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MOTOR VEHICLE STARTER HOLDING MEANS

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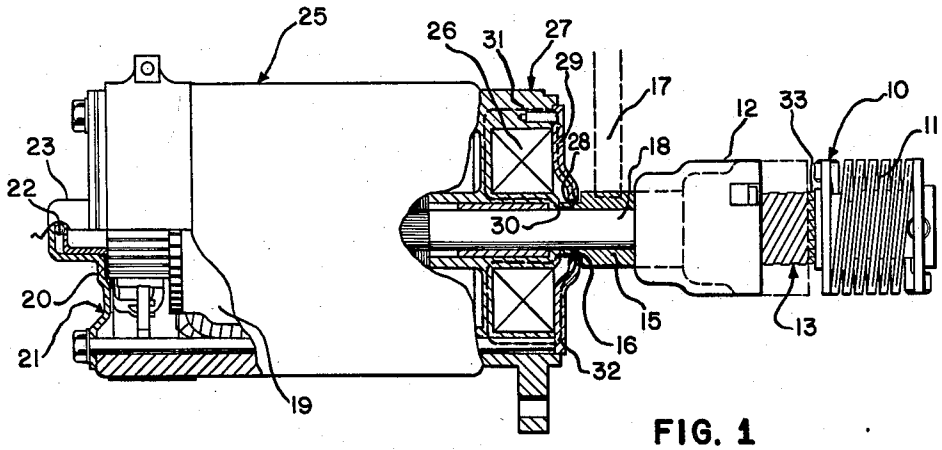


FIG. 1

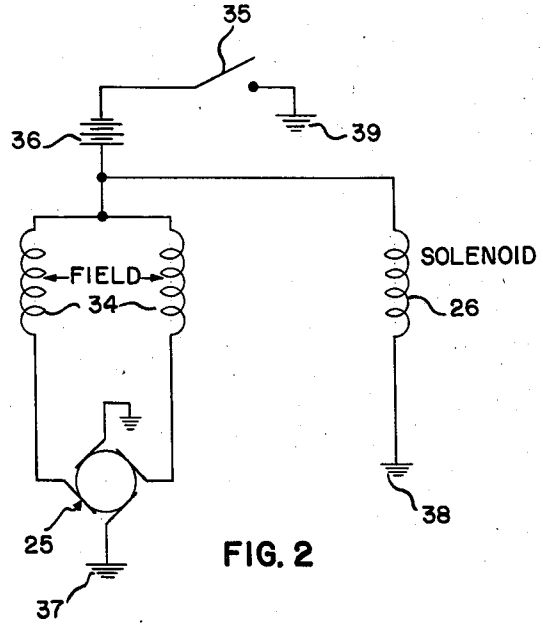


FIG. 2

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MOTOR VEHICLE STARTER HOLDING MEANS

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This invention is used in conjunction with conventional starting means to prevent starter motor disengagement from a motor vehicle engine turning means during false starts or spasmodic engine firing before the engine has started to fire regularly. This invention is used in conjunction with a Bendix drive wherein the pinion of said drive is driven by the starter motor and is engageable with the flywheel of the motor vehicle. After engagement with the flywheel the pinion drives the flywheel until the flywheel suddenly accelerates which may be caused by the firing of only one or two cylinders thereby disengaging the pinion from the fly wheel after which the engine may die. When the starting motor pinion is so disengaged it must be re-engaged with the motor vehicle flywheel before the engine can be successfully started which is not only inconvenient because of the additional time taken but constitutes a serious battery drain, especially in cold weather when such false starts are more common and said battery is under its most severe test due to the coldness and stiffness of the engine.

This invention provides means to keep the starter pinion engaged with the flywheel gear until a positive engine start has been obtained. This invention provides a low cost item capable of mass production which involves no additional mechanical linkage or latching mechanism or other means requiring precise or delicately balanced parts which are not only expensive to manufacture but difficult to maintain in operating condition.

An embodiment of this invention will now be more fully and completely described wherein reference will be made to drawings in which:

Figure 1 represents an elevational view partially cutaway of a starter motor and Bendix drive unit incorporating an embodiment of this invention; and

Figure 2 shows a schematice representation of the circuit of this embodiment.

Looking at Figure 1 as seen Bendix gear **10** having spring **11** with lead screw **13** which is fixed to armature shaft **18**. Internally threaded member **12** mates with the threads of screw **13** and is axially movable in relation thereto. Member **12** is indicated in two positions, one being dashed, to indicate this axial travel. Pinion gear **15** is fixed to member **12** and plunger **16** is an extension of and integral with pinion **15**. The lower portion of flywheel **17** is shown engaged with pinion **15** as it would be when the starting motor is in a driving or starting condition before the engine has started.

Starting motor **25** has armature **19**, commutator segments **20** and brush assembly **21**. Thrust bearing **22** is engaged between armature shaft **18** and the end of bell **23** of motor **25**. Solenoid coil **26** which comprises 306 turns of number 16 wire and draws approximately seven amperes at five volts is wound in an annular ring about armature shaft **18** in end assembly **27**. Assembly **27** is made of a ferrous material such as steel or cast iron and when solenoid **26** is energized creates a strong magnetic field between annular gap **28** between end plate **29** and plunger **16**, and annular gap **30** between plunger

16 and end assembly **27**. Gap **28** is preferably between .015 and .100 inch while gap **30** is .005 inch but these dimensions are not limiting of this invention.

In Figure 2 is shown a schematic representation of the connection of the solenoid coil in relation to the field windings **34** of series motor **25**. When switch **35** is closed, current from battery **36** flows through field windings **34** and motor **25** to ground **37** in one branch of the parallel circuit and also through solenoid **26** to ground **38** in the other branch. In this manner full battery potential is across coil **26** and creates a strong toroidal field in gaps **28** and **30**.

In operation of this embodiment of this invention, current is caused to flow through the field and armature of motor **25** by conventional starting means therefore imparting a rotary motion to armature shaft **18**. Lead screw **13**, since it is fixed to armature shaft **18**, is rotated therewith but member **12** being of a heavy construction has a strong tendency to remain stationary thereby rotating at a speed much less than that of screw **13**. Leftwardly linear motion is imparted to member **12** due to this difference in rotative speeds and pinion **15** comes into engagement with flywheel **17** causing wheel **17** to turn. Also plunger **16** enters end plate **29** and the magnetic circuit indicated by dashed lines **31**, **32** tends to hold plunger **16** along with pinion **15** in an engaged position while current is flowing through the coil or while the starter motor is being energized. Thrust bearing **22** allows shaft **18** to turn freely under the force exerted by solenoid **26**. In this manner it will take more than a false start or spasmodic firing in the engine cylinders to disengage pinion **15** by turning member **12** at a higher rate than lead screw **13** thereby giving its linear motion to the right. When the engine is self-sustaining plunger **16** will be held in engagement turning member **12** and screw **13** at a rate faster than armature shaft **18** and this ls permitted by ratchet gear **33** which permits relative rotation between screw **13** and shaft **18** in one direction but not the other. By varying gaps **28**, **30** or solenoid **26** plunger **16** may be disengaged shortly after positive engine starting thereby keeping ratcheting of gear **33** to a minimum. When the starter motor is de-energized the solenoid is deenergized thereby completely disengaging pinion **15** as flywheel **17** will cause pinion **15** to turn faster than screw **13** imparting rightward motion to pinion **15**.

It will be understood that the invention is not to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention, as defined in the appended claims.

What is claimed is:

1. In a starting motor assembly for an internal combustion engine, a motor frame, an armature shaft rotatably mounted in said frame, an armature mounted on said shaft, a pinion gear mounted on said armature shaft, mechanical means engaging said pinion gear for moving said pinion into engagement with an engine turning means when said armature is energized, a solenoid positioned in the motor frame in spaced coaxial relation to said armature shaft and at the end of the frame adjacent said pinion gear, an end plate having an opened central portion affixed to said frame, said pinion gear having an extension adapted to slide on said armature shaft into said opened central portion of the end plate when said pinion gear moves into engagement with said engine turning means, said solenoid creating a magnetic field when energized to hold the extension of the pinion gear in the opened central portion of the end plate and the pinion gear in engagement with said engine turning means during starter motor operation.

2. In a starting motor assembly for an internal com-

bustion engine, a motor frame, an armature shaft rotatably mounted in said frame, an armature mounted on said shaft, a pinion gear slidably mounted on said armature shaft, a threaded member mounted on said armature shaft, an internally threaded member having a large rotational inertia fixed to said pinion gear and mounted on said threaded member for moving said pinion gear into engagement with an engine turning means when said armature is energized and said armature shaft rotated, a solenoid positioned in the motor frame in spaced coaxial relation to said armature shaft and at the end of the frame adjacent said pinion gear, an end plate having an opened central portion affixed to said frame, said pinion gear having an extension adapted to move axially with said pinion gear into said opened central portion of the end plate when said pinion moves into engagement with said engine turning, said solenoid creating a magnetic field when energized to hold the extension of the pinion gear in the opened central portion of the end plate and the pinion gear in engagement with said engine turning means during starter motor operation.

3. A starting motor assembly for an internal combustion engine comprising, a motor frame, motor windings, an armature shaft rotatably mounted in said frame, an armature including a commutator fixed to said armature shaft, said motor frame including a first end plate having a bell for receiving the end of said armature shaft and a second end plate having an opened outset central portion through which said armature shaft passes, a pinion gear slidably mounted on the armature shaft, an inertia member fixed to said pinion gear mounted on said shaft for rotational and axial movement with respect thereto for moving said pinion gear into engagement with an engine turning means when said armature is energized and said armature shaft rotated, a solenoid connected across the motor windings mounted in said frame against said second end plate and in spaced coaxial relation with respect to said armature shaft for creating a magnetic field about the opened outset portion of the second end plate, said pinion gear having an extension which moves into said magnetic field when said pinion gear moves into engagement with the engine turning means, said magnetic field holding the pinion gear engaged wtih the engine turning means during starting motor actuation, a thrust bearing positioned between the bell of the first end plate and the end of the armature shaft adjacent the commutator for receiving the thrust on the armature shaft generated by the force of the magnetic field acting on the pinion gear extension.

4. In a starter motor assembly for an internal combustion engine, a starter motor frame, an armature shaft rotatably mounted in said frame, an armature mounted on said shaft, a pinion gear mounted on said armature shaft, mechanical means engaging said pinion gear for moving said pinion gear into engagement with an engine turning means when said armature is energized, a solenoid positioned around said armature shaft and at the end of the frame adjacent said pinion gear, said solenoid when energized creating a magnetic field acting on said pinion gear to hold said pinion gear in engagement with said engine turning means during starter motor operation.

5. In a starter motor assembly for an internal combustion engine, a starter motor frame, an armature shaft rotatably mounted in said frame, an armature mounted on said shaft, a pinion gear slidably mounted on said armature shaft, a threaded member mounted on said armature shaft, an internally threaded member having large rotational inertia affixed to said pinion gear and mounted on said threaded member for moving said pinion gear into engagement with an engine turning means when said armature is energized and said armature shaft is rotated, a solenoid positioned around said armature shaft and at the end of the frame adjacent said pinion gear, said solenoid when energized creating a magnetic field acting on said pinion gear to hold said pinion gear in engagement with said engine turning means during starter motor operation.

6. In a starter motor assembly, a starter motor frame, a power shaft mounted in said frame, a pinion gear mounted on said power shaft, mechanical means actuated by said power shaft and engaging said pinion gear for moving said pinion gear into engagement with an engine turning means when said power shaft is rotated, electromagnetic means positioned at the end of said starting motor frame adjacent said pinion gear and creating a magnetic field when energized, said pinoin gear moving into said magnetic field as it moves into engagement with said engine turning means, said magnetic field holding said pinion gear in engagement with said engine turning means during starter motor operation.

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