Jan. 2, 1968 W. R. FARMER 3,361,166

CHAIN SAW STARTING MEANS

Filed Feb. 10, 1965 2 Sheets-Sheet 1

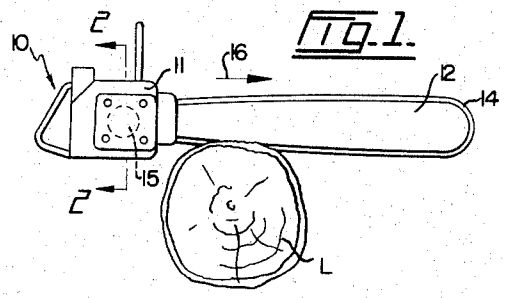


Fig. 1.

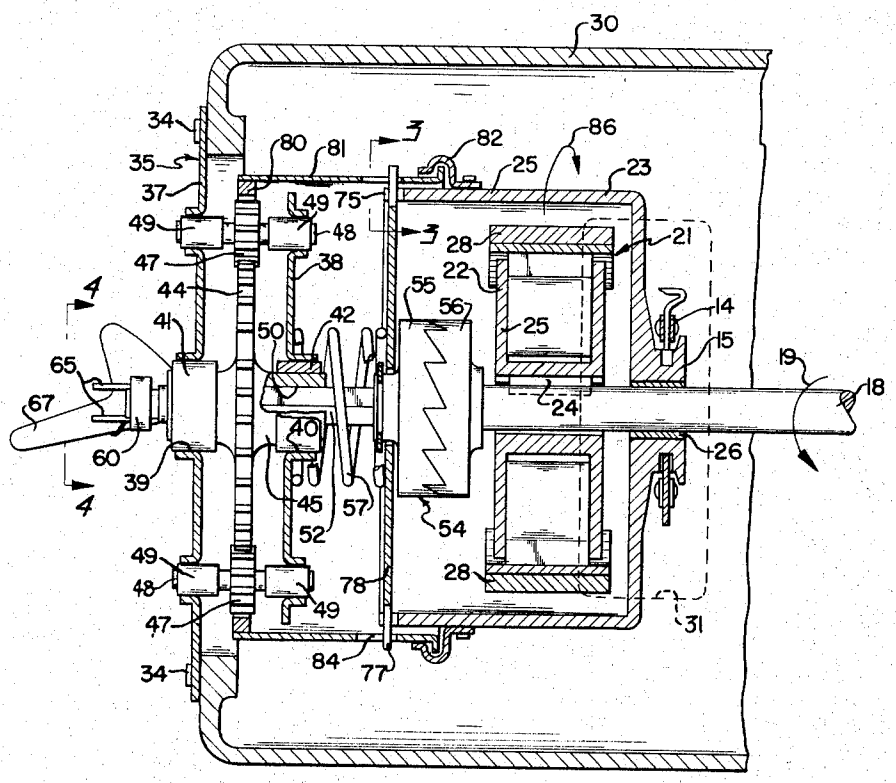


Fig. 2.

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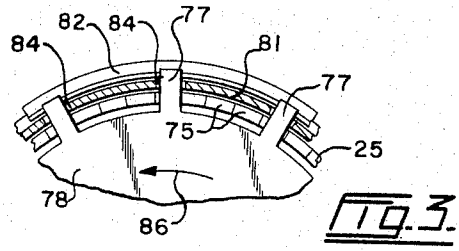


FIG. 3.

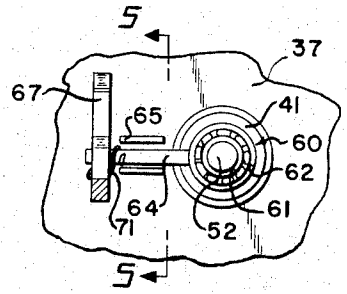


FIG. 4.

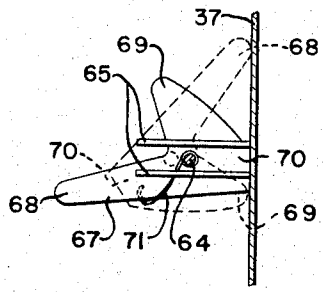


FIG. 5.

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CHAIN SAW STARTING MEANS

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ABSTRACT OF THE DISCLOSURE

Means connecting the crank shaft of a chain saw motor to the saw chain sprocket and permitting the motor to be cranked by moving the saw chain counter to the direction of cut.

Background of the invention

This invention relates to improvements in motor starting mechanisms and more particularly to means for cranking the gas powered engine and a chain saw.

Most saw chains presently in use are equipped with a recoil starting mechanism which is operated by means of a pull cord. Very often it will be found that such a mechanism fails to spin the motor sufficiently to cause it to fire, this being particularly the case in cold weather. A considerable effort must be expended to turn over a cold motor using the conventional hand operated starter and this was found to be such a disadvantage that some manufacturers are turning to electric starters and the like. However, the increased cost and additional weight of power operated starters largely offsets their advantages over manually operated starters.

Summary of the invention

The present invention contemplates the use of an auxiliary drive train which is interp osed between a part rotatable with a chain saw motor and a part rotatable with the saw chain. Such a drive train allows the motor to be cranked simply by reverse rotation of the saw chain, the simplified drive train providing an increased gear ratio which will spin the motor at a speed most likely to result in starting. The starting means is disconnected automatically once the motor fires and attains normal operating speed so that there is no likelihood of damage occurring to any of the chain saw parts through an oversight on the part of the saw operator who also has full manual control over the device.

Brief description of the drawings

FIGURE 1 is a side elevation of a chain saw equipped with the present starting means,

FIGURE 2 is an enlarged vertical section taken on the line 2—2 of FIGURE 1,

FIGURE 3 is a section taken on line 3—3 of FIGURE 2 and showing the pawl and ratchet drive,

FIGURE 4 is a section taken on the line 4—4 of FIGURE 2 and showing the control lever, and

FIGURE 5 is a section taken on the line 5—5 of FIGURE 4.

Description of the preferred embodiment

Referring particularly to FIGURE 1 of the drawings, the numeral 10 indicates a chain saw having a motor housing 11, a cutter bar 12, a saw chain 14, and a motor driven sprocket 15. When the chain saw motor is operating in the normal manner, the chain 14 is driven around the cutter bar 12 in a direction of cut indicated by arrow 16.

Referring now particularly to FIGURE 2 of the drawings, the chain saw motor will be seen to have a crank shaft 18 which rotates in the direction of arrow 19 to drive chain 14 in the direction of cut. In order to operatively connect shaft 18 and sprocket 15, the chain saw motor is provided with a suitable clutch 21. As shown in FIGURE 2, the preferred clutch 21 includes a drive member 22 and a driven member 23. Member 22 is secured to shaft 18 by a key 24 and member 23, which is in the form of an open-ended drum having a peripheral wall 25, is journalled on said crank shaft by means of a bearing 26. The member 22 is fitted with pivotally mounted clutch shoe 28 which are adapted to be swung by centrifugal force into driving engagement with the inner surface of the wall 25. Thus, the clutch 21 is applied automatically at a predetermined motor speed to transmit drive from shaft 18 to sprocket 15, the sprocket being integrally formed with the member 23. Since this type of clutch is well known and is used on many chain saws, further detailed description of the construction and operation of the clutch is not considered necessary. Other clutches will also serve to couple the saw chain drive sprocket to the crankshaft, for example, a manually operated clutch can be used. It is essential only that the motor clutch be disengageable when the starting means is in operation and that the clutch driven member have a part substantially similar to the peripheral wall 25.

The motor housing 11 has a portion 30 which encloses the clutch 21 and the parts associated therewith, this housing portion having a suitable opening 31, shown in dotted line only in FIGURE 2, through which the inner end of the saw chain 14 extends. Secured to the portion 30 by means of bolts 34, is a gear box generally indicated by the numeral 35. Gear box 35 comprises outer and inner plates 37 and 38 respectively, the two parallel and spaced apart plates being secured together by suitable spacers and bolts, not shown. Plates 37 and 38 have flanged central openings 39 and 40 and mounted in said openings are bearings 41 and 42. A gear 44, having a hub 45, is journalled in the bearings 41 and 42, the gear being disposed between the plates 37 and 38 in parallel relation thereto. Gear 44 is engaged by a suitable number of reversing pinions 47, the pinions having spindles 48 which are journalled in bearings 49 carried by the plates 37 and 38.

The gear hub 45 has a bore 50 in which a drive shaft 52 is slidably but non-rotatably mounted. Shaft 52 is shown in the drawings as being square with the bore 50 correspondingly shaped but obviously the shaft and the hub bore may be splined in the conventional manner to prevent relative rotation therebetween.

Drive shaft 52 and the crank shaft 18 are horizontally aligned and their adjacent ends are connected by a starting clutch generally indicated by the numeral 54. Clutch 54 consists of a drive member 55 secured to shaft 52 and a driven member 56 secured to shaft 18. The two clutch members interlock in the manner of a conventional claw clutch so that drive can be transmitted from shaft 52 to shaft 18 in the direction of arrow 19. When the shaft 18 overruns the shaft 52, the member 55 is forced away from the member 56 and the shaft 52 is caused to move endwise in the hub 45. A spring 57 is interposed between the gear box plate 38 and the clutch drive member 55 to urge said clutch member into engagement with the clutch member 56.

Fitted to the outwardly projecting end of the shaft 52, is a bearing 60 having an inner race 61 and an outer race 62, see particularly FIGURE 4. The outer race 62 has a radially extending pin 64 which is received between a pair of vertically spaced lugs 65, the lugs projecting outwardly from the outer plate 37 of the gear box 35. Rotatably mounted on the free end of the pin 64, is a hand lever 67 having an outer end 68, a toe 69 and an inner end 70 (FIGURE 5). A spring 71 is connected to the lever 67 and the pin 64, the lever being disposed in the solid line position of the drawings when the clutch 54 is

engaged. At this time, the spring **71** is under tension and is holding the inner end **70** of said lever in contact with the outer face of the plate **37**. When the clutch **54** is forcefully disengaged in response to overrunning of the shaft **18**, the shaft **52** is moved outwardly, and the spring **71** swings the hand lever **67** to the dotted line position shown in FIGURE 5. In this position, the outer end **68** and the toe **69** of the hand lever are held in contact with the plate **37** by pressure of the spring **57** and the clutch member **55** is supported out of engagement with the clutch member **56**.

Formed on the outer edge of the wall **25** of the driven member are ratchet teeth **75**, see FIGURES 2 and 3. The ratchet teeth **75** are adapted to be engaged by pawls **77** which are carried by an annular disc **78**, the disc being rotatably secured to the clutch member **55** and being movable therewith as the clutch **54** is engaged and disengaged.

The pinions **47** are engaged by a ring gear **80** and fitted to this ring gear is an inwardly projecting flange **81** which extends over the outer end of the wall **25**. A circular bracket **82** is secured to the peripheral wall **25** and the inner edge of the flange **82** is slidably supported in this bracket so that said flange, and the ring gear **80** supported thereby, can rotate relative to the driven member **23** of the clutch **21**. The flange **81** has a number of circumferentially spaced openings **84**, there being one such rectangular opening for each pawl **77**, the pawls projecting through the openings and being freely slidable therein.

When the chain saw is being used to saw through a log L, for example, the motor clutch **21** obviously is engaged while the starting clutch **54** is disengaged by placement of the hand lever **67** in the dotted line position of FIGURE 5. The shaft **18**, clutch **21**, and sprocket **15** rotate as a unit in the direction of arrow **19**. The saw chain **14** would then be moved around cutter bar **12** in the direction of arrow **16** to cut through the log.

Assuming that the chain saw motor is stopped for some reason and requires restarting, this can readily be accomplished as follows: Hand lever **67** is swung to the solid line position of the drawings, whereupon the starting clutch members **55** and **56** are engaged by the action of the spring **57**. Movement of the clutch member **55** to engage clutch member **56** moves the disc **78** inwardly whereupon the pawls **77** travel along their openings **84** and engage the ratchet teeth **75**. This engagement of the pawls and ratchet teeth couples the clutch member **23** to the flange **81** so that the ring gear **80** will be rotated with said member and the sprocket **15**.

The lower or cutting run of the saw chain **14** is then placed in contact with the top surface of the log as shown in FIGURE 1 and the chain saw is pulled towards the user. This causes the chain **14** to rotate about the cutter bar **12** in a direction opposite to arrow **16**. Movement of the saw chain **14** in this direction causes the member **23** to rotate in the same direction and, since the ratchet teeth **75** are then in driving contact with the flange **81** through the pawls **77**, said flange and the ring gear **80** attached thereto are also rotated in this direction which is indicated by arrow **86** in FIGURES 2 and 3. The pinions **47** drive the starting clutch gear **44** in the opposite direction and rotation of the shaft **52** is transmitted through the starting cluch **54** to the crank shaft **18**, the crank shaf being rotated in the normal direction of rotation indicated by arrow **19**. It will be noted that the ring gear—to reversing pinion—to starting clutch gear drive, provides an increased gear ratio which results in the shaft **18** being rotated faster than the saw chain **14** is rotated around the cutter bar. Thus, a short pull of a foot or so of the chain **14** will spin the crank shaft **18** in a manner most likely to cause the chain saw motor to start. Once the motor starts, the starting clutch **54** automatically is thrown out of engagement and is held disengaged by the hand lever **67** as previously described. At the same time, the disc **78** is moved outwardly so that the pawls **77** are removed from engagement with the ratchet teeth **75**. The ring gear **80** and flange **81** then remain stationary with the clutch member **23** continuing to rotate with the sprocket **15**. From the foregoing, it is readily apparent that there has been provided a simple and effective means for starting a chain saw.

What is claimed:

1. Means for starting an internal combustion motor of a chain saw having a saw chain, a part rotatable with the motor in the normal direction of rotation of said motor, and a part rotatable with the saw chain and being connected to said motor part by a motor clutch; said means comprising an automatically disengaging cluch including a driven member connected to the motor part and a drive member, drive means operatively connecting the saw chain part to the clutch drive member including means for reversing the direction of drive from said saw chain part to said clutch drive member, said drive means being adapted to rotate the motor part in the normal direction of rotation of said motor in response to a pull exerted on the saw chain in a direction opposite to the normal direction of cut of said saw chain.

2. Means for starting an internal combustion motor as claimed in claim **1**, and including means for manually operating the automatically disengaging clutch.

3. Means for starting an internal combustion motor as claimed in claim **2**, in which said drive means includes a one directional drive device adjacent the saw chain part.

4. Means for starting an internal combustion motor as claimed in claim **3**, and including means for operating the drive device as the automatically disengaging clutch is moved into and out of engagement.

5. Means for starting an internal combustion motor as claimed in claim **1**, in which said drive means rotates the clutch drive member faster than the saw chain part is rotated.

6. Means for starting an internal combustion motor of a chain saw having a saw chain, a crank shaft, a drive sprocket for the saw chain, and a motor clutch adapted to connect the crank shaft to the drive sprocket; said means comprising an endwise movable drive shaft rotatably mounted adjacent the crank shaft, an automatically disengaging clutch connecting the crank shaft to the drive shaft, a peripheral wall rotatable with the drive sprocket, a ring gear rotatably mounted on the peripheral wall, a gear mounted for rotation with the drive shaft, a reversing pinion meshing with the ring gear and the drive shaft gear, and drive means adapted to connect the peripheral wall to the ring gear.

7. Means for starting an internal combustion motor as claimed in claim **6**, and including spring means resisting disengagement of the automatically disengaging clutch.

8. Means for starting an internal combustion motor as claimed in claim **7**, and including manually operable means for rendering the automatically disengaging clutch inoperative.

9. Means for starting an internal combustion motor as claimed in claim **6**, in which said drive means includes a ratchet and pawl drive device which transmits drive between the peripheral wall and the ring gear when said peripheral wall is rotated in a direction opposite to the normal direction of rotation of the crank shaft.

10. Means for starting an internal combustion motor as claimed in claim **9**, and including means for simultaneously disengaging the drive device as the automatically disengaging clutch is moved to disengagement.

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