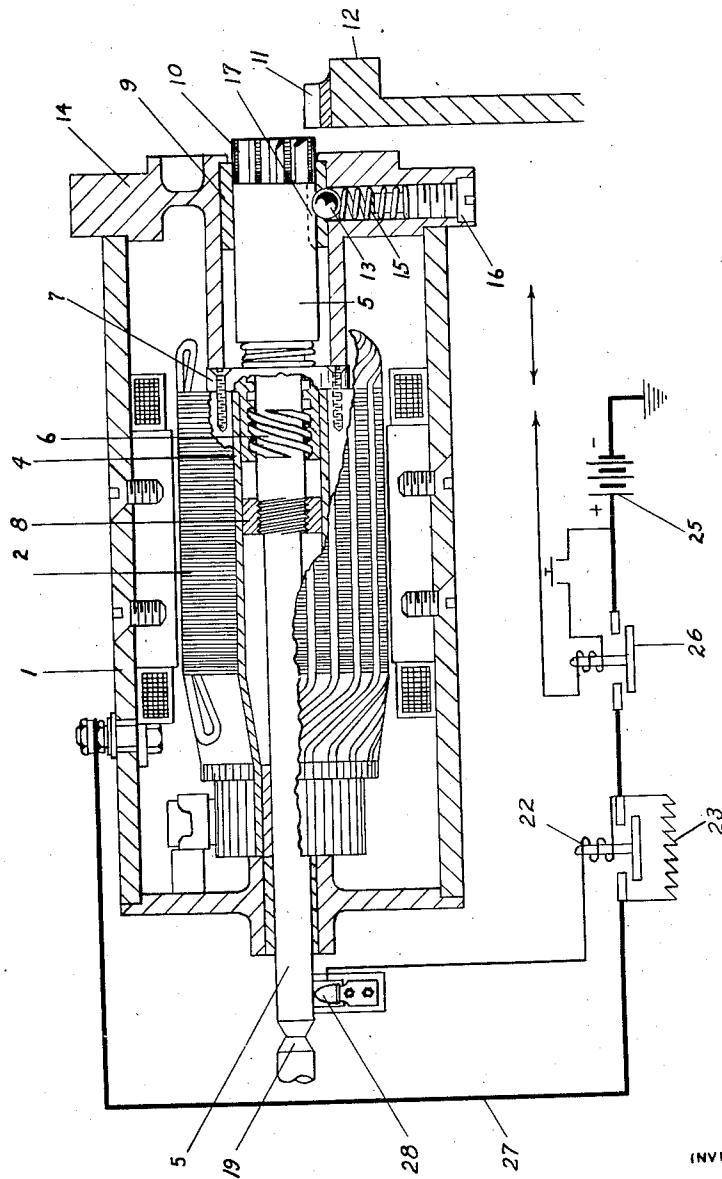
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STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES

Filed July 30, 1945

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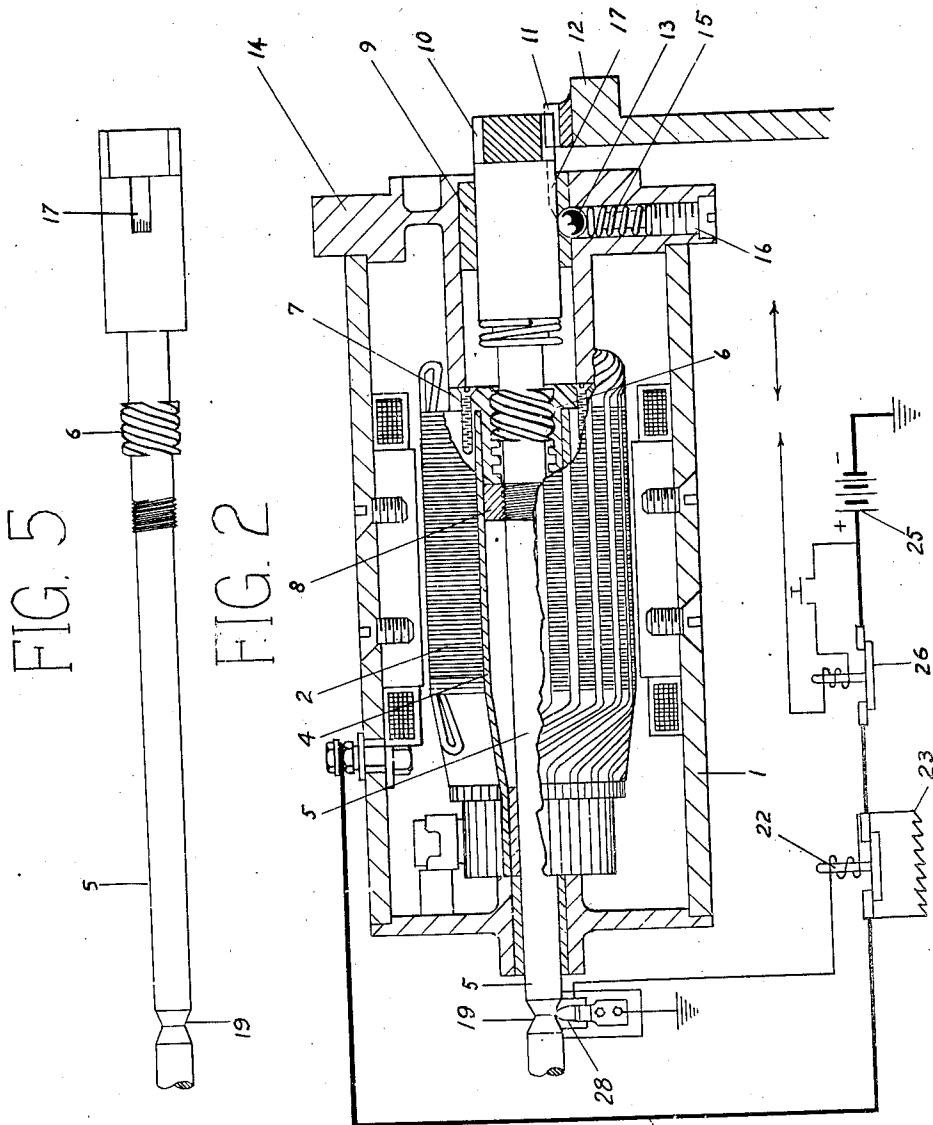
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FIG. 4

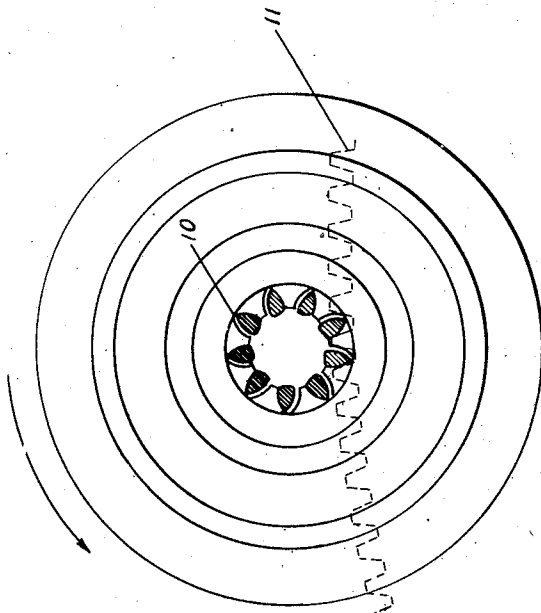
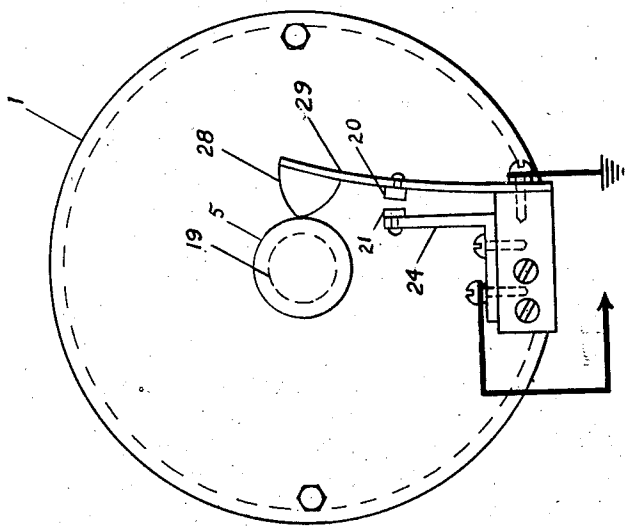


FIG. 3



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UNITED STATES PATENT OFFICE

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STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES

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Application July 30, 1945, Serial No. 607,725

8 Claims. (Cl. 290—38)

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My present invention relates to a starting device for an internal combustion engine.

The purpose of my present invention is to provide a starting device of the class above indicated which is new, simple in construction, not apt to get out of order, and very convenient and substantially automatic in its mechanical and electrical operation after the operator of the car, having the internal combustion engine, has operated the push button.

This invention relates particularly to a starting device for an internal combustion engine where upon the push button being manipulated in the proper way by the operator, the shaft bearing the pinion of the electrically operated starting motor is moved into mesh with the fly wheel ring gear and then the starting motor is automatically given full power and, thereupon rotates the fly wheel of the engine until the engine fires or begins to rotate under its own power, whereupon automatically the said pinion of the starting motor is retracted from the ring gear of the fly wheel and then the starting motor is automatically disconnected from its power, if that has not already been done by the operator ceasing to exert pressure on said push button.

Further purposes and advantages of this invention will appear from the specification and claims hereinafter set forth.

Fig. 1 is in the main a central vertical sectional view of the device with the parts in the position they occupy before the starter is operated, that is with the pinion that later engages the ring gear of the fly wheel of the combustion engine in in-operative or retracted position.

Fig. 2 is a view similar to Fig. 1 but with the advanceable shaft carrying the pinion advanced to be in mesh with the ring gear, and with both relays closed but before the shaft has been retracted.

Fig. 3 is a rear end view of the device with the shaft still in retracted position, and Fig. 4 is a front end view of the device.

Fig. 5 is an elevational view of the advanceable shaft.

Referring to the drawings in a more particular description it will be seen that my starting device is best illustrated in a construction where within a main cylindrical housing 1 there is mounted the hollow cylindrical armature 2 of the electrically operating starting motor within which armature there is located the armature tube 4. Within the armature mounting tube 4, there is centrally and longitudinally mounted the spiral-threaded advanceable shaft 5 which has

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intermediate its ends a section of rapid spiral threads 6 upon which is mounted a flanged nut 7, the flange being at the right hand end of the nut, as the parts are illustrated in Fig. 1.

Through the flange of said nut, several screws extend into the armature, whereby the nut is securely fastened to the armature 2. To the left of the rapid screw threads 6 as seen in Fig. 1, there is a stop nut 8 which limits the extent to which the flanged nut 7 can move the said shaft to the right as the parts are seen in said view. Beyond the flanged nut 7 the advanceable shaft 6 at its front end passes through the drive end bearing 9.

It will be understood that when the starting motor is energized the armature 2 with its securely attached flanged nut 7 can not move lengthwise but will rotate the flanged nut and thereby, in an obvious manner, the rapid screw-threaded spiral advanceable shaft will be advanced to the right, as the parts are shown in Fig. 1, and thereby the pinion 10 will be moved endwise to the right and ultimately into mesh with the teeth of the ring gear 11 which is a part of the fly wheel 12 of the internal combustion engine which is to be started.

The means I have shown for holding the shaft 5 from rotation as it is being advanced, is an aligning ball 13 mounted in a suitable hole in the drive end shield 14, said hole extending radially of the axis of the shaft 5 with the ball pressed inwardly by a spring 15 mounted outwardly from the ball and held in place under tension by a plug screw 16. This aligning ball 13 normally projects into a short slot 17 extending lengthwise of the shaft 5 at its pinion bearing end and the slot reaches to left to a point where the ball leaves the restraining influence of the slot when the pinion has come into full mesh with the ring gear.

It will be understood that upon the original pressing of the starting button for bringing the starting motor into operation, the current will pass from the battery 25 through the primary relay 26 and through the resistance 23 of the secondary relay 22 so that the current will be cut down to provide a reduced and controlled power for the starting motor through the main circuit 27.

It will be noted as shown in Figs. 1 and 2 that towards the left hand end of the advanceable shaft 5 there is a very obtuse encircling groove spaced away a short distance from the rubbing block 28 on arm 29. The mechanical action of this arm is best seen in the rear end view of the

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device, Fig. 3. It will be seen that the arm 29 while this device is not in action carries the rubbing block on the outer surface of the shaft 5. However, when the shaft 5 has been advanced to bring its pinion 10 into mesh with the teeth on the ring gear 11 this advancing movement of the shaft 5 has been just enough to let the rubbing block 28 of the arm 29 spring down into the encircling groove 19 which results in the electrical contact 20 on the arm 29 coming into engagement with a cooperating contact 21 on the fixed arm 24 whereby the current on the main circuit is shunted from the resistance 23 and the full current is now applied to the starting engine. This full torque or increased power of the starting motor results in continuing to rotate the pinion 10 anti-clockwise, as the device is illustrated and proceeds to rotate the ring gear 11 in mesh with said pinion with sufficient power to, in due time, start the combustion engine under its own power.

When the internal combustion engine does thus start under its own power, it gives the pinion 10 a quick spin due to the greater power and greater speed of the fly wheel when the engine is being driven under its own power and this rapid temporary rotation of the pinion 10 turns the pinion, which as has been said, is affixed thereto with the mechanical operation of the flanged nut being rotated so that the nut moves to the left on the rapid screw threads of the shaft 5 and thereby quickly withdraws the pinion 10 from contact with the ring gear 11. An immediate result of this withdrawing of the pinion 10 from the ring gear is to save the starting motor from a too fast and dangerously fast rotation from the now power driven engine. A further and simultaneous action of the rotation of the shaft 5 to its former position is to once more allow the rubbing block 28 on spring arm 29 to be pushed up by the cam action of the sloping side of the groove 19 until the rubbing block 28 is upon the general outside or regular circumference of the shaft 5 which operates to mechanically disengage the contact 20 on the arm 29 from the cooperating contact 21 on the fixed arm 29 thereby restoring the relay 22 to its original position where the resistance 23 is again interposed in the main circuit 27. Incidentally the retraction of the shaft 5 allows the ball 13 to again get into the slot 17 and function to prevent the rotation of the shaft 5 as it is being advanced next time.

It will now be seen that all the parts have been returned to their original position they had before the starting device was operated and the device is again ready to repeat the cycle of operations that has been described in detail.

What I claim as new and desire to secure by Letters Patent is:

1. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, a spring pressed ball adapted to extend into a slot in said advanceable shaft to prevent the rotation of the shaft when it is being advanced, said ball becoming

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inoperative when the shaft has been fully advanced, a preliminarily-acting electric circuit for the starting motor brought into operation by pressing the starting button whereby the advanceable shaft is advanced and the pinion brought into mesh with the ring gear, means then automatically operating for bringing into operation the full current for the starting motor whereby the engine is started and thereupon automatically the said shaft is retracted thereby disengaging the pinion from the ring gear.

2. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, a spring pressed ball adapted to extend into a slot in said advanceable shaft, to prevent the rotation of said shaft when it is being advanced, said ball becoming inoperative when the shaft has been fully advanced.

3. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, a spring pressed ball adapted to extend into a slot in said advanceable shaft to prevent the rotation of said shaft when said shaft is being advanced, said ball becoming inoperative when the shaft has been fully advanced, a preliminarily-acting electric circuit for restricted torque for the starting motor to advance the said shaft until the pinion thereof has been moved into mesh with the ring gear before the pinion is rotated with its full torque.

4. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, means preventing the rotation of the shaft when it is being advanced, wherein the means for preventing the rotation of the said shaft while it is being advanced comprise a longitudinal surface slot in the forward end of the shaft and a spring-tensioned ball mounted in said main housing and projecting into said slot, said slot ceasing at its rear end when the forward movement of the shaft has brought the said pinion into full mesh with the ring gear, whereby the engine-rotated ring gear

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rotates the said advanceable shaft and withdraws the pinion from the ring gear.

5. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, means preventing the rotation of the shaft when it is being advanced wherein the means for applying full torque to the starting motor on the pinion having come into full mesh with the ring gear comprises a pair of relatively tensioned arms carrying electrical contacts normally spaced apart by a rubbing block on one of said arms engaging the periphery of said shaft near its rear end with said shaft having an encircling depression which comes into register with said rubbing block when the shaft has been fully advanced thereby allowing said electrical contacts to come into engagement with each other and establish a circuit which cuts out a resistance theretofore cutting the current down to the controlled and reduced amount of the initially acting preliminary amount used for the advancing of its shaft, the increased amount being enough to cause the starting motor to start the engine.

6. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when the said shaft has been fully advanced, said shaft having a short length of rapid screw threads intermediate its ends, a nut fitting said rapid screw threads on the advanceable shaft and securely fastened to said armature, means preventing the rotation of the shaft when it is being advanced, wherein the means for applying full torque to the starting motor on the pinion having come into full mesh with the ring gear comprises a pair of relatively tensioned arms carrying electrical contacts normally spaced apart by a rubbing block on one of said arms engaging the periphery of said shaft near its rear end with said shaft having an encircling depression which comes into register with said rubbing block when the shaft has been fully advanced thereby allowing said electrical contacts to come into engagement with each other and establish a circuit which cuts out a resistance theretofore cutting the current down to the controlled and reduced amount of the initially acting preliminary amount used for the advancing of said shaft, the increased amount being enough to cause the starting motor to start the engine and retract the shaft so that the pinion is withdrawn from the ring gear and the said rubbing block returns to the periphery of the shaft and brings said resistance into the circuit.

7. In a starting device for an internal combustion

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engine having a ring gear on its fly wheel, a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, a movable shaft mounted within said armature carrying at its front end a pinion adapted to mesh with said ring gear on the fly wheel when said shaft has been fully advanced, said shaft having screw threads intermediate its ends, a nut fitting said screw threads on the advanceable shaft and fastened to said armature, a spring pressed ball adapted to engage a slot in said shaft to prevent the rotation of said shaft when it is being advanced, said ball becoming inoperative when said shaft has been advanced, an electric circuit having a resistance therein, whereby to provide a controlled power for the starting motor, and a spring pressed rubbing block adapted to extend into a groove in said shaft to close an electrical contact that will shunt said resistance to allow greater power to said shaft for rotating said pinion.

8. In a starting device for an internal combustion engine having a ring gear on its fly wheel, the combination of a main housing, an electrically operated starting motor mounted within said housing and having a hollow armature, an advanceable shaft mounted within said armature and carrying at its end a pinion adapted to mesh with said ring gear on the fly wheel when said shaft has been advanced, said shaft having screw threads formed thereon, a nut fitting said screw threads on said shaft and fastened to said armature, a spring pressed ball adapted to be extended into a slot formed in said shaft, whereby to prevent the rotation of said shaft when being advanced, said ball becoming inoperative when said shaft has been advanced, and electric circuit having a resistance therein for turning said shaft slowly, said shaft having a groove formed therein, and a rubbing block attached to a spring member for engaging said groove in said shaft, whereby to close an electric circuit for shunting said resistance, whereby to speed up the rotation of said shaft.

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