

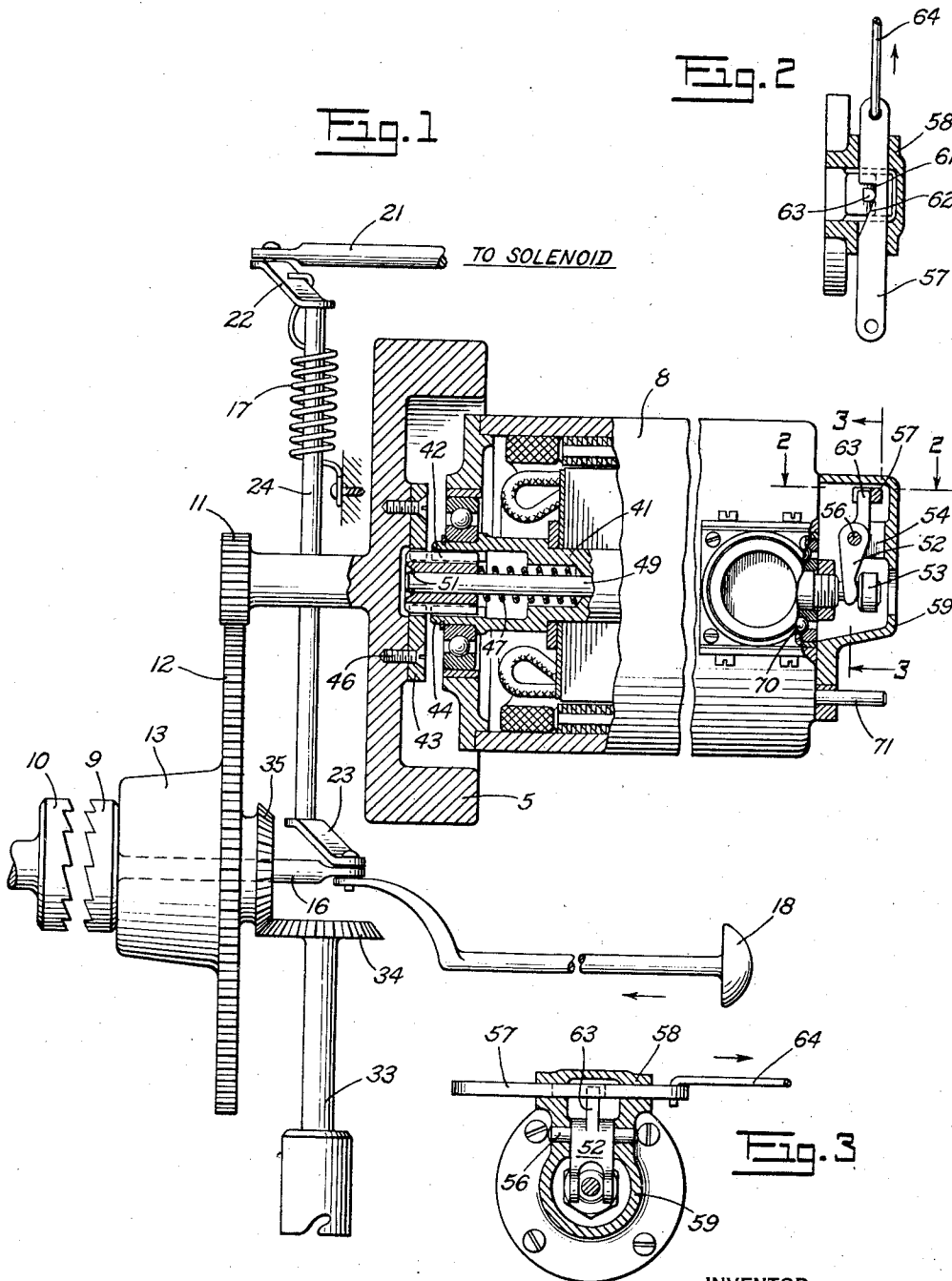
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R. M. NARDONE
ENGINE STARTING MECHANISM

2,261,402

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3 Sheets-Sheet 1



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Fig. 4

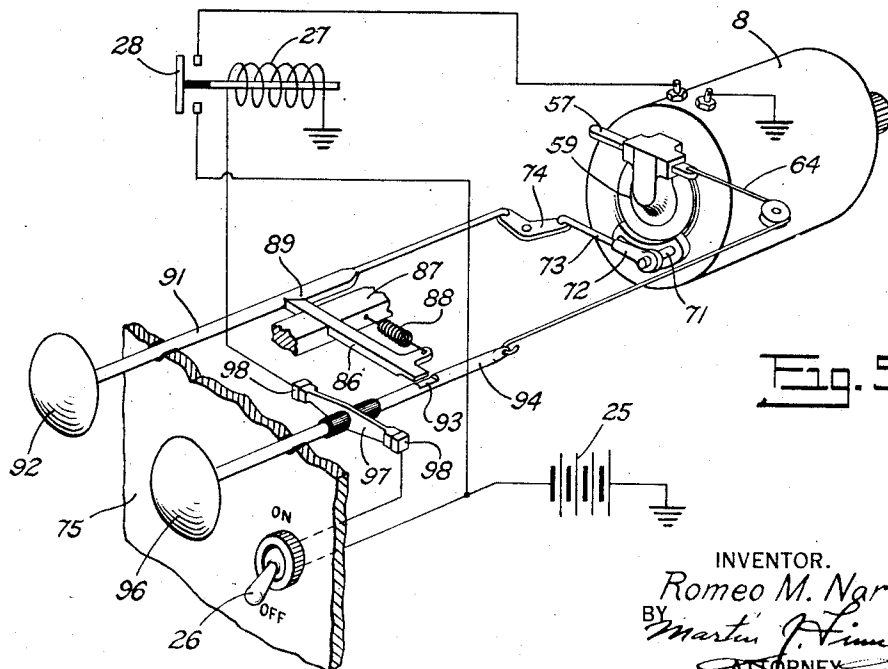
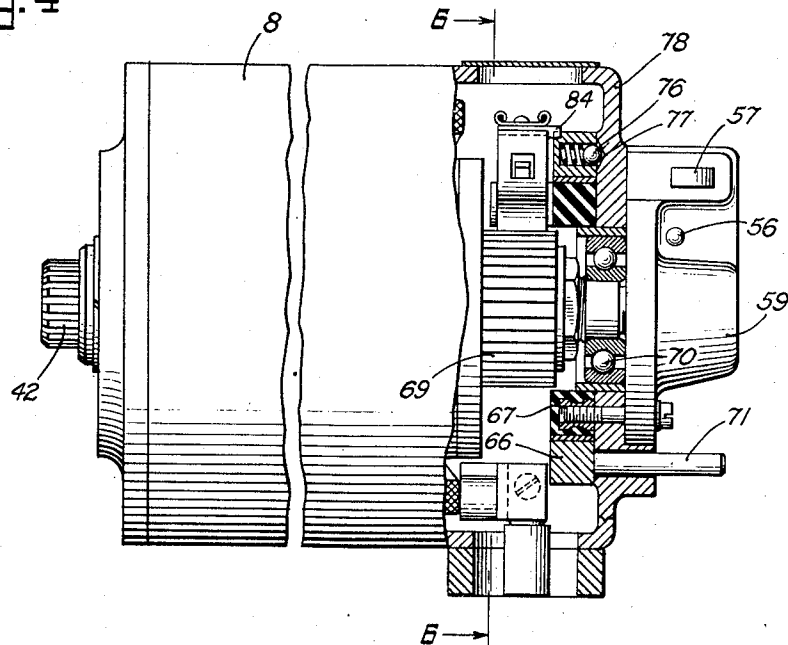


Fig. 5

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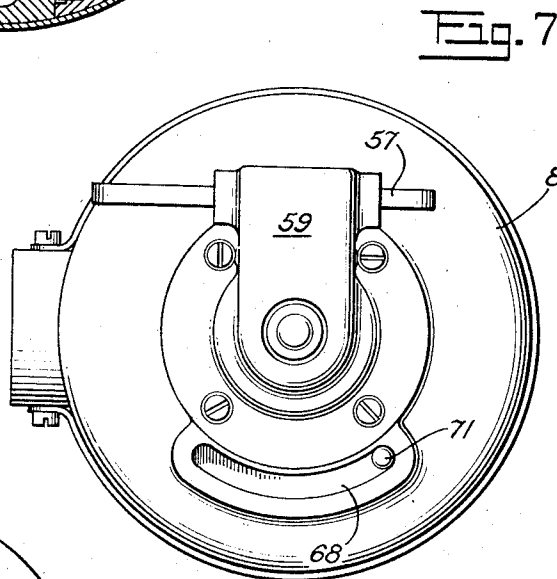
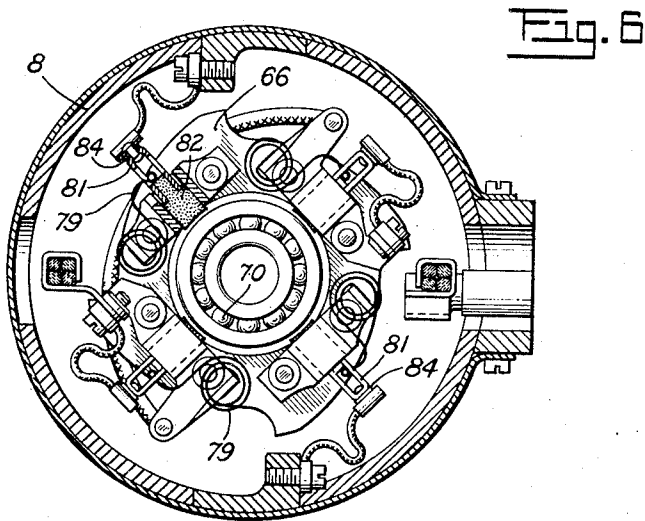
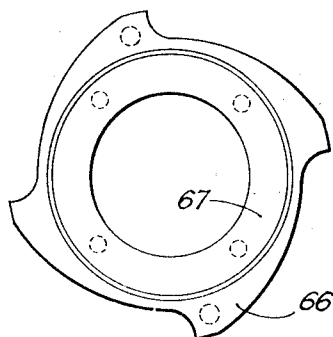


Fig. 8



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UNITED STATES PATENT OFFICE

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ENGINE STARTING MECHANISM

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4 Claims. (Cl. 290—38)

This invention relates to engine starting mechanism of the inertia type.

Operation of mechanism of this character usually involves acceleration of the inertia element, or elements, prior to movement of the engine-engaging element of the starter to engine-engaging position. This accelerating process may be manual, or it may involve use of power derived from an electric motor. My Patent No. 2,068,462 shows an inertia starter having an inertia element in the form of a flywheel which may be accelerated manually or by use of an electric motor; the connections between the motor and flywheel involving a uni-directional clutch which overruns when the manual accelerating means is employed—the motor thus remaining at rest, wherefore its commutator and brushes do not act as a drag on the flywheel during the accelerating process.

While this elimination of brush drag is desirable under these conditions of manual acceleration, there are occasions when the addition of the mass of the motor armature, to that of the flywheel, would provide a desirable increase in the total inertia effect, which increase would be even more substantial if the brush drag were to be removed. On other occasions where this added inertia effect is not necessary, it is of course preferable to relieve the operator of the necessity of accelerating the additional mass of the motor armature, or of raising the brushes from their commutator engaging positions.

It is accordingly one of the objects of the present invention to provide, in an inertia type starter having alternative means for acceleration of the inertia element, a novel control for disconnecting one of said alternative accelerating means when use of the other is contemplated.

A second object is to provide an improved brush lifting mechanism operative to remove the drag of the motor brushes—assuming that one of the alternative accelerating means is an electric motor—whenever it is desired to add to the inertia effect by leaving the motor connected for acceleration with the main inertia element (flywheel), as by operation of the alternative (hand-rotated, for example) accelerating means.

A third object is to provide novel interlocking means operative upon both the disconnecting and the brush lifting controls whereby the former can not be moved to the disconnecting position so long as the brushes remain lifted, thus assuring that the operator will get the benefit of the added inertia effect of the motor armature, with-

out brush drag, in the event that conditions render such added inertia effect desirable.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawings wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a view, partly in elevation, partly in section, and partly schematic, of an inertia starter to which the present invention may be applied as hereinafter described;

Fig. 2 is a view of the disconnecting means above referred to, as seen along the line 2—2 of Fig. 1;

Fig. 3 is another view of the disconnecting means, as seen along line 3—3 of Fig. 1;

Fig. 4 is a view of the motor shown in Fig. 1 but with a different portion of the housing broken away, to show the brush lifting mechanism;

Fig. 5 is a view in perspective of both the brush lifting and disconnecting controls, with the interlocking mechanism applied thereto;

Fig. 6 is a transverse sectional view along the line 6—6 of Fig. 4;

Fig. 7 is an end view of the motor of Figs. 1, 4 and 5; and

Fig. 8 is a view in elevation of the brush lifting cam.

In the drawings there is shown a representation, mainly diagrammatic, of one type of engine starting mechanism to which the present invention is applicable. As shown therein the flywheel 5 is disposed in alignment with the electric motor 8 constituting one of alternative accelerating means referred to above. Interposed between the engine engaging clutch member 9 and the flywheel 5 are the usual gear train and capacity controlling pre-set clutch, the former being shown as having at one end a high speed pinion 11 rotatable with flywheel 5, and at the low speed end a gear 12 to rotate the barrel 13 housing the said pre-set clutch in the usual manner, (as illustrated in detail in Lansing Patent No. 1,833,948) whereby rotation is imparted to the engine engaging clutch element 9. Movement of the clutch member 9 into engagement with corresponding clutch member 10 of the engine is under the control of axially mov-

able rod 16 passing centrally and slidably through clutch barrel 13 and connecting with clutch member 10 through yieldable means, as in the aforesaid Lansing patent, or directly, as indicated. The rod is normally restrained in the clutch-retracting position shown, by suitable means such as coiled torsion spring 17 corresponding to the coiled torsion spring 106 of the aforesaid Lansing patent, and is movable into the clutch meshing position by manual means 18 or by energization of a solenoid whose plunger 21 connects with rod 16 by way of the intervening levers 22 and 23 and the rockshaft 24 about which the spring 17 is coiled.

The winding (not shown) of this meshing solenoid may be interposed in a circuit from battery 25, which circuit may contain a hand-switch 26 and a second solenoid 27 (Fig. 5), the latter having a plunger-carried switch element 28 controlling flow of current to motor 8.

In case of motor failure (or if the battery charge is weak) the starter may be operated by accelerating the flywheel by hand through the hand-cranking shaft 33 connecting with the starter gear train as indicated at 34, 35.

As shown in Fig. 1, the connection between the motor armature shaft 41 and the flywheel 5 takes the form of an externally splined sleeve or clutch element 42 normally meshing with two internally splined elements 43 and 44, the former being integrated with the flywheel, as by screws 46, and the latter being integrated with the armature shaft 41. A coiled compression spring 47 bears at one end against the base of the socketed part of armature shaft 41, and at its opposite end exerts pressure upon clutch element 42 to hold the latter in the meshed position shown. A rod 49 slidably extends through armature shaft 41 and operatively connects with clutch 42 by means of a lock ring 51 embedded in a circumferential groove located near the end of rod 49, whereby rearward sliding of said rod will draw clutch 42 to the right and interrupt driving relationship between armature shaft 41 and flywheel 5.

To effect such rearward movement of rod 49 there is provided a bifurcated lever 52 straddling said rod 49 and abutting a collar 53 fixed by suitable means to the rear end of said rod, where it protrudes beyond the bearing and retainer assembly 70 at the rear of armature shaft 41. Supports 54 provide pivotal mounting for lever 52, and a rocking thereof about pivot bearing 56 is effected by reciprocation of a bar 57. As shown in Figs. 1, 2, 3, 5 and 7, this bar 57 is slidably received in the upper portion 58 of the sub-housing 59 at the rear of the motor, and includes a notch 61 having a cam edge 62 (Fig. 2) engageable with the upper end 63 of lever 52 to rock the latter in response to a pull exerted upon the bar actuating cable 64 in the direction of the arrows in Figs. 2, 3 and 5. The means shown in Fig. 5 for controlling cable movement are described more fully hereinafter.

The brush lifting mechanism is shown in Figs. 4 and 6 as including a ring 66 (see also Fig. 8) having support upon an inner ring 67 of insulating material surrounding bearing assembly 70; said ring 66 being shiftable about said supporting ring 67 to a limited extent, as determined by the length of arcuate slot 68 (Fig. 7) at the rear of housing 8, which slot receives a pin 71 secured at its inner end to the ring 66 and at its outer end receives a fitting 72 (Fig. 5) serving as anchorage for one end of a link 73 whose outer

end is received in a bell-crank 74 operable from the panel 75 (in the operator's compartment of the vehicle on which the engine to be started is installed) by the interlocking operating means hereinafter described more fully. The outer surface of ring 66 is cut to form a plurality of cam elements corresponding in number and spacing to the number of brushes engageable with the commutator 69 of the motor, and said cam elements being adapted to cooperate with the brush carriages 81 (shown best in Fig. 6) in such manner as to raise the brushes 82 to positions of disengagement with respect to the commutator 69 when the high or outer portions of the cam surfaces are brought into engagement with the projecting arms 84 extending from the brush carriages 81 into the path of rotation of the cam ring 66. The cam ring is normally restrained from movement from the position in which the brushes are engaged by suitable means, as indicated in Fig. 4, and takes the form of a spring-pressed detent 76 registerable with a depression 77 located in the end portion 78 of the housing in such position as to assure feeding of current to the commutator by way of the brushes 82 unless and until the cam ring 66 is shifted by actuation of the bell-crank 74 whereupon pin 71 rides along slot 68 to the opposite end thereof and thereby rotates cam ring 66 in a counterclockwise direction as viewed in Fig. 6 to produce a lifting of the brush carriages 81 and hence the brushes 82 mounted therein, against the opposition of the opposing springs 79. If desired, an additional detent similar to the detent 76 may be provided to engage with the depression 77 when the pin 71 has reached the opposite limit of its arcuate stroke, to assure retention of the brushes in the disengaged position during the full cycle of flywheel acceleration.

The interlocking means, whereby shifting of the clutch element 42 to the disengaged position is rendered impossible while the brushes are in the disengaged position, is shown in Fig. 5 as taking the form of a bar 86 slidable in a guide block 87 to which is anchored a spring 88 normally holding bar 86 in the position shown, in which position its cam-surfaced end registers with the correspondingly shaped cam-surfaced notch 89 in manually operated rod 91 whose outer end projects through panel 75 to receive a knob or handle 92, and whose inner end is received in the brush lifting bell-crank 74. The end of bar 86 opposite rod 91 is engageable with a notch 93 in rod 94 whose outer end projects through panel 75 to receive a knob or handle 96, and whose inner end receives the end of the clutch shifting cable 64. Also mounted on rod 94 (but insulated therefrom) is a switch bar 97 normally bridging contacts 98 in the circuit to relay 27.

With the arrangement illustrated, outward movement of rod 91 will slide bar 86 into locking engagement with rod 94, thus making it impossible to disengage clutch 42 so long as the said rod 91 remains in the outer (brush lifted) position. Thus, there is automatic assurance that, during manual acceleration of flywheel 5, with the brushes raised to eliminate frictioned drag, the inertia of the motor armature will be available to supplement that of the flywheel. If, on the other hand, the operator finds that, under existing conditions in a given instance, he does not require this added inertia effect, he may relieve himself of the burden of manual acceleration of the additional weight constituted by the motor armature. This he will do by pulling out-

wardly on member 94, to disengage clutch 42. This action, incidentally, will lock the brushes against being raised; but this is immaterial, since there can be no energization of the motor 8, as the outward pull of rod 94 causes the motor en-
 5 ergizing relay circuit to be held open at the switch 97. Thus accidental energization of the motor, during use of the manual means 33 for flywheel acceleration, is precluded.

What I claim is:

1. The combination, with a flywheel, of alternative accelerating means including a gear train on one side of the flywheel and an electric motor on the opposite side thereof, said motor including brush lifting mechanism for rendering the
 15 motor inoperative, means including a part extending through the motor for disconnecting the latter from the flywheel, said means also including a part for holding said disconnecting means in the disconnecting position during use of said
 20 gear train to accelerate the flywheel, and interlocking means co-operating with said brush lifting mechanism for holding said disconnecting means in the opposite position.

2. The combination, with a flywheel, of alternative accelerating means including a gear train on one side of the flywheel and an electric motor on the opposite side thereof, said motor including a commutator and a set of brushes engaging
 25 said commutator, yieldable means individual to each brush to urge said brushes into contact with said commutator, means surrounding said commutator and acting simultaneously upon all

brushes to lift said brushes out of contact with said commutator against the opposition of said
 yieldable means, and means co-acting with said
 brush-lifting means for preventing interruption
 5 of the driving connection between said motor and flywheel so long as said brush-lifting means is in the brush-lifting position, whereby rotation of the gear train may cause acceleration of both
 said flywheel and motor, thus adding the inertia
 10 effect of the latter to that of the flywheel.

3. The combination, with a flywheel, of alternative accelerating means including a gear train on one side of the flywheel and an electric motor on the opposite side thereof, said motor including
 15 brush-lifting mechanism for rendering the motor inoperative, and means including a part extending through the motor for disconnecting the latter from the flywheel, said means also including a cooperating part for holding said disconnecting
 20 means in the disconnecting position during use of said gear train to accelerate the flywheel.

4. The combination, with a flywheel, of alternative accelerating means including a gear train and an electric motor, said motor including
 25 brush-lifting mechanism for rendering the motor inoperative, and means including a part extending through the motor for disconnecting the latter from the flywheel, said means also including a cooperating part for holding said disconnect-
 30 ing means in the disconnecting position during use of said gear train to accelerate the flywheel.

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