June 16, 1953 W. P. DALRYMPLE 2,642,055

ENGINE STARTER MECHANISM

Filed Aug. 1, 1951 5 Sheets-Sheet 1

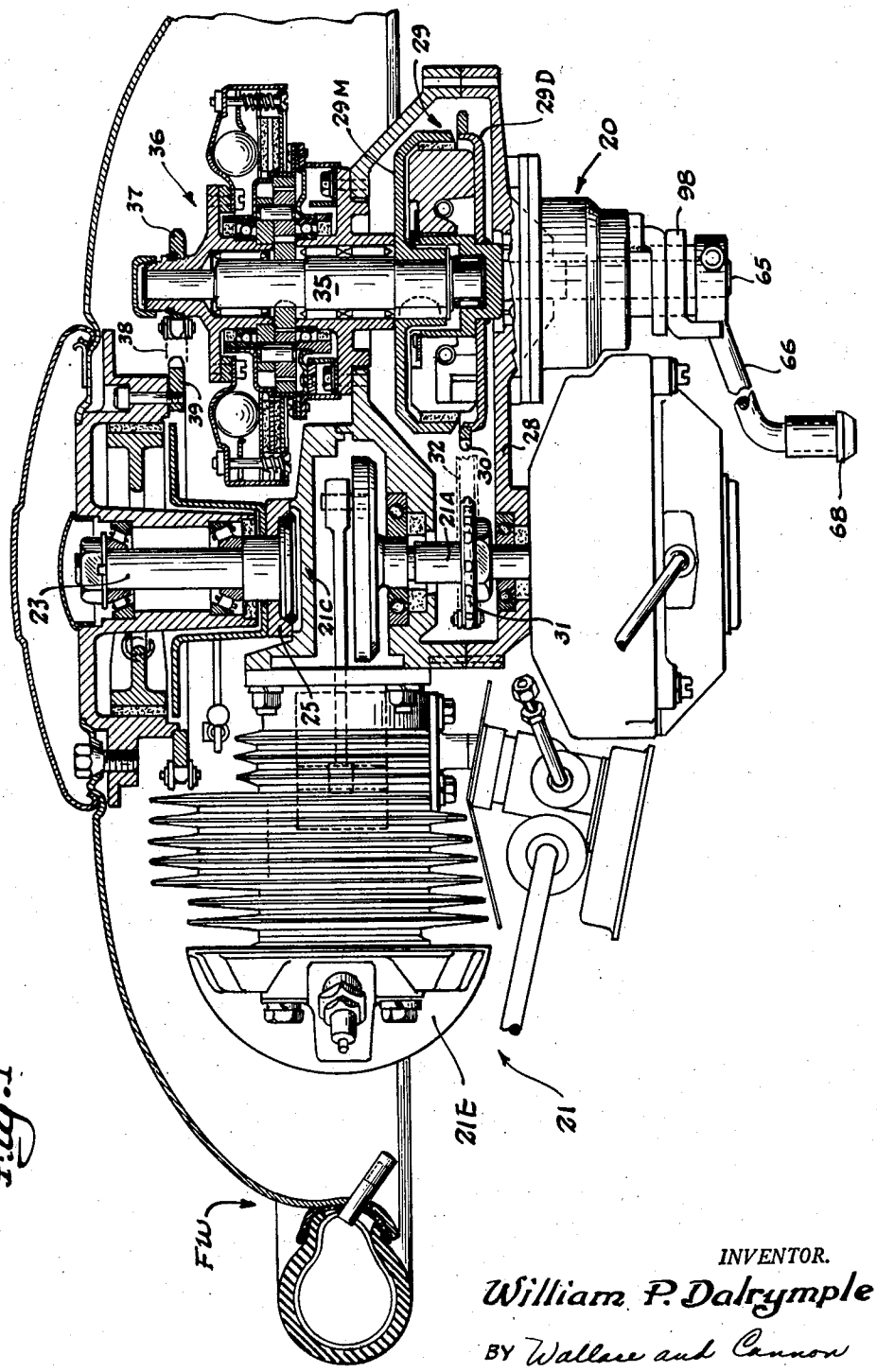


Fig. 1

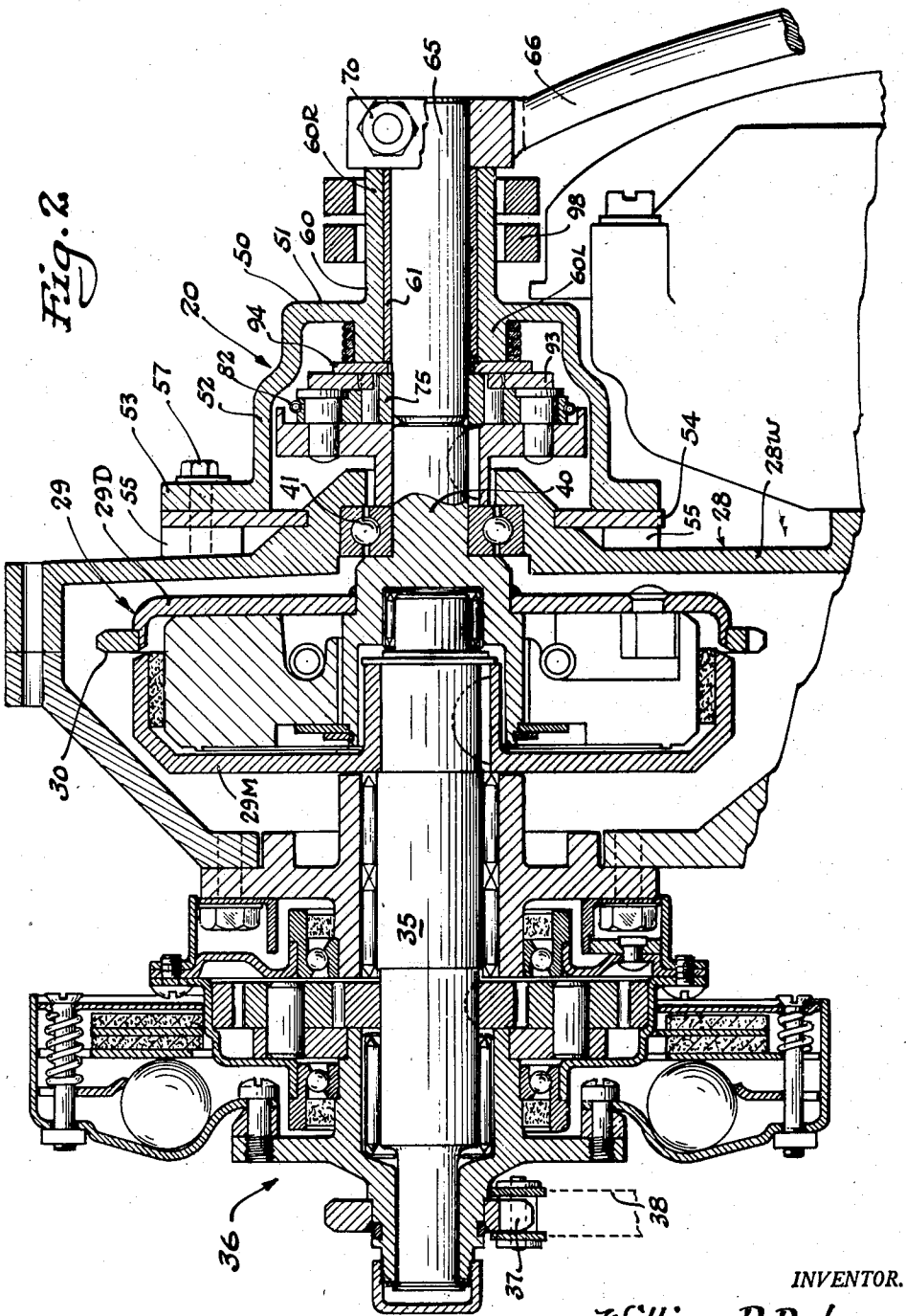
INVENTOR.
William P. Dalrymple
BY Wallace and Cannon
ATTORNEYS

June 16, 1953 W. P. DALRYMPLE 2,642,055

ENGINE STARTER MECHANISM

Filed Aug. 1, 1951 5 Sheets-Sheet 2

Fig. 2



INVENTOR.

William P. Dalrymple

BY Wallace and Cannon

ATTORNEYS

June 16, 1953 W. P. DALRYMPLE 2,642,055

ENGINE STARTER MECHANISM

Filed Aug. 1, 1951 5 Sheets-Sheet 3

Fig. 4

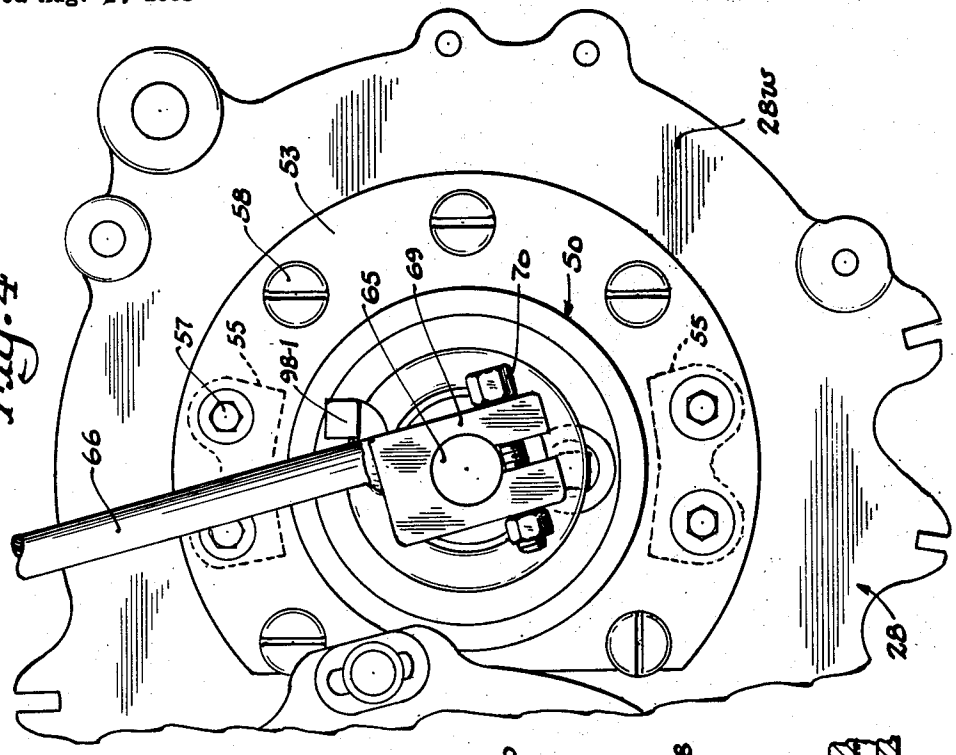
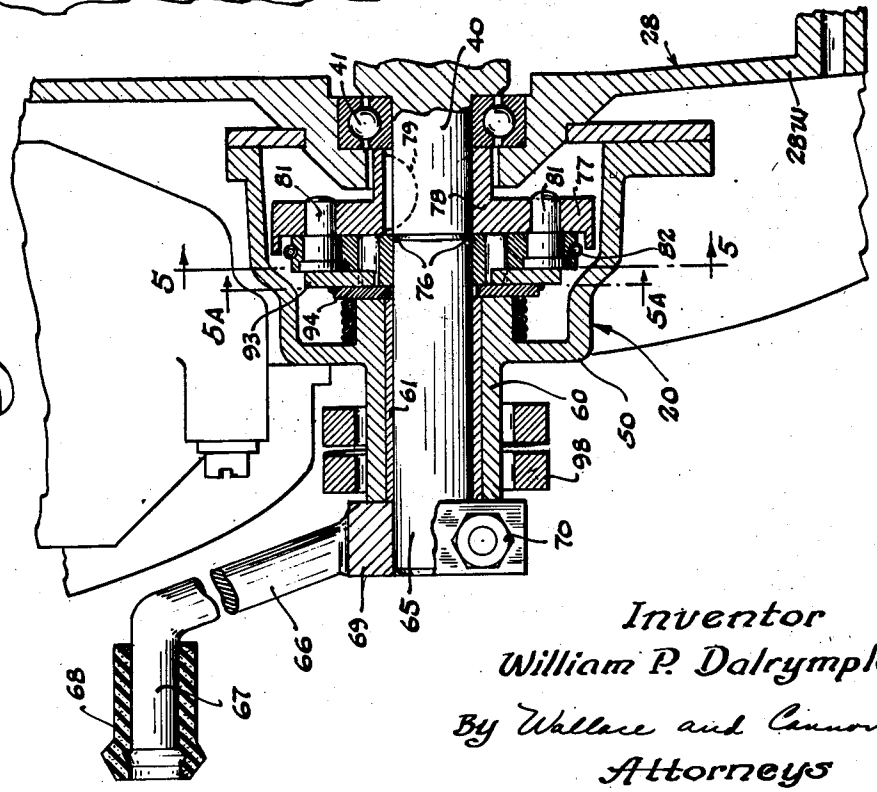


Fig. 3



Inventor
William P. Dalrymple
By Wallace and Cannon
Attorneys

June 16, 1953 W. P. DALRYMPLE 2,642,055

ENGINE STARTER MECHANISM

Filed Aug. 1, 1951 5 Sheets-Sheet 4

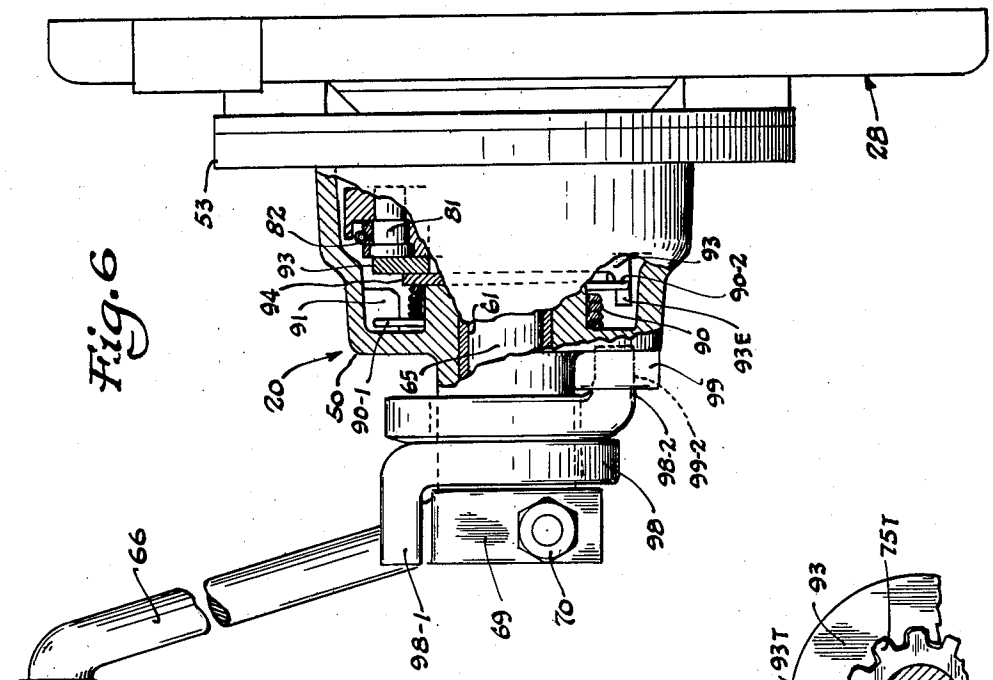


Fig. 6

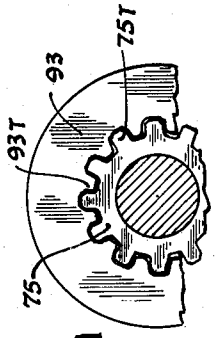


Fig. 5A

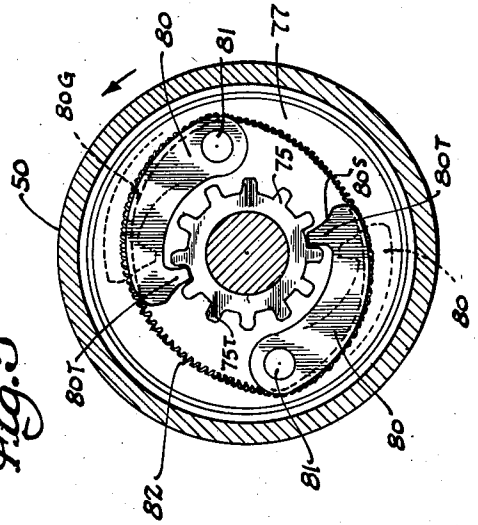


Fig. 5

Inventor
William P. Dalrymple
By Wallace and Cannon
Attorneys

June 16, 1953 W. P. DALRYMPLE 2,642,055

ENGINE STARTER MECHANISM

Filed Aug. 1, 1951 5 Sheets-Sheet 5

Fig. 8

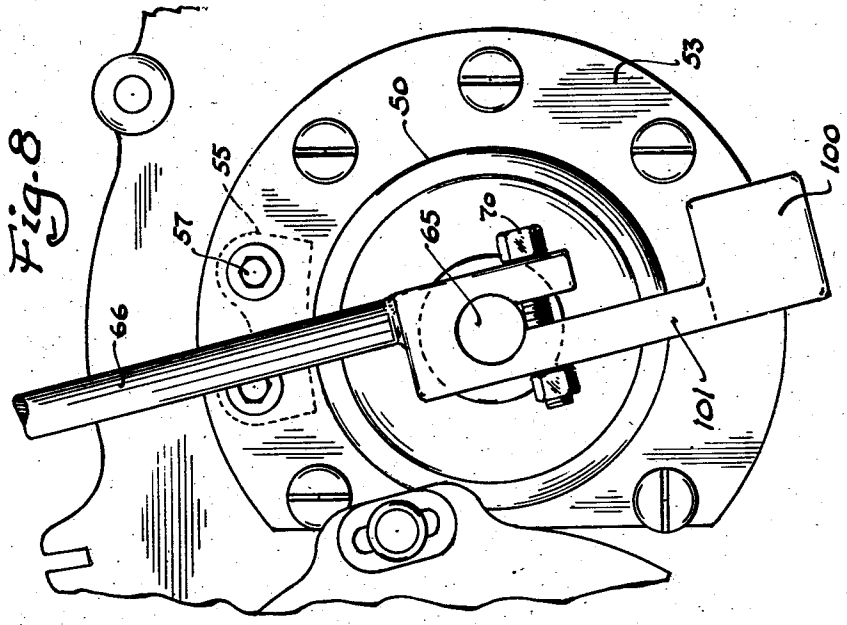
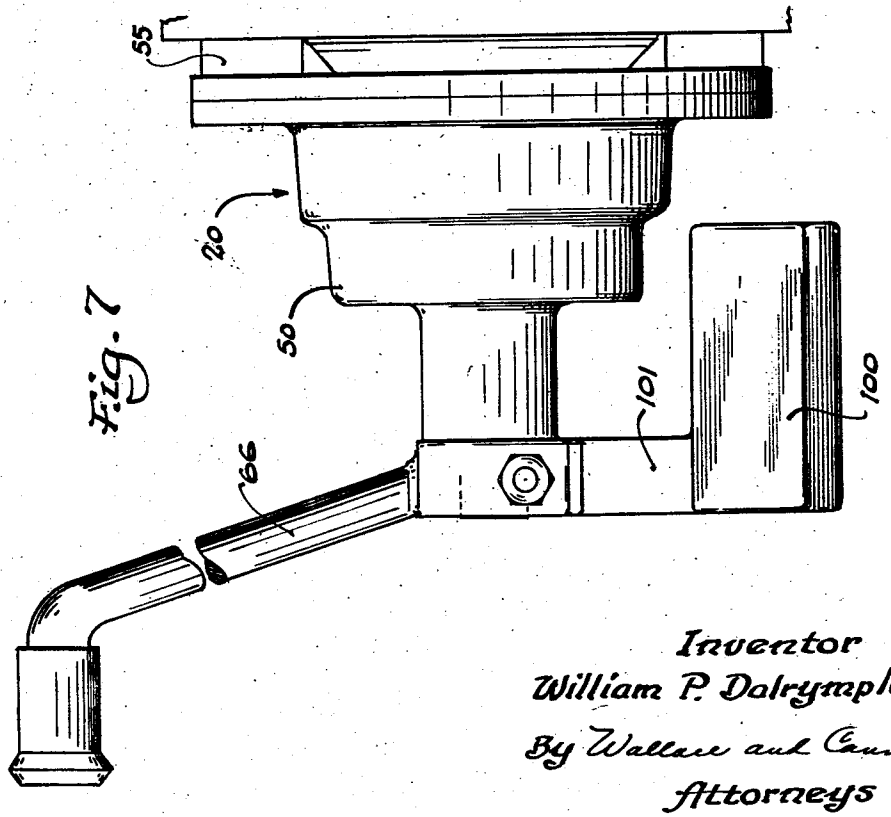


Fig. 7



Inventor
William P. Dalrymple
By Wallace and Cannon
Attorneys

Patented June 16, 1953 2,642,055

UNITED STATES PATENT OFFICE

2,642,055

ENGINE STARTER MECHANISM

William P. Dalrymple, Rochester, N. Y., assignor to American Brake Shoe Company, Wilmington, Del., a corporation of Delaware

Application August 1, 1951, Serial No. 239,790

3 Claims. (Cl. 123—185)

1

This invention relates to starter mechanisms for power units of the kind used for bicycles or tricycles, and particularly the invention relates to such starters of the kick or foot operated type.

In my copending application, Serial No. 183,177, filed September 5, 1950, there is disclosed a power unit that is particularly adapted for use as the propulsion means in a wheeled vehicle such as a bicycle or a tricycle and the starter mechanism of the present invention adapted particularly for use in association with power units of the general character disclosed in my aforesaid copending application. In such power unit, a driving engine of the internal combustion type is afforded, as well as power transmission means including clutch means, and all of these elements are arranged within the periphery of the wheel that is to be driven by such power unit, and the starter mechanism of the present invention is adapted for association with the power transmission means of such a unit in such a way that the starter mechanism may be utilized to impart starting movements to the internal combustion engine that forms part of the power unit.

An important object of the present invention is to afford a kick or foot-power starter mechanism that is simple and effective in its construction, and which is adapted to be readily associated with an element of the power transmission in such a power unit. More particularly it is an object of the present invention to afford such a starter mechanism wherein the operating elements are simple and sturdy in construction and in which the starter elements are effectually maintained in their disengaged relationship during engine operation. Other and further objects are to afford such a mechanism wherein the foot operated crank element may be maintained in a selected out-of-the-way position when not in use.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a horizontal sectional view taken through a power unit adapted for use with a

2

wheeled vehicle such as a tricycle or a bicycle, and embodying the starter mechanism of the present invention;

Fig. 2 is an enlarged horizontal sectional view showing the starter mechanism in association with the power transmission mechanism;

Fig. 3 is a view showing a portion of Fig. 2;

Fig. 4 is a side elevational view taken from the left in Fig. 3;

Fig. 5 is a vertical sectional view taken substantially along the line 5—5 of Fig. 3;

Fig. 5A is a fragmentary sectional view taken along the line 5A—5A of Fig. 3;

Fig. 6 is an elevational view taken partially in vertical section;

Fig. 7 is an outside elevational view showing an alternative construction; and

Fig. 8 is a side elevational view taken from the left in Fig. 7.

For purposes of disclosure the invention is herein illustrated as embodied in a foot-operated starter mechanism 20 that is shown in Figs. 1 and 2 as incorporated in a power unit 21. This power unit in many of its details is like the unit illustrated in my copending application, Serial No. 183,177, filed September 5, 1950, and reference may be had to such copending application for details of the structure, mounting and arrangement of such power unit. It may be noted, however, that the power unit 21 is utilized to drive a wheel such as the front wheel FW, and as disclosed in my aforesaid copending application, this wheel FW is mounted on an axle 23 that is carried on and extends laterally in one direction from a center strut 25. This center strut is arranged as disclosed in such copending application for mounting in the steering column of a tricycle or bicycle so that the wheel FW constitutes a driven front wheel for such tricycle or bicycle. The center strut 25 serves also as a mounting for the other elements of the power unit 21, and this power unit 21 includes an internal combustion engine 21E having a crank case 21C, one wall of which is secured to the opposite side of the center strut 25 as disclosed in said copending application.

The internal combustion engine 21E acts to drive a crank shaft 21A that is located in a transmission housing 28 that is formed in part by a wall of the crank case 21A and in part by extensions of such crank case. Within the transmission housing 28, a primary centrifugal clutch 29 is mounted and this primary clutch is disclosed in detail in my copending application, Serial No. 239,789, filed August 1, 1951. Such primary clutch 29 includes a driven member 29D that includes a sprocket 30, and this sprocket is driven from

the crank shaft 21A by means including a sprocket 31 on the crank shaft 21A and interconnecting chain 32. The primary clutch 29 also includes a driven member 29M that is mounted on an output shaft 35 and this output shaft serves to drive a centrifugally controlled change-speed mechanism 36, the output element of which includes a sprocket 37. Such sprocket 37 is connected by a chain 38 to a sprocket 39 that is mounted on and fixed to the front wheel FW so that the internal combustion engine 21E may serve through the clutch 29 and the change-speed transmission 36 to drive the front wheel FW. It is to be noted that the change-speed mechanism 36 and its functioning in the complete transmission between the engine 21E and the wheel FW are disclosed in detail in my copending application Serial No. 239,788, filed August 1, 1951.

As will be observed in Figs. 2, 3, 4 and 6 of the drawings, the transmission housing 28 includes a wall 28W on the right hand side thereof as viewed in Fig. 2 and, this wall 28W serves as a mounting for a stub shaft 40 upon which the driven element 29D of the clutch 29 is mounted. This shaft 40 is supported in the wall 28W by a ball bearing 41 as herein shown, and the outer end of the shaft 40 projects to the right in Fig. 2 beyond the bearing 40 so as to afford a connection for association with the starter 20 of the present invention.

In affording the starter 20, a supplemental housing or starter housing 50 is afforded, this housing being generally cup-shaped in form to afford an outer wall 51, a generally annular side wall 52 and an annular mounting flange 53 at the left hand of the side wall 52 as viewed in Fig. 2. This annular mounting flange 53 is adapted to bear against a separate mounting plate 54 that is secured against the outer side of the wall 21W in a plane perpendicular to the axis of the shaft 40, as shown in Fig. 2, the supplemental mounting plate 54 is spaced somewhat from the wall 28W by spacer pads 55. The plate 54 serves of course to afford a mounting for the flange 53, and while said mounting is afforded by separate elements in the present instance, the requisite mounting surfaces may of course be afforded by integral portions of the wall 28W. It will be observed that the flange 53 is bolted in position by means of cap screws 57, as shown in Figs. 2 and 4, such cap screws extending through the flange 53, the plate 54 and being threaded into the pads 55. In the present instance such pads 55 are provided at but two points, above and below the axis of the shaft 40, and throughout other portions of the periphery of the flange 53, additional screws 58 are extended through the flange 53 and threaded into the plate 54, thereby to afford an oil-tight seal for the left hand end of the housing 50.

Th other or right hand end wall 51 of the housing 50 has an elongated bearing sleeve 60 formed integral therewith, and this sleeve as shown in Fig. 2 extends inwardly of the wall 51 as at 60L and extends outwardly of the wall 51 as at 60R. Within the sleeve 60, an additional bearing sleeve 61 is mounted to afford a bearing for a starter shaft 65 which at its inner or left hand end, as viewed in Fig. 2, is abutted with or located closely adjacent the right hand end of the shaft 40, these two shafts being in axial alignment. At its outer or right hand end, as viewed in Fig. 2, the shaft 65 has a starter crank 66 secured thereto so that by operation of the crank 66, rotative movements may be imparted to the starter shaft 65. In the present instance, this crank 66 has an outer arm 67 which carries a resilient engagement sleeve 68 that may be engaged by the foot of an operator to impart rocking movement to the crank 66. At its radially inner end, the crank 66 has a split mounting collar or fork 69 that surrounds the shaft 65, and a clamping bolt 70 is utilized to secure the crank 66 onto the shaft 65 in the desired angular position.

Within the starter housing 50, ratchet and pawl mechanism is provided for releasably connecting the starter shaft 65 with the transmission shaft 40 so that rotative starting movement may be imparted to the shaft 40 through actuation of the starter shaft 65. In affording such ratchet and pawl mechanism, a ratchet wheel 75 is fixed on the inner end of the starter shaft 65, and in the present instance this is accomplished by brazing the ratchet wheel 75 to the shaft 65 as indicated at 76. On the shaft 40 a disc 77 is mounted by means of a mounting sleeve 78 which surrounds the shaft 40 and the sleeve 78 is keyed to the shaft 40 as indicated at 79. The disc 77 is located closely adjacent to the ratchet wheel 75 in an axial sense, and on the side of the disc 77 that is adjacent to the ratchet wheel 75 a pair of pawls 80 are pivotally mounted by pivot studs 81.

The pawls 80 extend in what may be termed a leading direction from their pivots 81 and at its end, each pawl has a tooth 80T that is adapted to engage the teeth 75T of the ratchet wheel. The radially outer faces of the pawls 80 have longitudinal grooves 80G formed therein to receive and laterally position a continuous annular spring 82 which is in the nature of an endless coil spring that is contractile in character. Thus the spring 82 tends to maintain the teeth 80T in engagement with the teeth 75T as will be evident in Fig. 5 of the drawings. It will be observed that the leading edges of the teeth 80T that are remote from the respective pivots of the pawls 80 are sloping in form as at 80S so that the starting lever or arm 66 and the ratchet wheel 75 may, when desired, be rotated in a reverse direction or clockwise direction in Fig. 5 so as to locate such arm in a position convenient for the application of actuating forces thereto. It will be seen that after the starting lever 66 has been positioned in such a location that it extends generally upwardly, the operator may apply a downward force thereto by foot-actuation so as to rotate the ratchet wheel 75 in the counterclockwise or starting direction that is indicated by the arrow in Fig. 5 of the drawings. Such starting movement is of course transmitted to the pawls 80 since these pawls are, under such circumstances, engaged with the teeth of the ratchet wheel 75, and hence the plate 77 and the transmission shaft 40 will be given rotative motion in a forward or starting direction so as to tend to start the motor 21E. If the motor 21E starts properly upon such actuation, the shaft 40 will be driven in the forward direction indicated by the arrow in Fig. 5 of the drawings, and in the initial period of such rotation, the surfaces 80S on the pawls will act to cam the pawls 80 out of the spaces between the teeth 75T of the ratchet. As the speed of the disc 77 increases, the centrifugal force acting on the pawls 80 will cause these pawls to shift outwardly against the action of the spring 82 and to the dotted line positions indicated in Fig. 5 of the drawings. This rotative movement of the shaft 40 will serve

to maintain the pawls 80 in their outward or inactive position until such time as the engine 21E is stopped, and the pawls 80 will then be returned to their active or engaged positions as the shaft 40 approaches its stopped relation.

The starting lever 66 will normally tend, by gravity, to assume a downward or depending position after the starting operation has been performed, and this is in many instances considered to be satisfactory. In other instances however the user may desire to have the starting lever 66 located in an upwardly extending relationship such as that shown in Fig. 4 of the drawings, and in such an event means are afforded, as shown in Figs. 1 to 6 of the drawings, for returning the starting lever 66 to such an upwardly extending position at the conclusion of a starting operation. In the form of the invention shown Figs. 1 to 6 of the drawings, such return means are afforded by a spring arrangement that is housed within the starter housing 50. Thus, as shown particularly in Figs. 2, 3 and 6, a torsion spring 90 is disposed within the housing 50 and about the bearing sleeve portion 60L. One arm or end 90—1 of this spring extended radially outwardly so as to engage a lug 91 that is formed on the inner side of the wall of the housing 50 opposite the sleeve section 60L. The other end 90—2 of the torsion spring 90 is arranged to act upon the starter shaft 65 so as to urge the same in a return or reverse direction. In the present instance such association of the end 90—2 of the spring with the starter shaft is attained by means including a washer 93. This washer 93, as shown in Fig. 5A of the drawings has its inner edge formed with teeth 93T that extend between and mesh with the teeth 75T of the ratchet wheel 75. This serves to rotatively interconnect the ratchet wheel 75 with the washer 93, and at its outer edge, the washer 93 has an ear 93E extended in a longitudinal direction therefrom, such ear 93E being engaged by the end 90—2, Fig. 6. The washer 93 is in the present instance guided and stabilized in its position by an additional washer 94 that is disposed between the washer 93 and the end of the sleeve 60L.

With the construction thus afforded it will be observed that the torsion return spring 90 will act to return the arm 66 in a reverse direction toward an upwardly extending relation, and the desired normal or upwardly extending position of the arm 66 is determined by stop means which are disposed in the path of the arm 66. Such stop means are preferably resilient in character so as to readily absorb the shock of the return movement, and such resiliency in the stop means is of special advantage in the event that the engine backfires and imparts unduly fast return or reverse movement to the arm 66. Thus in the present instance the stop means are afforded by one end 98—1 of a relatively heavy torsion spring 98 that surrounds the sleeve section 60R. The other end 98—2 of the torsion spring 98 is anchored to the starter housing 50 which in the present instance has a lug 99 formed thereon just below the sleeve section 60R. This lug has an axial bore 99—2 formed therein, and the end 98—2 of the torsion spring extends into this bore. It will be observed that end 98—1 extends in a generally horizontal direction above the axis of the sleeve 60R as will be evident in Figs. 4 and 6 and the arm 66 is arranged to engage the end 98—1 when the arm 66 reaches the desired upward or normal position.

The positioning means for the arm 66 may take other forms, as for example, as shown in Figs. 7 and 8. In this form, the return spring 90 and the cushioning or abutment spring 98 are eliminated, and the arm 66 is positioned in the desired upwardly extending relation by means of counterweight 100. This counterweight 100 is located at the end of an arm 101 that is formed integrally with the clamping section 69 that is used to secure the arm 66 on the shaft 65. The angular relation of the arms 66 and 101 serve in this instance to determine the normal position of the arm 66, as will be evident in Fig. 8.

From the foregoing description it will be apparent that the present invention affords a highly efficient kick or foot-powered starter for internal combustion engines, and it will also be evident that the starter mechanism of the present invention is simple in character and is adapted for convenient and efficient association with the power transmission mechanism of a power unit.

Thus, while I have illustrated and described the preferred embodiments of my invention, it is to be understood that these are capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A starter assembly comprising a first rotatable shaft having a manually operable lever means attached to one end thereof and a ratchet means attached to the other end thereof, a driving means having an integral disc portion adjacent said ratchet means, a pawl mounted on said disc on the side thereof facing toward said ratchet means, said pawl being pivotally mounted on said disc for pivotal movement relative thereto, means urging said pawl into engagement with said ratchet means and being ineffective at predetermined speeds of said driving means whereby said pawl is centrifugally disengageable from said ratchet means, a housing for said shafts, a first abutting means carried by said first rotatable shaft, a second abutting means fixed to said housing internally thereof, a third abutting means fixed to said housing externally thereof and having a portion against which said lever means is adapted to bear, and spring means held under compression between said first and second abutting means to normally cause said lever means to bear against said third abutting means in position to be actuated.

2. A starter assembly comprising a first rotatable shaft having a manually operable actuating lever secured to one end thereof and a ratchet means secured to the other end thereof, a second rotatable shaft adapted to be connected rotatably with the first shaft, a pawl carried by the second shaft so as to be rotatable therewith and mounted thereon for pivotal movement toward and away from engaging relation with said ratchet to thereby couple said first and second shafts, means urging said pawl into engagement with said ratchet and being ineffective at a predetermined speed of said second shaft whereby said pawl is centrifugally disengageable from said ratchet, a housing arranged about said shafts, a first abutting means carried by said first shaft so as to be rotatable therewith internally of said housing, a second abutting means carried by said housing internally thereof, a torsion spring arranged about a portion of said housing and having one end disposed in position to afford a yield-

able stop for said manually operable lever to locate the same in an actuating position, and a second spring compressed between said first and second abutting means with the ends thereof bearing against said first and second abutting means to thereby cause said lever to bear against said yieldable stop.

3. A starter assembly according to claim 2 in which the said means for urging the pawl into engagement with the ratchet is in the form of an annular contractile spring arranged in a longitudinal groove in the back of the pawl, and in

which said housing includes a bearing sleeve concentric to said shafts, said torsion spring and said second spring each being mounted concentrically on and about said bearing sleeve.

WILLIAM P. DALRYMPLE.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,364,980	Jimerson	Dec. 12, 1944