June 7, 1960 E. T. HANSEN 2,939,448

ELECTRIC STARTER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed April 4, 1957 3 Sheets-Sheet 1

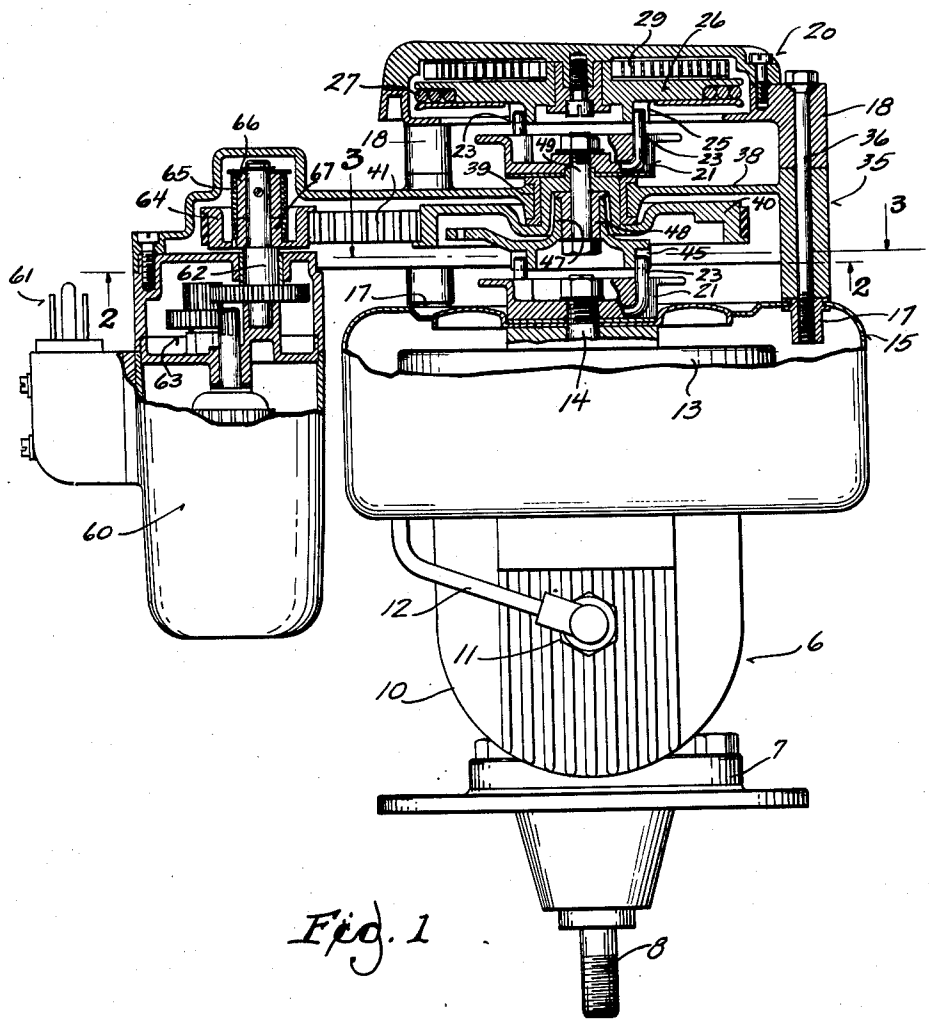


Fig. 1

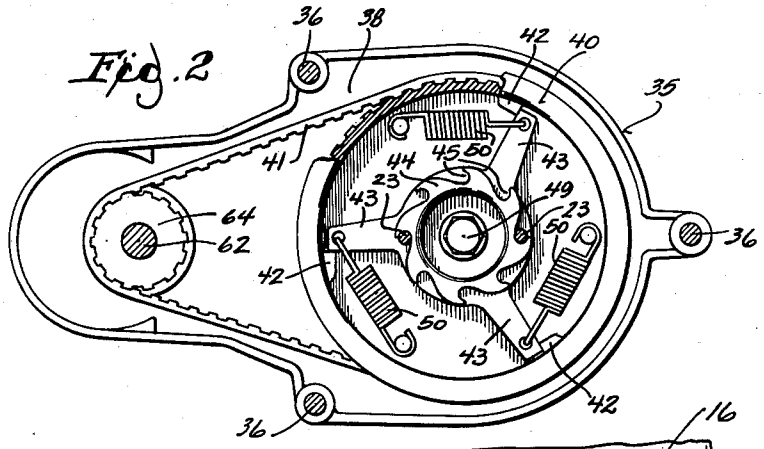
INVENTOR.
EINAR T. HANSEN
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

June 7, 1960 E. T. HANSEN 2,939,448

ELECTRIC STARTER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed April 4, 1957 3 Sheets-Sheet 2

Fig. 2



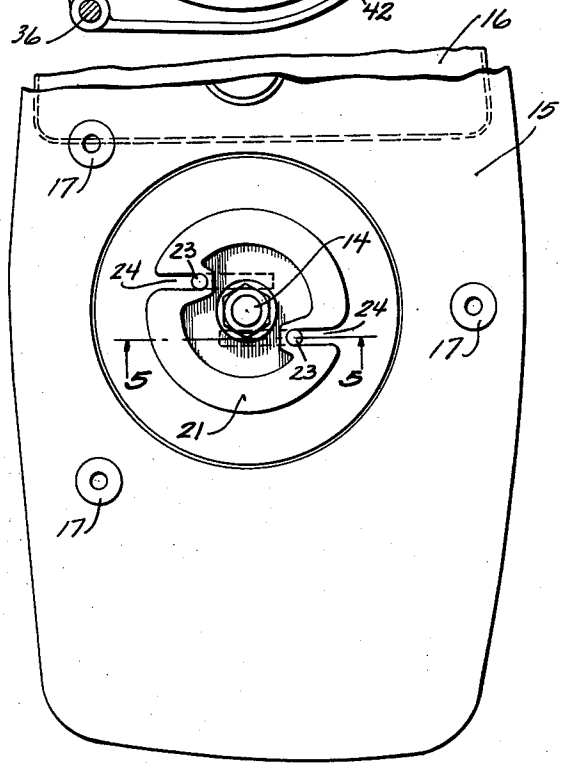


Fig. 3

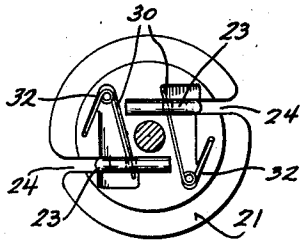


Fig. 4

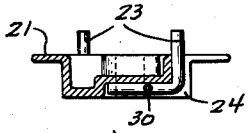


Fig. 5

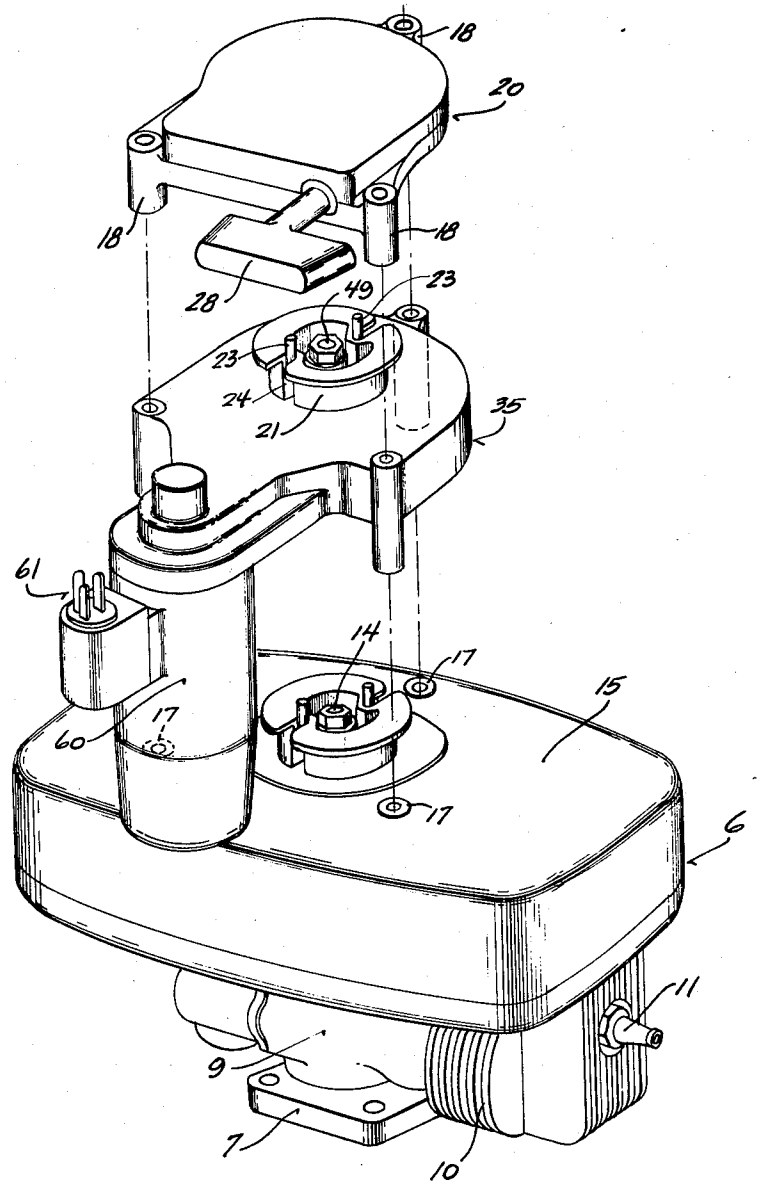
INVENTOR.
EINAR T. HANSEN
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

June 7, 1960 E. T. HANSEN 2,939,448

ELECTRIC STARTER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed April 4, 1957 3 Sheets-Sheet 3

Fig. 6



INVENTOR.
EINAR T. HANSEN
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

United States Patent Office 2,939,448 Patented June 7, 1960

2,939,448

ELECTRIC STARTER ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Einar T. Hansen, Wauwatosa, Wis., assignor to Outboard Marine Corporation, Waukegan, Ill., a corporation of Delaware

Filed Apr. 4, 1957, Ser. No. 650,751

6 Claims. (Cl. 123—179)

This invention relates to an electric starter attachment for internal combustion engines.

The invention is applicable to a wide variety of internal combustion engines. By way of example, it is illustrated in an embodiment which is intended for use in connection with the internal combustion engine of a power mower, this being one type of engine in which the crankshaft is upright.

One of the objectives is to provide an attachment which can be interposed between the flywheel and the recoil starter of an otherwise conventional engine, whereby the starter can be added to existing engines and whereby the engine may be sold with or without the electric starter as may be desired by the customer.

To achieve these results, the starting motor is supported upon, and arranged to drive through, a housing member which is so designed that it can be sandwiched between the flywheel housing and the recoil starter housing with no change whatever other than the lengthening of the fastening bolts to accommodate the increased dimensions resulting from the change.

In the type of engine herein illustrated, the flywheel carries a centrifugally released overrunning clutch mounted in an emergency starting pulley and having axially projecting clutch dogs. In the original assembly, these dogs interact with ratchet teeth connected to the recoil starter pulley. The electric starter mechanism inserted between the recoil starter and the engine includes a like ratchet with which the original dogs interact, this ratchet being mounted through shock absorbing means within a pulley driven from the electric starting motor. This pulley in turn carries a rotor in which are mounted centrifugally releasable dogs identical with those of the original device and meshing with the ratchet of the recoil starter pulley in the same manner as in the original device.

Thus the new drive to the engine crankshaft includes two centrifugally releasable overrunning clutches which are axially aligned with each other and with the crankshaft and have between them the pulley actuated by the electric starting motor. Both of these releasable overrunning clutches are centrifugally released when the engine reaches operating speed so that thereafter the pawls thereof do not engage either of the drive ratchets. The clutch proximate to the flywheel precludes transmission of motion either to the starting motor or to the recoil starter from the operating engine, while the superimposed clutch protects the recoil starter only.

In the drawings:

Fig. 1 is a view partially in side elevation and partially in axial section showing a starting motor installed in accordance with the present invention.

Fig. 2 is a view taken in section looking upwardly from the line 2—2 of Fig. 1.

Fig. 3 is a view taken in section looking downwardly from the line 3—3 of Fig. 1.

Fig. 4 is a bottom plan view of the rotor in which the centrifugally releasable dogs are mounted, the construction shown being typical of both of the two rotors of this type present in the assembly.

Fig. 5 is a view taken in section on line 5—5 of Fig. 3.

Fig. 6 is a view showing in perspective the mutually separated recoil starter housing, electric starter housing and mount, and the engine to which these parts are applicable.

The engine generically designated by reference character 6 comprises a supporting base 7 below which projects the drive shaft 8. On the base 7 is mounted the crankcase 9 from which the cylinder 10 projects laterally, being provided with cooling fins on its sides and end and having a terminal spark plug installation at 11 to which the ignition wire 12 leads from the usual flywheel magneto. The magneto is not illustrated, but the flywheel is designated in Fig. 1 by reference character 13. The flywheel is mounted on the upper end of the crankshaft 14 and enclosed by a shroud or housing 15 within which is the fuel tank 16 in accordance with conventional practice.

Three bosses 17 fixed to housing 15 receive clamping bolts which extend through the bosses 18 of the recoil starter housing 20 to secure the recoil starter to the engine. In accordance with conventional practice, the upper end of the crankshaft 14 carries a rotor 21 which is shown in detail in Figs. 4 and 5. The L-shaped pawls 23 are guided in outwardly opening channels 24 in rotor 21 and have upwardly projecting portions arranged to coact with the teeth of a driving ratchet wheel. In the original assembly, the ratchet wheel teeth 25 are formed on the under side of pulley 26 on which the starting cord 27 is coiled. The starting cord has the usual starting handle 28 and is rewound on the pulley 26 after use by means of a helical spring 29 within housing 20 as best shown in Fig. 1.

The pawls 23 are urged into engagement with teeth 25 by means of the hairpin type springs 30 which are carried on the under side of rotor 21, confined in slots 32, and having their longer legs passed through small holes in the respective pawls in the manner clearly shown in Figs. 5 and 6. These springs are relatively light and when the engine is in operation, centrifugal force urges the respective pawls outwardly in the ways provided by slots 24 so that they are completely free of contact with the teeth 25 and are not restored to engagement therewith until the bias of springs 30 becomes greater than the bias of the centrifugal force developed during operation. In other words, when the engine stops, the pawls are re-engaged with the teeth in readiness for a further starting operation.

When electric starting is to be provided for the engine 6, the bosses 18 are disconnected from the flywheel housing 15, and intervening housing 35 is sandwiched between housings 15 and 20 and secured in place by longer bolts 36 (Fig. 1). The housing 35 includes a web 38 which provides a bearing at 39 for the hub of a pulley 40 about which is trained the belt 41 driven from the electric starting motor in a manner hereinafter described. While the ratchet teeth may be mounted directly on pulley 40 in the same manner in which teeth 25 are mounted on pulley 26 in the conventional structure, it is preferred to incorporate means for reducing shock.

To this end, the pulley 40 is provided beneath its rim with lugs 42 engaged by the tips of arms 43 on a separately fabricated ratchet wheel 44 which has teeth at 45 engaged by the pawls 23 of the original rotor 21. The ratchet wheel 44 is rotatable independently of pulley 40 in a clockwise direction as viewed in Fig. 2, having its own hub portion 47 journaled on a bushing 48 anchored by bolt 49 to the upper rotor 21 of the overrunning clutch of the recoil starter. Tension springs 50 anchored to the pulley 40 are connected to the arms 43 of ratchet wheel

44 and bias the ratchet wheel in a direction to engage arms 43 with lugs 42 as shown in Fig. 2. In the event of shock, limited movement between pulley 40 and ratchet wheel 44 is accommodated by the yielding of springs 50.

With the parts assembled as thus far described, it will be evident that when the operator pulls sharply on the handle 28 to withdraw the starting cord 27 from the pulley 26 of the recoil starter, the rotation of the pulley will be communicated from ratchet teeth 25 through pawls 23 to the upper rotor 21 which, in turn, will drive through pulley 40, springs 50 and arms 43 of ratchet wheel 44 and through its teeth 45 to the pawls 23 of the lower rotor 21 to the crankshaft 14 in an engine starting direction. Assuming that the engine is to be electrically started, the crankshaft will be driven in the following manner.

The starting motor 60 is desirably made for operation with 110 volt, 60 cycle current. A motor of the type used in portable electric drills has been found suitable. Current from a convenient outlet is provided through the terminal plug contacts 61 to energize the motor which drives its output shaft 62 through any appropriate gear train such as that shown at 63 Mounted concentrically with shaft 62 is a driving pulley 64 about which the belt 41 is trained. Pulley 64 may be considerably smaller than the driven pulley 40 above described in order to provide for additional reduction beyond what is achieved in the gear train 63. In the instant device, the drive from shaft 62 to the driving pulley 64 is effected through an overrunning clutch of the type which employs a coil spring 65 as its coupling element. The shaft 62 carries a collar 66 identical in diameter with the hub 67 of the drive pulley 64. The collar and hub are encircled by a coil spring 65 which contractilely engages both and is wound in such a direction as to be tightened on the collar 66 when the shaft is the source of power, but to relax its grip on collar 66 when the rotation is coming from the hub to the shaft.

Thus, when the motor 60 is energized, motion is transmitted through the gear reducing train and overrunning clutch 65, 66, 67 to the driving pulley 64 and thence by means of belt 41 to the driven pulley 40 to actuate the arms 43 of ratchet wheel 44 in a direction to drive the crankshaft 14 through the pawls 23 in the manner already described.

When the electric drive is effected, the upper ratchet pawls 23 will ratchet over the teeth 25 of the recoil starter pulley 26 so that no motion will be communicated to the recoil starter pulley. When the recoil starter pulley is in operation, the coil spring clutch of the electric drive will interrupt transmission of motion backwardly into the electric motor. When the engine is in operation under its own power, the lower overrunning clutch will normally preclude transmission of motion either to the electric starter or to the recoil starter but as already noted, each of these devices is secondarily protected by its own overrunning clutch.

I claim:

1. In a manually operable and power operable starter for an engine shaft, the combination with a manually operable rotor and the engine shaft to which starting power is to be applied, of two overrunning clutches in series between said rotor and shaft and including driving clutch means connected with the rotor, driven clutch means connected with the shaft, and a motor-driven member comprising a driven clutch means with which the driving clutch means coacts and a driving clutch means coacting with the first-mentioned driven clutch means.

2. The combination with an engine having a shaft exposed for starting and provided with a driven starter clutch element, of a power starter comprising a subframe having means detachably connecting it with said member, a motor mounted on the subframe, a rotatable member aligned with said shaft and having an operative connection with the motor to be driven thereby and including a driving clutch element complementary to the driven clutch element with which the engine shaft is provided, said member further having a second driven clutch element, a second subframe detachably connected with the subframe first-mentioned and connectable with the engine interchangeably with the first-mentioned subframe, a manually operable starter rotor mounted on the second subframe in alignment with the engine shaft, and a driving clutch element carried by said manually operable starter rotor, said member having its own driven clutch element operatively associated with the driving clutch element last mentioned, the driving clutch element of said rotor and the driven clutch element of said member constituting a first overrunning clutch and the driving clutch element of said member and the driven clutch element on said engine shaft constituting a second overrunning clutch, both of said clutches being aligned in series between the manually operable rotor and said shaft.

3. The device of claim 2 in which said driving connections include a third overrunning clutch whereby to free said motor from operation from said member.

4. The combination with an engine provided with a flywheel and a housing therefor and a shaft projecting from said flywheel, of a first extension housing mounted on the housing first mentioned, a second extension housing mounted on the first extension housing, a manually operable starter comprising a rotor supported on the second extension housing and provided with a first driving clutch element, a power operable member aligned with the rotor and mounted on the first extension housing and having a driven clutch element operatively coacting with the driving clutch element of said rotor, said member further having a driving clutch element and said shaft having a driven clutch element operatively coacting therewith, a motor mounted on the first extension housing, and driving connections carried by the first extension housing and operatively connecting said motor with said member for the driving of said engine shaft through said member and its driving clutch element and the driven clutch element of said shaft, said rotor being adapted to drive said shaft through said member, the drive from said rotor to said shaft including in series two overrunning clutches comprising all of the driving and driven clutch elements aforesaid.

5. The device of claim 4 in which said second extension housing is directly applicable to said flywheel housing upon removal of the first extension housing, the driving clutch element of said rotor being thereupon directly applicable to the driven clutch element of said engine shaft.

6. The device of claim 4 in which the motion-transmitting connections from said motor to said member include a train of meshing gears and a third overrunning clutch, a pulley driven from the third overrunning clutch, and a belt connecting the pulley with said member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,006,064	Clarke	Oct. 17, 1911
1,288,086	McGrath	Dec. 17, 1918
1,288,087	McGrath	Dec. 17, 1918
1,288,088	McGrath	Dec. 17, 1918
1,727,086	Vastano	Sept. 3, 1929
2,404,419	Weatherly	July 23, 1946
2,530,623	Martin	Nov. 21, 1950
2,693,718	Gericke	Nov. 9, 1954
2,731,005	Lausen	Jan. 17, 1956
2,759,372	Hertrich	Aug. 21, 1956
2,838,938	Sacchini et al.	June 17, 1958
2,835,241	Brooks	May 20, 1958