

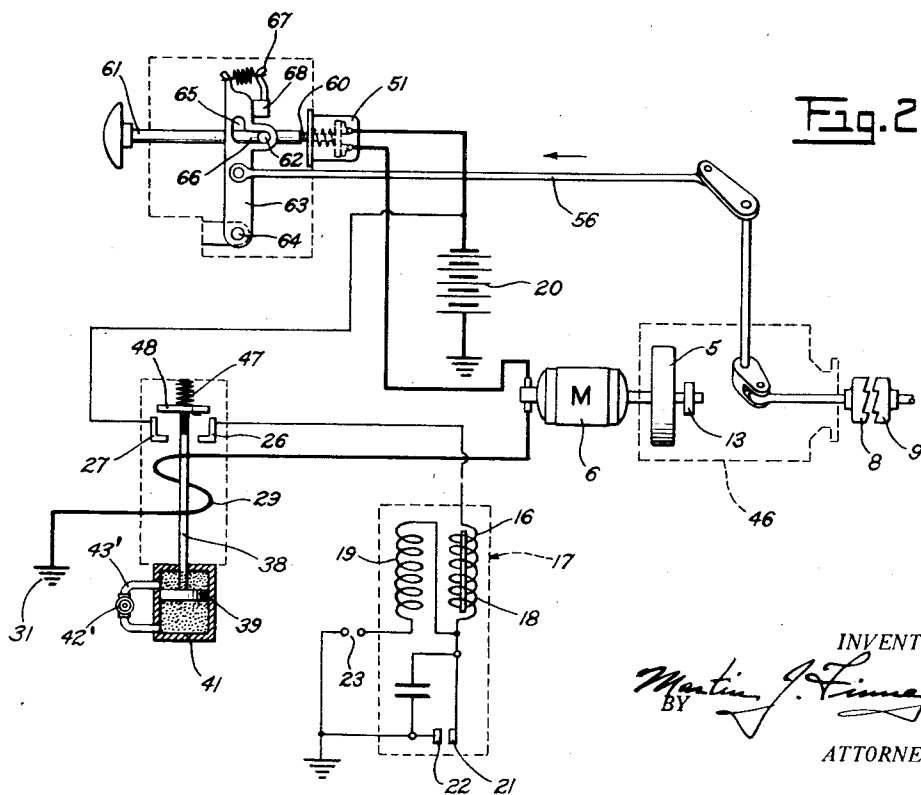
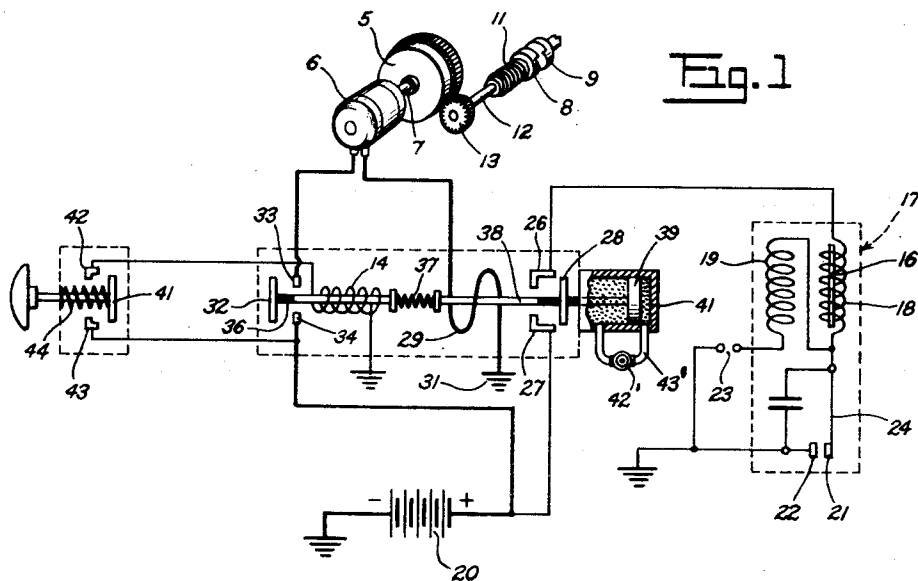
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ENGINE STARTING MECHANISM

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ENGINE STARTING MECHANISM

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This invention relates to engine starting mechanisms, and more particularly to starters for engines of the internal combustion type.

5 An object is to provide supplemental electrical means for rendering starting of the engine by a mechanical starting mechanism less difficult, such means being operable as a direct consequence of operation of the mechanical starting mechanism.

10 A further object is to provide means for operating said supplemental means as a direct consequence of the operation of the means for producing rotation of the mechanical cranking means, the said supplemental means being thereby made operative to facilitate proper ignition of the firing charge in the combustion chamber or chambers of the engine to be started.

15 A further object is to provide means of the foregoing character which shall continue to operate for a predetermined interval after rotation producing means has terminated.

20 Still another object of the invention is to provide novel inter-connected electrical means for operating both the ignition facilitating means and the rotation producing means.

25 Another object is to produce apparatus of the foregoing character which is of relatively simple construction, easily manipulable, and positive in its operation.

In the drawing:

30 Figs. 1 and 2 are diagrams, partly schematic and partly mechanical, of two embodiments of the invention.

35 In Fig. 1 the mechanical cranking means is shown as including a flywheel 5 constituting an inertia element, an electric motor 6 directly connectable to the flywheel shaft 7 to accelerate the flywheel, and an engine engaging member 8 automatically meshable with the engine member 9 by a time-delay screw mechanism 11 rotatable with shaft 12 and preferably identical in structure, and method of operation, with that illustrated in Patent No. 2,038,181 granted to Raymond P. Lansing on April 21, 1936, and particularly in Fig. 2 of said patent. The reduction gear train between flywheel 5 and screw 11 is indicated diagrammatically at 13.

40 In both Figs. 1 and 2 there is indicated a circuit interrupting device commonly known as a vibrator, and means for actuating the said vibrator. Such vibrator, as shown in Fig. 1, contains a core or plunger 16 adapted to be actuated by the creation of magnetic forces in the coil 17, such coil consisting of the usual primary and secondary windings 18 and 19, the construction being such that upon each interruption of the

circuit at the contacts 21 and 22, the resulting break-down of the magnetic field of the primary winding 18 causes the passage by induction of a relatively high potential current through the secondary winding 19, thereby creating a jump-over spark at the ignition points in the engine cylinder represented at 23 in the schematic drawing, such spark being repeated at each vibration of the arm 24. The result is a series of rapidly repeated sparks, the vibrations being so rapid that the effect is practically a continuous spark for a length of time sufficient to produce combustion of the charge in the engine cylinder and hence a starting of the engine under its own power.

15 The novel means for causing the operation of the foregoing ignition facilitating means as a direct consequence of the operation of the motor energizing means comprises an electric circuit to the vibrator, adapted to be closed only in the event of, and in response to, energization of the inertia starter motor 6. As shown in Fig. 1 this condition of dependency, or "cause and effect", is achieved by interposing a pair of normally separated contacts 26 and 27 in the circuit from the source 20 to the vibrator coil 17, the said contacts 26, 27 being bridgable by contact plate 28 only in the event of, and in response to, flow of current through the windings of inertia starting motor 6. The current flowing through said motor 6 will also flow through solenoid winding 29 on its way to ground 31; and such flow is initiated by closure of contact plate 32 against contacts 33 and 34 of the motor circuit from battery 20. This contact plate 32 is insulatedly mounted on plunger 36 within solenoid winding 14, and is normally held out of engagement—as is also contact plate 28—by a spring 37 interposed between the adjacent ends of plungers 36 and 38, the latter being the movable core of switch solenoid winding 29, previously described. A manually closable switch 41 connects winding 14 with battery 20, when moved to engage contacts 42, 43, from which it is normally separated by spring 44.

45 Solenoid plunger 38 of Fig. 2 corresponds to plunger 36 of Fig. 1, and in each case it terminates in a piston 39 movable at a slow rate within a dash-pot cylinder 41, the rate of retardation being regulable by adjustment of valve 42' in by-pass 43', connecting the two chambers, of which the piston 39 constitutes the movable wall. A suitable retarding fluid occupies the chambers of the dash-pot, and its restricted flow back and forth retards movement of plunger 38, and hence retards closure of contacts 26 and 27. Thus the moment of energization of

vibrator coil 17 is adjustably delayed beyond the moment of first flow of current through motor windings 6 (Fig. 1 or Fig. 2) and solenoid windings 29 (Fig. 1 or Fig. 2); likewise (and due to the dash-pot action) the re-opening of the switch (28 in Fig. 1; 48 in Fig. 2) is correspondingly delayed beyond the moment of termination of flow of current through the motor 6.

In Fig. 2 such current flow occurs directly in response to closure of switch 51, actuated by operating means which are preferably identical with those illustrated at 56, and 60 to 69 inclusive, in the drawings of Patent No. 1,786,118 granted to Raymond P. Lansing on December 23, 1930, the said means also controlling the time of movement of the engine engaging member 8 into engagement with engine member 9. The inertia starter indicated diagrammatically at 46 in Fig. 2 may be identical with that shown in detail in Fig. 1 of said Lansing Patent No. 1,786,118. A tension spring 47 normally holds contact plate 48 out of contact with members 26 and 27 in Fig. 2.

The operation of the embodiment of Fig. 1 will be apparent from the following description of the Fig. 2 embodiment:

Describing a cycle of operation of the Fig. 2 embodiment, and beginning with the parts in the normal position shown in Fig. 2, the operator will first thrust the plunger 61 inwardly, whereupon the switch 51 is operated and the motor 6 and coil 29 are energized.

Energization of the motor 6 produces acceleration of the flywheel 5, while energization of the coil 29 (preferably of the type indicated at 11 in the Maurer Patent No. 1,909,415) produces a retarded descent of the bridging member 49 into engagement with contact plates 26 and 27. When such engagement occurs current flows from the source 20 through the bridging plate 48 to the ignition coils 16 and 19 and results in production of a plurality of sparks within the combustion chamber or chambers of the engine, to facilitate starting thereof as soon as the engine crankshaft begins to turn over; but this turning over, of course, does not begin until the operator draws the plunger 61 outwardly whereupon the switch 51 will be permitted to open and the lever 63 (which had heretofore remained in its normal position notwithstanding the movement of the plunger 61 inwardly, due to the pin and slot construction shown at 62 and 66 in the said Patent No. 1,786,118) will be actuated against the tension of the spring 67. As a result, the rod 56 will be shifted longitudinally, thereby bringing the clutch jaws 8 and 9 into engagement. The engine member will thereby be rotated by the energy stored in flywheel 5 and the engine will be cranked. When the engine operates under its own power, the driving member will be automatically disengaged through the conventional screw action between the screw shaft and nut (not shown) as in Patent No. 1,786,118.

During this cranking operation (with either the embodiment of Fig. 1 or Fig. 2) booster coil 16 remains energized, due to the "carry-over" effect of dash-pot 41 upon the switch 48, which effect delays the re-opening of the switch for a predetermined interval after termination of current flow through motor 6, the switch contacts 26 and 27 being elongated, as indicated, to permit this prolongation of the closed circuit condition.

It will be seen that, in each embodiment, energization of the vibration coil is a direct (al-

though delayed) consequence of flow of current through motor windings 6.

What is claimed is:

1. The combination with an inertia starting mechanism and clutch for starting an engine by kinetic energy stored in said mechanism, of ignition current supply means including a source of current and an induction coil for supplying ignition current to the engine, an electric motor for energizing said inertia starting mechanism, an electromagnet controlling energization of said induction coil, and means for causing current to flow from said source to said motor and electromagnet in sequence, prior to movement of said clutch to operative engine-starting position.
2. The combination with an inertia starting mechanism and ignition current supply means including a source of current and an induction coil for supplying ignition current to the engine, an electric motor for energizing said inertia starting mechanism, an electromagnet controlling energization of said induction coil, and means for causing current to flow from said source to said motor and electromagnet in sequence.
3. The combination with an inertia starting mechanism and ignition current supply means including a source of current for supplying ignition current to the engine, an electric motor for energizing said inertia starting mechanism, an electromagnet controlling operation of said ignition current supply means, and means for causing current to flow from said source to said motor and electromagnet in sequence.
4. The combination with an ignition current generator of a flywheel and rotating means therefor including an electric motor, a source of current, a circuit from said source to said motor, said circuit including a normally open switch, and means responsive to closure of said switch to cause current to flow from said source to said ignition current generator said last named means including an electromagnetically actuated switch in series with said ignition current generator and closable by the magnetic action resulting from flow of current through said motor.
5. The combination with an ignition current generator of a flywheel and rotating means therefor including an electric motor, a source of current, a circuit from said source to said motor, said circuit including a normally open switch, and means responsive to closure of said switch to cause current to flow from said source to said ignition current generator said last named means including an electromagnetically actuated switch in series with said ignition current generator and closable by the magnetic action resulting from flow of current through said motor and means for retarding the effectiveness of said magnetic action to a predetermined degree.
6. The combination with an ignition current generator of a flywheel and rotating means therefor including an electric motor, a source of current, a circuit from said source to said motor, said circuit including a normally open switch, and means responsive to closure of said switch to cause current to flow from said source to said ignition current generator said last named means including an electromagnetically actuated switch in series with said ignition current generator and closable by the magnetic action resulting from flow of current through said motor and means acting upon said second-named switch to open it after cessation of said current flow.
7. The combination with an ignition current

generator of a flywheel and rotating means there-
for including an electric motor, a source of cur-
rent, a circuit from said source to said motor,
said circuit including a normally open switch,
5 and means responsive to closure of said switch
to cause current to flow from said source to
said ignition current generator said last named
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switch in series with said ignition current gener-

ator and closable by the magnetic action re-
sulting from flow of current through said motor
and means acting upon said second-named switch
to open it after cessation of said current flow and
means for delaying the effectiveness of said last-
named means for an interval of predetermined
length.

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