

[54] ELECTRIC START FOR MOWERS

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[58] Field of Search56/25.4; 123/179, 190

[56] References Cited

UNITED STATES PATENTS

2,908,353	10/1959	Isaccs et al.....123/179 X
2,996,927	8/1961	Rome123/179
3,070,081	12/1962	Mercer et al.123/179
3,174,471	3/1965	Weglage et al.56/25.4 X

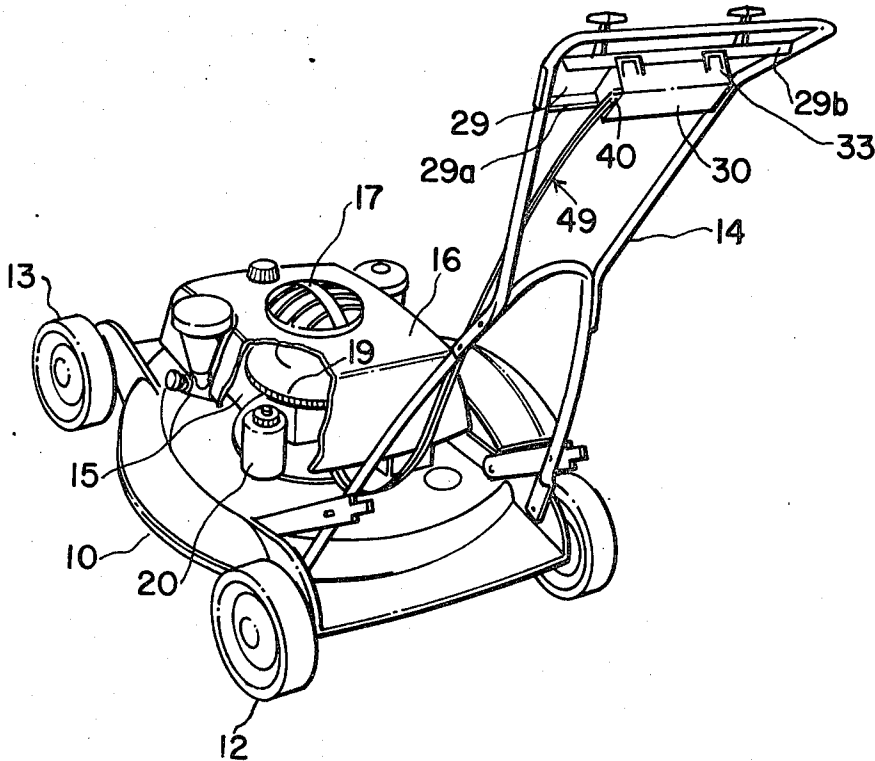
3,536,051 10/1970 Hamman.....123/179 SE
3,398,587 8/1968 Martin.....56/25.4 UX

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[57] ABSTRACT

An electric start system for a lawn mower powered by an internal combustion engine. The engine is cranked by means of a Bendix type starter, the pinion of which engages the engine flywheel during the cranking operation, and then automatically disengages therefrom when the engine starts. The electric motor of the Bendix starter is powered by batteries carried on the handle of the mower and is energized by a key switch also on the handle within easy and convenient reach of the operator. A charger is also provided which enables the battery to be recharged on or off the mower. The battery also has a single receptacle connector for selective connection to the starter motor and charger, whereby the engine cannot be started when the battery is being recharged.

16 Claims, 8 Drawing Figures



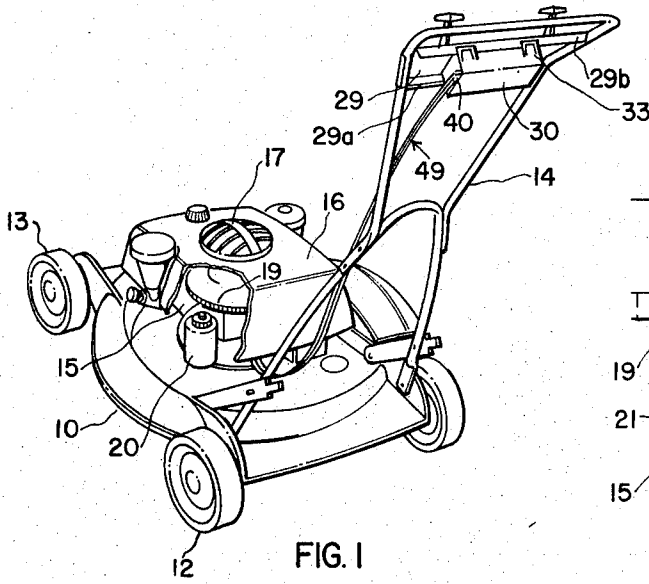


FIG. 1

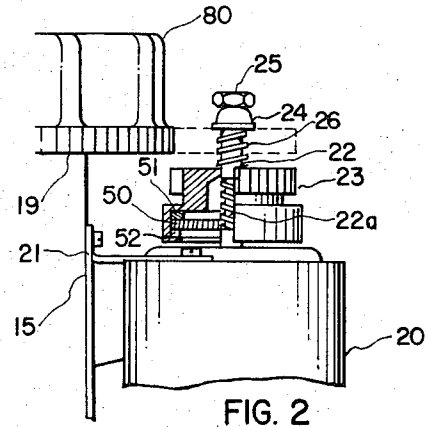


FIG. 2

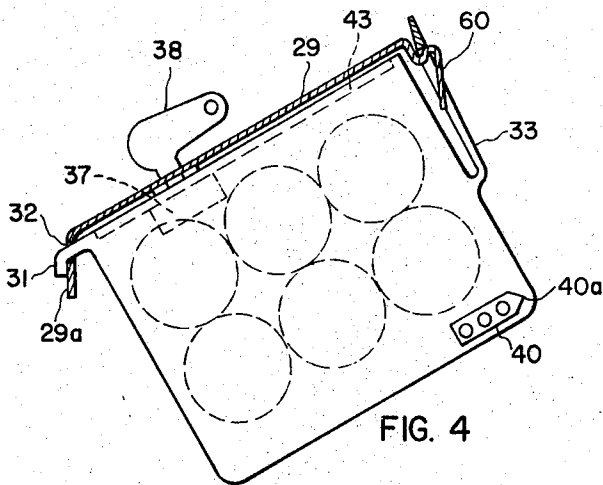


FIG. 4

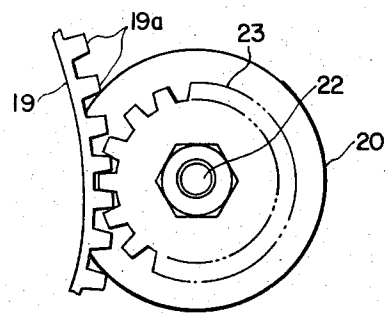


FIG. 3

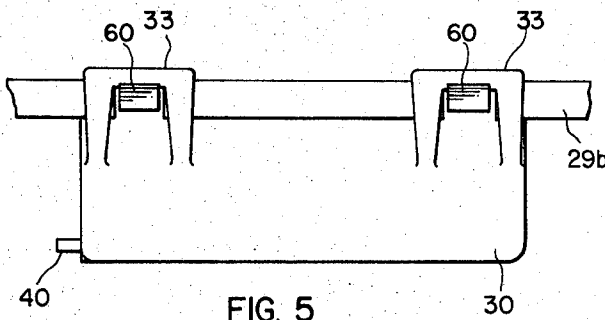


FIG. 5

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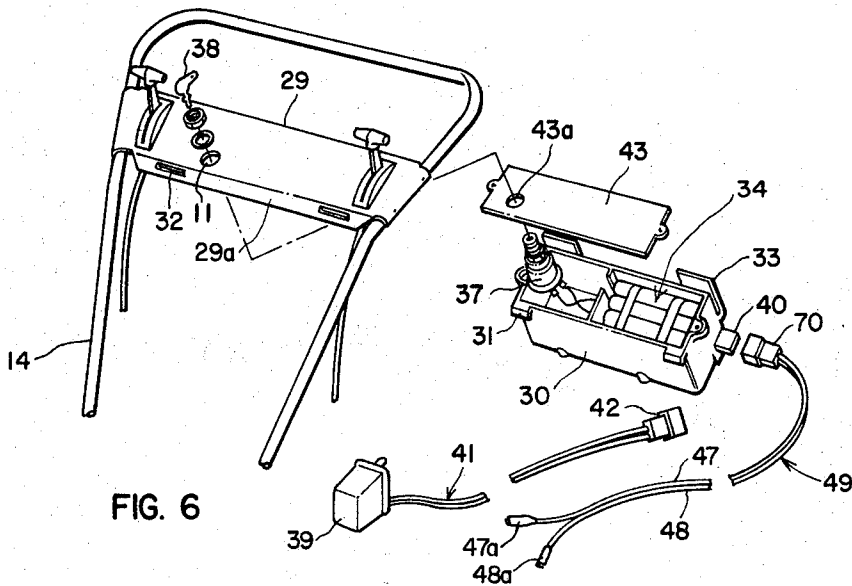


FIG. 6

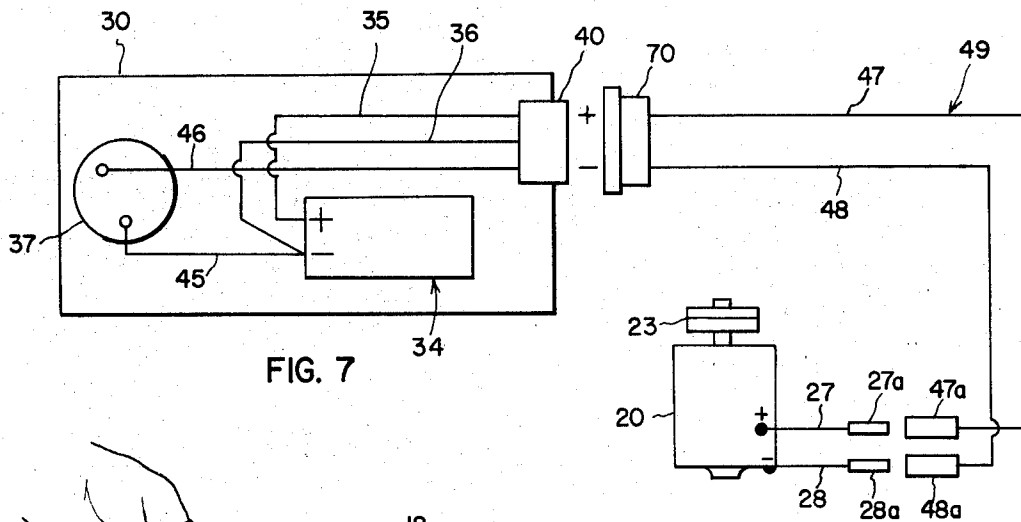


FIG. 7

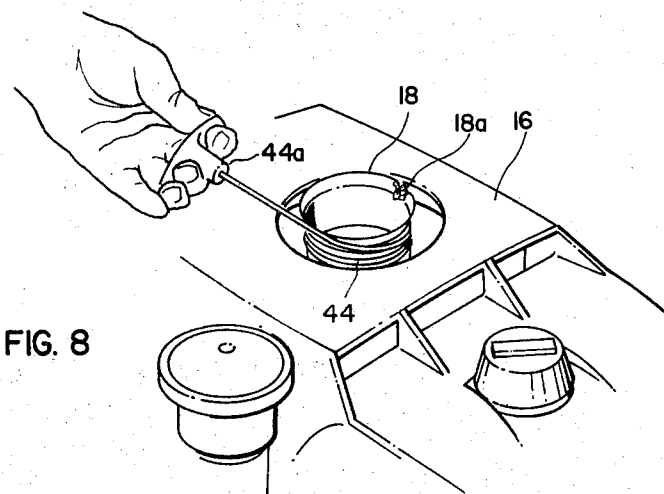


FIG. 8

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ELECTRIC START FOR MOWERS

Gas powered lawn mowers are conventionally started either by means of a recoil type starter in which the operator pulls a rope to spin the engine or by means of an impulse type starter in which a spring is wound manually by means of a crank handle, and the spring is then released to spin the engine. Both of these types of conventional starting systems involve a considerable expenditure of effort on the part of the operator and many people are incapable of expending the necessary amount of effort, or must expend same with considerable difficulty. Also, these conventional types of starting systems commonly require the operator to repeat the starting operation if the engine doesn't start on the first try, thereby requiring repeated pulls on the rope of the recoil type starter or repeated cranking of the crank handle of the impulse starter. This repetition is tiring, annoying, and time consuming. Another disadvantage of the conventional starting systems is that they usually require the operator to stand close to the mower housing, and in so doing the operator is exposed to the hazard of injuring his feet if they should inadvertently find their way under the housing when the engine starts.

Therefore, an important object of this invention is to provide an effortless starting system for a lawn mower powered by an internal combustion engine.

Still another object is to provide a starting system for a mower powered by an internal combustion engine which can be operated by the operator a safe distance from the mower housing.

Still another object is to provide a starting system for a lawn mower in which one of the necessary components of the starter can be conveniently and quickly removed from the mower by the operator when not in use to be sure that the mower will not be started by children. These and other objects and advantages will appear and be apparent from the following description and drawings accompanying same in which:

FIG. 1 is a perspective view of a mower embodying one preferred form of this invention,

FIG. 2 is an elevational view of the starter and flywheel, with portions broken away,

FIG. 3 is a top view of FIG. 2,

FIG. 4 is a side view of the battery case and starting switch, with portions broken away,

FIG. 5 is a rear view of FIG. 4,

FIG. 6 is an exploded view of the steering handle, battery, switch and charger,

FIG. 7 is a wiring diagram of the starting system,

FIG. 8 is a perspective view of a portion of the mower of FIG. 1 showing an alternate method of manually starting the engine in the event that electric start system malfunctions.

Referring to the drawings, a rotary mower is illustrated which incorporates one preferred embodiment of the electric starting system of this invention. The illustrated rotary mower (which may be of any conventional design) includes a housing 10 which encloses a conventional rotatable cutter blade (not shown), a pair of ground engaging rear traction wheels 12, a pair of ground engaging front traction wheels 13, and an upwardly and rearwardly extending steering handle 14 behind which the operator normally walks for guiding the mower. A gas engine 15 is mounted on the deck of the mower housing and it is enclosed by a shroud 16. The

shroud 16 is provided with a removable shroud insert 17 covering a pulley 18 to the crank shaft for manual starting of the engine as an alternate backup method to be discussed in more detail hereinafter.

The engine is provided with a flywheel 19 attached to the engine crank shaft, which flywheel is provided with peripheral gear teeth 19a about the entire periphery thereof, which gear teeth are provided to permit starting of the engine by the electrical starting system hereinafter described.

The starting system of this invention includes a Bendix type starting system mounted directly on the mower. This Bendix system includes an electric motor 20 mounted on the engine by means of a bracket 21, said motor having a drive shaft 22 powered thereby extending vertically upward therefrom. The drive shaft is helically threaded as at 22a and has rotatably mounted thereon the starter pinion 23. The pinion is drivingly connected to the shaft by nut 50 which is internally threaded so as to engage the drive shaft. A resilient annular rubber bumper 51 is interposed between and frictionally engages the pinion and nut and the nut is held in driving engagement with the pinion by lock ring 52. The stop cup 24 is mounted on the outer end of the shaft and retained thereon by means of a nut 25 to limit the upward movement of the starter pinion, with an anti-drift spring 26 being wound on the shaft and interposed between the cup and the pinion, which spring serves as an anti-drift device to inhibit vibrational movement of the pinion when the starter is not in use.

The starter pinion is located below and out of engagement with the gear teeth of the flywheel when the starting system is inoperative as shown by the full line position of FIG. 2. However, when the starting system is operative and the motor 20 is energized, the rotation of the drive shaft causes the starter pinion to travel upwardly along the shaft into driving engagement with the flywheel, in a well known manner, whereupon it proceeds to drive the flywheel and crank the engine until the engine starts. The Bendix gear 23 assuming the broken line position of FIG. 2 when in starting engagement with the flywheel. When the engine does start, the speed of the flywheel exceeds that of the starter pinion and causes it to move downward and out of engagement with the flywheel in a manner well known. The motor is provided with leadwires 27 and 28 having connectors 27a and 28a for connection to the wiring harness and the battery.

A control panel or escutcheon plate 29 is provided on the upper end portion of the handle 14 within easy reach of the operator. A casing 30 having a cover 43 is detachably mounted on the control panel on the underside thereof by means of a pair of front hook tabs 31 carried by the upper edge of the casing and extending forwardly therefrom, which tabs are installed in slots 32 formed in front flange 29a in the control panel. A pair of inverted U-shaped spring clips 33 extend upwardly from the back wall of the casing in spaced relationship therewith and snap over a pair of detents 60 formed on the rear flange 29b of the control panel to hold the casing in place.

The casing 30 houses battery means which in the illustrated embodiment comprises a battery pack 34 consisting of 12 Ni-Cad (Nickel-Cadmium) batteries connected in series. Wires 35 and 36 connect the bat-

tery in circuit with receptacle connector 40 extending laterally from one end of the casing 30. The casing also houses a starter switch 37, the upper end of which extends through an opening 11 provided in the control panel and opening 43a in the cover 43. The switch is operated by a quickly removable and insertable key 38. The switch is spring loaded so that it will automatically return to "off" (open) position from starting (closed or "on") position whenever it is released by the operator. The switch 37 is connected in circuit with the battery by wire 45, and with receptacle 40 by wire 46.

The wiring harness 49 for connecting the battery to the starter motor comprises a pair of wires 47-48 joined at one end by plug connector 70 which is adapted to plug into receptacle 40. The other ends of the wires 47-48 are provided with connectors 47a-48a for connection with connectors 27a-28a respectively of the starter motor.

Thus, to start the engine, the operator sets the throttle control in the choke position and positions himself behind the handle, in which position the operator's feet are positioned a safe distance from the mower housing. The operator then inserts the key 38 in drive starter switch 37 and turns same to the starting position which energizes the electric motor of the Bendix drive. The energization of said motor causes the drive pinion to move upwardly into engagement with the flywheel and turns same until the engine starts. When the engine starts the speed of the flywheel overruns that of the drive pinion and causes the drive pinion to descend to its inoperative position. The operator then releases the key and the key then automatically returns to "off" position and then the mower is running and ready to use. When the operator is finished mowing, he can remove the key from the starter switch and store the key in some place remote from the mower so that the key (and electric start system) cannot be used by children to start the mower, thus making it tamper proof.

The battery will periodically need recharging. To accomplish this recharging, the trickle charger 39 is provided which can be plugged into any standard 115 volt A.C. single phase 60 cycle household outlet. The trickle charger 39 is provided with electric cord 41 having a plug connector 42 which is adapted to be inserted into the battery receptacle 40 to recharge the battery, provided of course, that plug connector 70 has first been disconnected from receptacle 40, since the battery has only the single receptacle 40. Thus, as a safety feature the battery has a single receptacle 40 for selective connection of the battery to either the trickle charger or the electric starter motor. Thus, only the charger or the electric motor can be connected to the battery at any given moment and it is impossible for the battery to be connected to the charger and the starter motor simultaneously.

In the event that the starting system hereinbefore described should malfunction for any reason, an alternate means of starting the mower is provided, said alternate means comprising the aforementioned pulley 18. The shroud insert 17 is removed and a rope 44 having handle 44a is installed in slot 18a of the pulley and wound thereabout. The rope is then pulled by grasping the handle 44a thereby spinning the pulley and crankshaft and cranking said engine.

To recharge the battery, the motor is disconnected therefrom and the trickle charger connected thereto. It will be noted that the key is located on the control panel in a position readily accessible to the operator when standing behind the handle in normal operative position. Thus, whenever the mower is started, the operator is positioned a safe distance from the mower housing so that his feet cannot inadvertently be inserted under the mower housing when the cutting blade begins to turn.

It will also be noted that the casing 30 can be quickly dismantled from the handle for replacing the batteries or repairing or replacing the switch, or for recharging the batteries, since it is sometimes more convenient to recharge the battery with it removed from the mower.

The casing is removed from the handle by grasping the casing from the rear with both hands simultaneously, with the thumbs resting on the upper edges of the mounting tabs or spring clips 33. The clips 33 are flexed slightly to the rear by the thumbs, thereby disengaging them from the detents 60. The casing then pivots downwardly on the front tabs 31 and is then completely disconnected by pulling the casing rearwardly to free the tabs 31 from their supporting slots.

It will also be noted that the flywheel 19 has fan blades 80 extending upwardly therefrom, so that the flywheel also serves as the fan means for cooling the engine.

It will be further noted that this arrangement enables the starter motor and Bendix drive to be located close to the engine and under the shroud, where it can be protected from the elements, and where it does not detract from the aesthetic appearance of the mower.

As an additional precaution, one side 40a of the receptacle 40 is provided with a V-shape, whereas the opposing side is straight. The connectors 42 and 70 are provided with corresponding shapes, so that there is only one way of connecting or mating them with receptacle 40. This assures that proper polarity will be achieved when the connection is actually made.

The flywheel 19 and the gear teeth 19a thereof are formed of cast aluminum, which minimizes the cost and reduces the weight.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportion of the various parts without departing from the scope of this invention.

What is claimed is:

1. In a rotary mower which includes a housing, a vertical shaft internal combustion engine mounted on said housing, a cutting blade mounted on said shaft and located beneath said housing, and a drive gear drivingly attached to the upper end of said shaft, an electric starting system comprising:

1. an electric motor secured to said engine, said motor including an upstanding output shaft extending a substantial distance beyond said motor and terminating vertically adjacent to the gear teeth on said drive gear said shaft having external helical threads advancing away from said motor in a rotational direction opposite to the rotational direction of said motor;
2. a pinion gear with a bore therethrough having internal helical threads therein matching the external threads of said output shaft for interconnection

therewith, said pinion gear located on said output shaft and normally positioned in threaded engagement adjacent to said motor when said motor is not energized;

- 3. stop means on the extended end of said output shaft to prevent said gear from advancing off said shaft when said motor is energized, whereby upon energizing said motor said gear will advance along said shaft to engage said gear teeth and rotatably drive said drive gear;
- 4. a battery mounted on said mower for energizing said motor; and
- 4. a manually operable switch mounted on said mower in circuit with said motor and battery for starting and stopping said motor.
- 2. The mower of claim 1, including handle means for steering said mower, and wherein said battery is mounted on said handle.
- 3. The mower of claim 2, wherein said handle includes a forwardly and upwardly facing panel, and wherein said battery is mounted on said panel on the underside thereof.
- 4. The mower of claim 3, wherein said battery includes a casing,
 - said casing having a forwardly extending tab,
 - an opening in said panel for receiving said tab and thereby supporting the front portion of said casing, and spring clip means carried by the rear portion of said casing and releasably attachable to said panel for supporting the rear portion of said casing.
- 5. The mower of claim 1, wherein said switch automatically moves from closed to open position when released.
- 6. The mower of claim 1, wherein said switch is operated by a removable key.
- 7. The mower of claim 1, wherein said switch is operated by a removable key and automatically moves from closed to open position when said key is released.
- 8. The mower of claim 1, including handle means for steering said mower, and wherein said switch is mounted on said handle within reach of an operator standing behind said handle.
- 9. The mower of claim 8, wherein said handle includes a forwardly and upwardly facing panel, and wherein said switch is mounted on the underside of said panel and extends upwardly through an opening in said panel.
- 10. The mower of claim 9, wherein said switch is housed in a common casing with said battery, said casing being mounted on the underside of and supported by said panel.
- 11. The mower of claim 2, including a casing, said casing housing therewithin said battery and said switch,

said casing being mounted on the upper end portion of said handle means.

- 12. The mower according to claim 11, wherein said switch is operated by a removable key.
- 13. The mower according to claim 1, including spring means for downwardly biasing said pinion gear.
- 14. The mower according to claim 13, wherein said switch is normally electrically open and biased towards the open position,
- 10 and wherein said switch is inoperable without a key.
- 15. The mower according to claim 14, including a casing for containing said battery, wherein said casing includes only one receptacle connector for connecting said battery with said motor or alternatively with a battery charging device, said receptacle connector being capable of engaging only one plug connector at a time from said motor or said charging device.
- 16. In a rotary mower which includes a housing, a vertical shaft internal combustion engine mounted on said housing, a cutting blade mounted on said shaft and located beneath said housing, and a drive gear drivingly attached to the upper end of said shaft, an electric starting system comprising:
 - 1. an electric motor secured to said engine, said motor including an upstanding output shaft extending a substantial distance beyond said motor and terminating vertically above the gear teeth on said drive gear, said shaft having external helical threads advancing away from said motor in a rotational direction the same as the rotational direction of said motor;
 - 2. a pinion gear with a bore therethrough having internal helical threads therein matching the external threads of said output shaft for interconnection therewith said pinion gear located on said output shaft and normally positioned in threaded engagement with said external helical threads adjacent the terminating end of said output shaft and above said drive gear teeth when said motor is not energized;
 - 3. stop means adjacent the terminating end of said output shaft to maintain said pinion gear on said output shaft;
 - 4. spring means for urging said pinion gear toward said stop means, whereby upon energizing said motor said gear will advance down along said shaft to engage said gear teeth and rotatably drive said drive gear;
 - 5. a battery mounted on said mower for energizing said motor; and
 - 6. a manually operable switch mounted on said mower in circuit with said motor and battery for starting and stopping said motor.

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