

June 2, 1936.

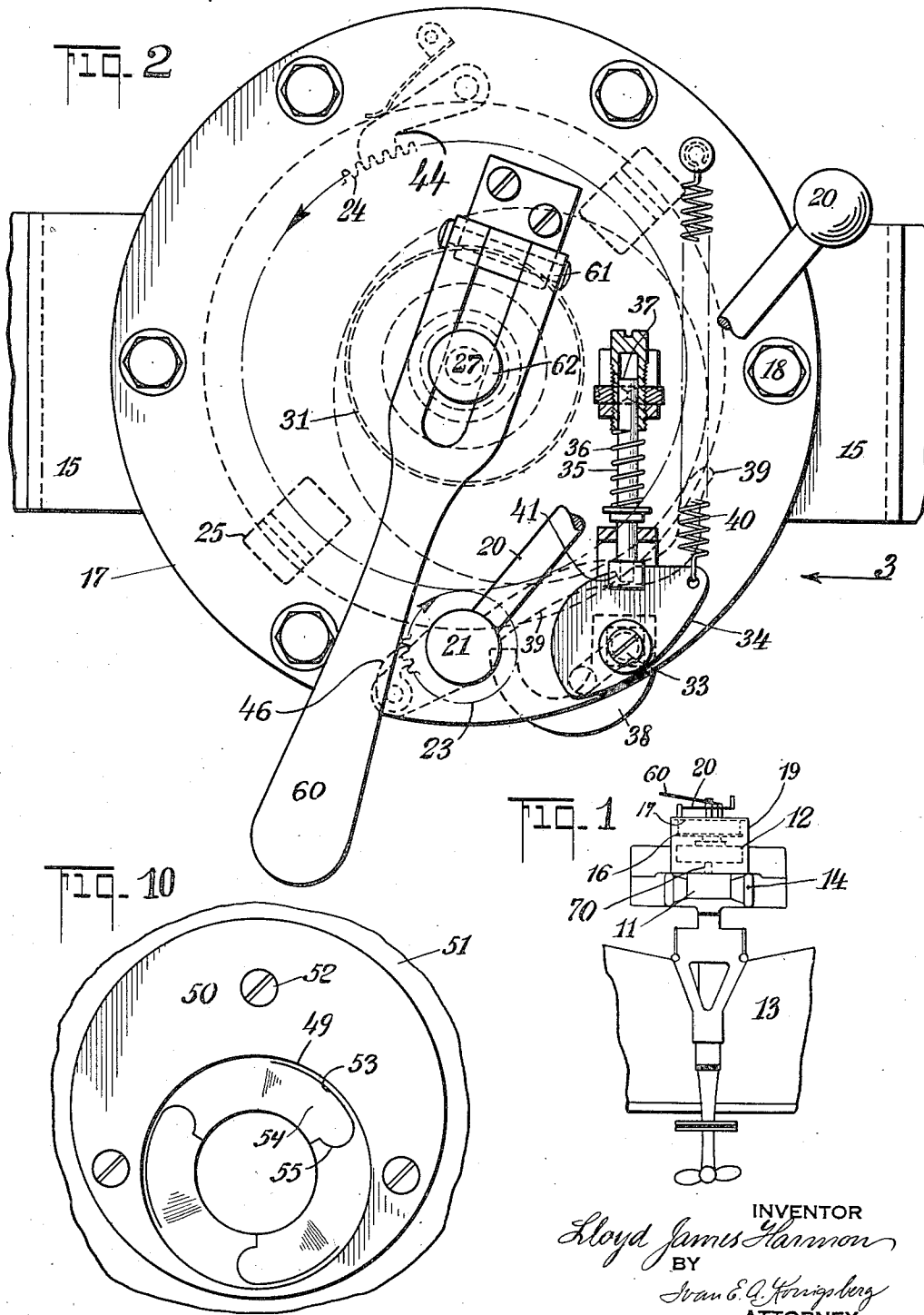
L. J. HARMON

2,042,841

SELF STARTER FOR OUTBOARD MOTORS

Filed Oct. 18, 1934

3 Sheets-Sheet 1



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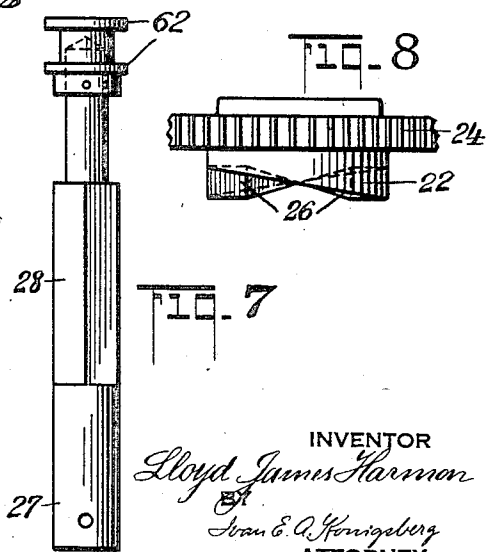
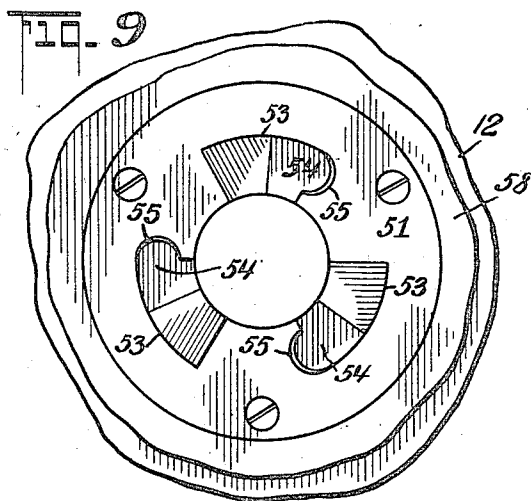
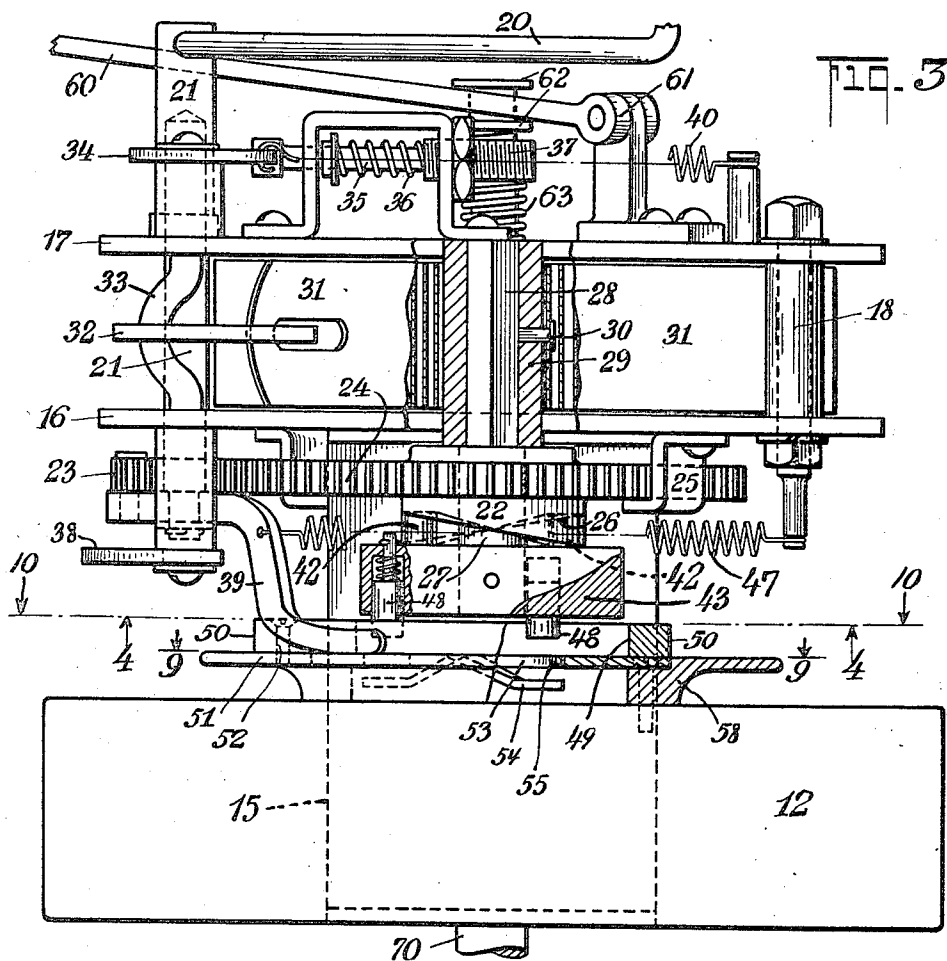
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SELF STARTER FOR OUTBOARD MOTORS

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3 Sheets-Sheet 2



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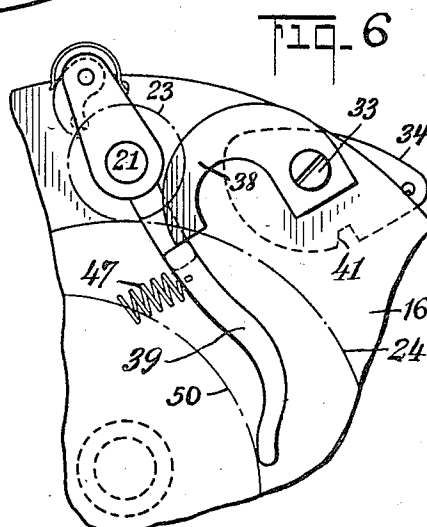
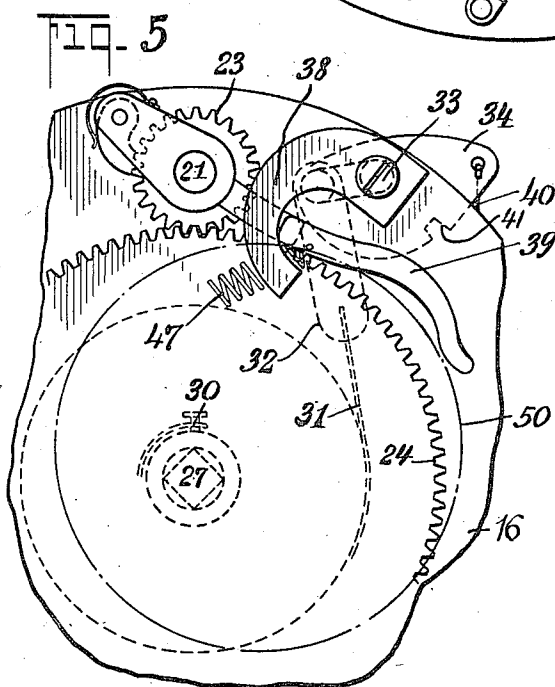
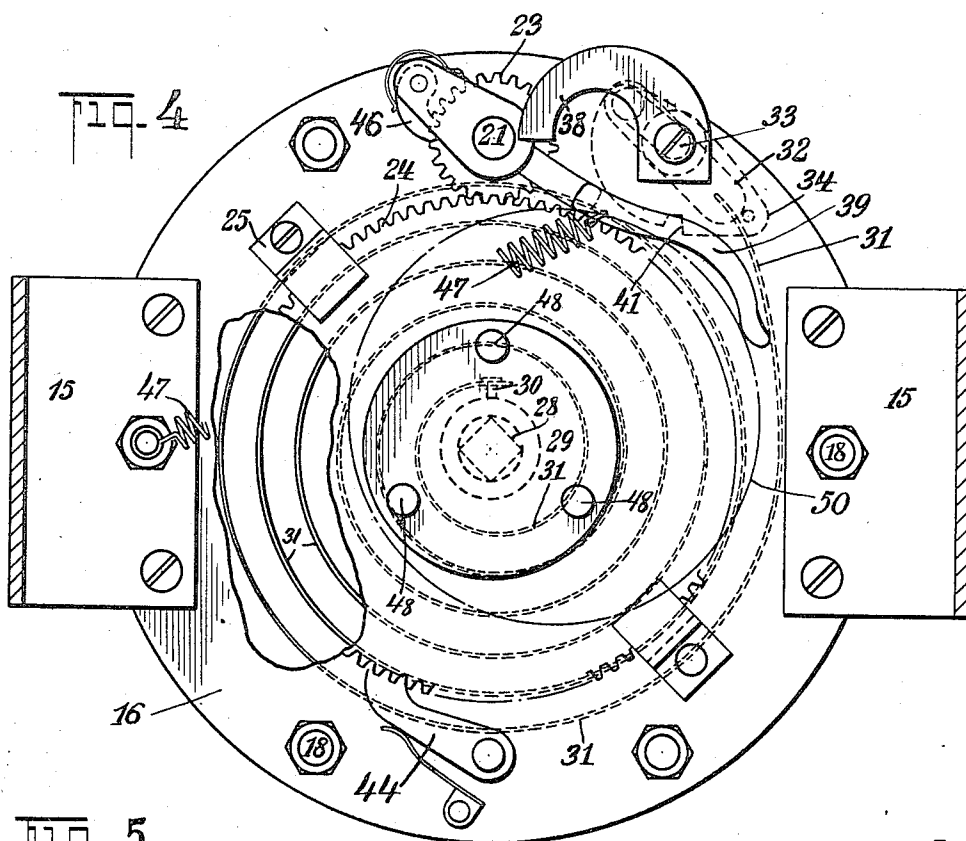
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SELF STARTER FOR OUTBOARD MOTORS

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3 Sheets-Sheet 3



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SELF STARTER FOR OUTBOARD MOTORS

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Application October 18, 1934, Serial No. 748,829

10 Claims. (Cl. 185-41)

The object of this invention is to provide a selfstarter for outboard motors. Heretofore, so far as I know, it has been the universal practice to start outboard motors by means of a rope which is attached, more or less successfully, to some element secured to the crank shaft of the motor. Such rope pulling devices are inconvenient and sometimes entirely impractical for instance when the motor is to be started by a woman, because such rope pulling devices which are analogous to the crank handle for an automobile engine require quite some skill and strength in order to operate successfully. Attempts have been made to supply outboard motors with electric starters. These have not proved practical because they take up too much space in a boat; they are heavy and require a battery for their operation. When it is remembered that outboard motors at times are used on canoes or other frail craft, it will be seen that a successful and practical selfstarter must include means to meet the particular problems which arise especially in connection with outboard motoring. Spring actuated starters may have been proposed but so far as I know none have ever been used in practice.

It is therefore the broad object of this invention to provide a spring-actuated selfstarter for outboard motors which, besides starting the motor, also operates to rewind the main starting spring automatically. It is also an object of the invention to embody the selfstarter in a unitary structure adapted to be attached to outboard motors of varying makes and models. Another object is to provide an all around efficient and simple selfstarter which may be manufactured at low cost and adapted to be attached to the motor without requiring specially skilled labor. Other objects will appear hereinafter. Accordingly the invention is embodied in a selfstarter constructed and arranged as hereinafter described and as illustrated in the accompanying drawings in which

Fig. 1 is a view in outline of an outboard motor equipped with a selfstarter embodying this invention looking at the stern of the boat, the rudder being omitted and parts of the boat broken away.

Fig. 2 is a top plan view of the selfstarter with parts in section and parts broken away.

Fig. 3 is a view partly in elevation and partly in section looking in the direction of arrow 3 in Figure 2.

Fig. 4 is a bottom view on line 4-4 of Figure 3 with parts broken away.

Figs. 5 and 6 are detail bottom views of parts shown in Figure 4.

Fig. 7 is a detail view of the starter shaft.

Fig. 8 is a detail view of parts of a starting clutch mechanism.

Fig. 9 is a view on line 9-9 of Figure 3 with parts broken away. Line 9-9 coincides with line 4-4.

Fig. 10 is a view on line 10-10 of Figure 3 with parts broken away.

Referring first to Figure 1, the outboard motor of a standard design is designated 11 and its fly-wheel 12. The motor is attached in the usual manner to a boat 13 and has a framework at 14 to which the selfstarter is attached in any suitable manner. As indicated in Figures 2 and 4 the attaching means may consist of a pair of brackets 15, 15 screwed on to the framework of the motor. The brackets 15 support a lower plate 16 and the latter again supports an upper plate 17 by bolts 18 or otherwise. The two plates 16 and 17 constitute the framework of the selfstarter, the mechanism of which is preferably enclosed by a shield or casing 19, Figure 1. It is obvious that the brackets 15 may be arranged for attachment to different makes and models of outboard motors.

The invention will perhaps be understood best if the description of the several parts follow the order of operation. Assuming, therefore, that the starter has been attached to the motor and the main spring is unwound, means are provided for manually winding the spring. Figures 2, 3 and 4 show the parts in their respective positions when the main spring is unwound. The spring may then be wound by operating the following instrumentalities.

On top of the selfstarter there is provided a handle 20 detachably secured to a winding shaft 21 which passes downward through the two plates 17 and 16. Below the latter the shaft carries a pinion 23 which meshes with a large gear 24. The gear is supported on suitable lugs 25 secured to the plate 16. The handle 20 may be secured to the winding shaft by passing through a hole therein or other means may be used.

The gear 24 has a hub 22 the lower surface of which forms upper clutch members 26, see Figure 8. The gear 24 turns freely on the starter shaft 27. Above the gear the starter shaft has a square portion 28 which fits slidably within a bushing 29, which has a square hole to fit the shaft. The main starter spring 31 has its one end secured to the bushing at 30. The clutch members 26 are arranged to engage lower clutch

member 42 in the form of two pins which are fast in and project upwardly from a clutch disk 43 pinned to the starter shaft 27, Figure 3.

It will therefore be seen that when the handle 20 is operated, motion is imparted to the winding shaft 21 and its pinion 23, hence to the large gear 24. The rotation of the latter rotates the upper clutch members 26 which in turn engage the lower clutch members 42 on the clutch disk 10 attached to the starter shaft and the latter is thus rotated to wind the spring 31. When sufficient tension has been put on the spring, the operator ceases to turn the handle 20 and the large gear is then held against further rotation by the pawl 44, 15 see Figures 2 and 4. The starter is now ready to function.

The outer end of the starter spring 31 is secured by a link 32 to the crank portion of a crank shaft 33, Figure 3, supported in the two plates 16 20 and 17. Above the plate 17 the crank shaft carries a cam 34 having a notch 41 which is engaged by a spring pressed plunger 35, the spring 36 of which may be adjusted at 37 in an obvious manner. A spring 40 is attached to the cam and serves to 25 pull it back into the position shown in Figure 2 after the cam has been released from the plunger 35 as will be explained hereafter.

Below the plate 16 the crank shaft 33 carries a hook 38 adapted to engage a pawl lever 39 30 which is pivoted loosely on the winding shaft 21 and which pawl lever carries a pawl 46 in engagement with the pinion 23. A spring 47 is attached to the pawl lever.

The clutch disk 43 carries three spring pressed 35 starting pins 48 which extend a distance below the disk, see Figure 3. The pins rotate with the disk and move within the central hole 49 of an eccentric cam 50 which is screwed fast to a clutch plate 51 by means of three screws 52, see Figure 40 10. The clutch plate 51 is cut out as seen in Figures 3 and 9 to form three recesses 53 the bottoms of which are depressed as at 54 whereby to form three clutch notches 55. The depressed 45 bottoms 54 of the recesses 53 form sloping approaches to the notches 55. The reason for this construction is that thereby the starting pins 48 may have space to gradually move into engagement with the notches 55 when said pins are depressed as will be explained later.

50 The clutch plate 51 is a standard equipment on the outboard motor and is screwed fast to the usual starter member 58 on the flywheel 12.

The top of the starter shaft 27 is engaged by a forked starting lever 60 pivoted at 61 which 55 operates between two collars 62 on the shaft in a well known manner. A spring 63, Figure 3, surrounds the shaft 27 below the one collar 62 between the latter and the upper plate 17. The spring 63 tends to move the shaft 27 upwards 60 into normal position as will be understood. 70 is the motor shaft fast to the flywheel 12 as usual.

When it is desired to start the motor, the operator depresses the starting lever 60 thereby 65 moving the starter shaft 27 downward and causing the lower clutch members 42 to become disengaged from the upper clutch members 26 (this clutch is thrown out) and also bringing the starter pins 48 down upon the sloping bottoms 54 70 of the recesses 55. The spring 31 is now free to move and it immediately unwinds vigorously, bringing the starter pins into engagement with the notches 55 (this clutch is thrown in) and thus imparts a vigorous rotative movement to the 75 flywheel 12 which causes the motor to start. The

spring 31 unwinds very rapidly and when it is almost unwound the tension of said spring is no longer able to overcome the tension of the cam spring 40 and the latter pulls the cam 34 around 5 in a position where it is again engaged by the plunger 36. This means that the crank shaft 33 is rotated so that the hook 38 no longer catches the pawl lever 39 and the latter is now free to move by contact with the eccentric cam 50 which rotates with the flywheel. 10

Consequently for each movement of the eccentric cam the pawl lever 39 by reason of the pawl 46 imparts a rewinding movement to the pinion 23 and gear 24 and the main spring is re-wound. This movement is very rapid. In fact 15 it takes about one minute to rewind the spring. At the end of the rewinding movement the main spring 31 overcomes the tension of the springs 40 and 35, the crank shaft 33 is again rotated and the parts brought into the position shown in Figure 5 when the hook 38 has caught the pawl lever 20 39 to hold it in its outermost position so that it no longer causes rewinding. The starter shaft has of course been returned to its upper position by the spring 63 and now the spring 31 is again 25 held in wound position ready for the next starting operation.

To sum up: The main spring 31 being unwound the parts are in the position shown in Figures 3 30 and 4 and the hook 38 on the crank shaft 33 does not engage the pawl lever 39, the crank shaft being held against rotation by the spring 40 and the plunger 35. The spring may now be wound by operating the winding shaft 21. When the spring has reached its proper predetermined tension, it overcomes the tension of the springs 40 35 and 35, the cam 34 is released from the plunger and the hook 38 is swung inward to catch the pawl lever 39 to hold it in its outermost position, see Figure 5. 40

When the starting lever 60 is operated the spring holding clutch 26—42 is thrown out and the starting clutch 48—55 is thrown in to start 45 the motor by spinning the flywheel.

The motor having been started and the main 45 spring thus having spent its force, the spring 40 pulls the crank shaft around to swing the hook away from the pawl lever and the latter is now free to cooperate with the eccentric cam 50 to 50 rewind the spring and at the end of the rewinding movement the hook 38 is again swung inward to catch the pawl lever because the latter has finished its rewinding operation.

It will be observed therefore that while the 55 motor is running, the main spring 31 remains wound ready for the next starting operation. Depression of the starting lever releases the main spring from its holding clutch 26—42, throws in the starting clutch 48—55 and the motor 60 starts. During the expanding movement of the main spring, rewinding cannot occur because the pawl lever 39 is held inoperative. At the end of the expanding movement the pawl lever is released to cause the rewinding of the spring. 65 When the spring has been rewound the pawl lever is again caught in its outermost position and no further rewinding can occur.

The illustration in Figure 6 shows that the 70 parts are so timed and arranged that the hook 38 is not moved fully into its outward position until the pawl lever has been brought back upon the high part of the cam 50, the parts being shown in their relative positions just before the cam finishes its last one half revolution from low 75 to high with respect to the lever 39.

The starting device herein disclosed has been constructed and tested and proven a complete success. The starting is accomplished automatically by merely depressing the starting lever manually for each starting operation. All the other elements function automatically. The device has been designed in a manner which adapts it for unitary construction and manufacture readily attachable to existing models of outboard motors.

It will be observed that the rewinding of the main spring is automatically controlled and limited by adjusting the tension of the plunger spring in that the main spring continues to be rewound until the tension of the plunger spring is overcome to permit release of the crank shaft which operates the hook 38 to stop the rewinding operation of the pawl lever 39. The same is of course true when the starting spring is wound manually.

It will also be understood that while I have disclosed my invention in its preferred form, changes and modification may be made within the principle of the invention and the scope of the appended claims.

I claim:—

1. A selfstarter for a motor comprising a starting spring normally held in wound condition, a shaft for automatically releasing said starting spring, clutching means automatically operated by said shaft to operatively connect the starting spring to the motor to start the same, cooperating means on the selfstarter and the motor for automatically rewinding the starting spring when the motor has been started and means actuated by the starting spring for stopping the rewinding of the starting spring when a predetermined tension thereof has been attained and a spring for restoring said shaft to normal position subsequent to its releasing operation.

2. A selfstarter for a motor comprising a starting spring normally held in wound condition, a manually operated shaft for automatically releasing said starting spring, clutching means automatically operated by said shaft to operatively connect the starting spring to the motor to start the same, cooperating means on the selfstarter and the motor for automatically rewinding the same when the motor has been started, means actuated by the spring for stopping the rewinding of the spring when a predetermined tension thereof has been attained and means for actuating said manually operated shaft.

3. A selfstarter for a motor having a flywheel comprising a starting spring normally held in wound condition, mechanism for automatically releasing the spring, means automatically operated by said releasing mechanism for operatively connecting the spring to the flywheel of the motor to start the same, a member secured to the flywheel of the motor, a rewinding mechanism on the selfstarter actuated by said member when the motor has been started and means actuated by the starting spring for controlling the operations of said rewinding mechanism.

4. A selfstarter for an outboard motor having a flywheel comprising a starting spring normally held in wound condition, a shaft for automatically releasing the spring, means automatically operated by said shaft for operatively connecting the spring to the flywheel of the motor to start the same, a member secured to the flywheel of the motor, a rewinding mechanism on the selfstarter actuated by said member when the motor has been started and means actuated by the

starting spring on the selfstarter for automatically stopping the operation of the rewinding mechanism when the starting spring has been rewound to desired tension.

5. A selfstarter for a motor comprising a starting spring, normally held in wound condition, means for releasing said spring, means automatically operated by said releasing means for connecting the spring and the motor to start the latter when the spring has been released, means for rewinding the spring after the motor has been started, said rewinding means including a gear operatively connected to the spring, a pawl for operating said gear to rewind the spring, a lever for actuating the pawl, means for supporting said gear, pawl and lever on the selfstarter, a member on the motor for operating said pawl and means secured to the one end of the starting spring for stopping the operation of the said rewinding pawl.

6. A selfstarter for a motor comprising a starting spring, means for winding the same, elements automatically stopping the winding of the spring when a predetermined tension thereof has been attained, a manually operated starter shaft, means holding the same in normal inactive position when the spring has been wound, a clutch automatically thrown in by said starter shaft when the latter is manually operated for operatively connecting the starting spring and the motor to start same, means for operating the starter shaft to actuate said clutch, rewinding means on the selfstarter, a member on the motor for actuating said rewinding means after the motor has been started and means operated by the starting spring for causing the said stopping elements to limit the rewinding operation when the spring has attained its predetermined tension.

7. A selfstarter for a motor having a flywheel secured to the motor shaft comprising a starter spring, means for holding the same under tension including a first clutch facing the flywheel, a second clutch secured to the flywheel, a starter shaft, clutch members thereon interposed between the aforesaid two clutches, means automatically holding said starter shaft in normal position with some of its clutch members in engagement with the said first clutch and means for operating said starter shaft to disengage its said clutch members from the said first clutch and to engage other of its clutch members with the said flywheel clutch to cause the starter spring to rotate said starter shaft to start the motor.

8. A selfstarter for a motor having a flywheel secured to the motor shaft comprising a starter spring, means for holding the same under tension including a first clutch facing the flywheel, a second clutch secured to the flywheel, a starter shaft, clutch members thereon interposed between the aforesaid two clutches, a spring for automatically holding said starter shaft in normal position with some of its clutch members in engagement with the said first clutch and means for operating said starter shaft to disengage its said clutch members from the said first clutch and to engage other of its clutch members with the said flywheel clutch to cause the starter spring to rotate said starter shaft to start the motor, said holding spring serving to automatically restore the starter shaft to its normal position.

9. A selfstarter for a motor comprising a starter spring, means normally holding the same under tension, a starter shaft, clutching members on said shaft in normal engagement with said hold-

ing means to prevent operation of said shaft; a clutch secured to the motor shaft, means for operating the starter shaft to disengage some of its clutching members from said holding means and
5 engage other of its clutching members with the said motor shaft clutch to cause the starting spring to operate the starter shaft to start the motor, a spring for automatically disengaging said last mentioned clutching members from the
10 said motor shaft clutch to permit said spring to be wound, spring winding mechanism, a cam actuated by the motor for operating said spring winding mechanism and means actuated by the starter spring for automatically stopping the
15 winding of the spring when sufficient tension thereof has been obtained.

10. A selfstarter for a motor comprising a starter spring, mechanism normally holding said spring under tension, a spring winding gear included in said mechanism, a clutch on said gear,

a second clutch secured to the motor shaft, a starter shaft, an upper and a lower clutch thereon, a spring holding the upper clutch in normal engagement with the said gear clutch and the lower clutch out of engagement with the said
5 motor shaft clutch, means for operating said starter shaft to reverse the positions of the said upper and lower clutches to cause the starter spring to rotate the starter shaft to start the motor, said spring serving to automatically return the
10 starter shaft and its clutches to normal position for winding the spring after the motor has been started, a pawl for operating said gear to wind the spring, a member secured to the motor shaft for actuating said pawl and means secured to the free
15 end of the spring for automatically stopping the operations of said pawl when the spring has obtained sufficient tension.

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