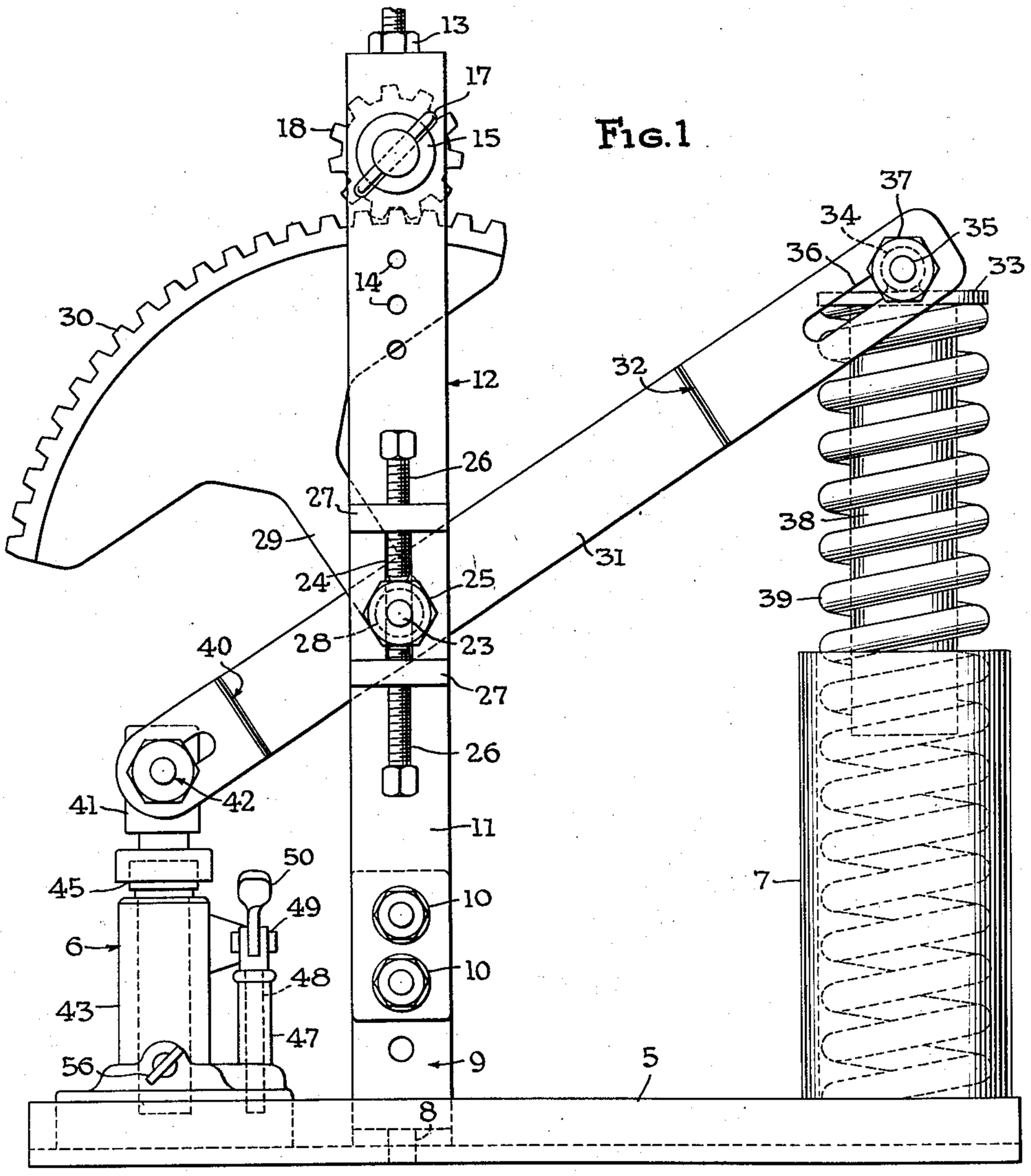
Jan. 6, 1953 E. A. KLIEWER, SR 2,624,424

ENGINE STARTER

Filed Feb. 3, 1949 2 SHEETS—SHEET 1

Fig. 1



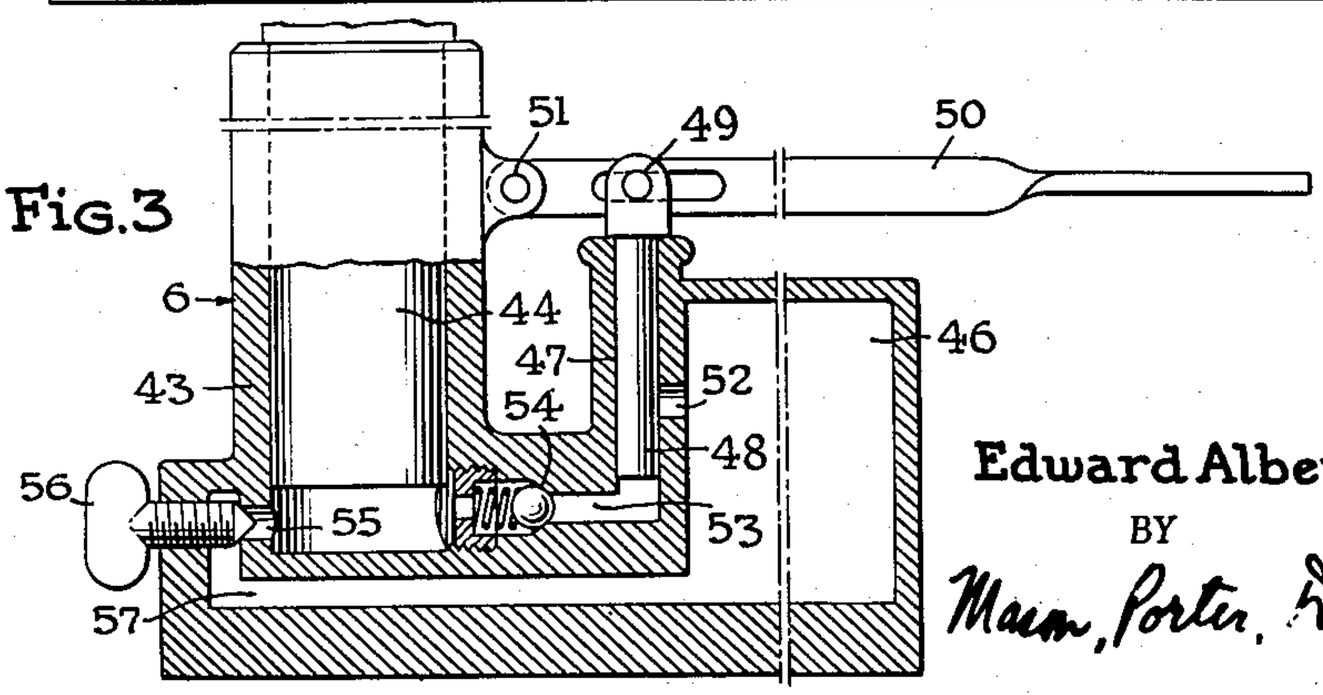


Fig. 3

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ENGINE STARTER

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Fig. 2

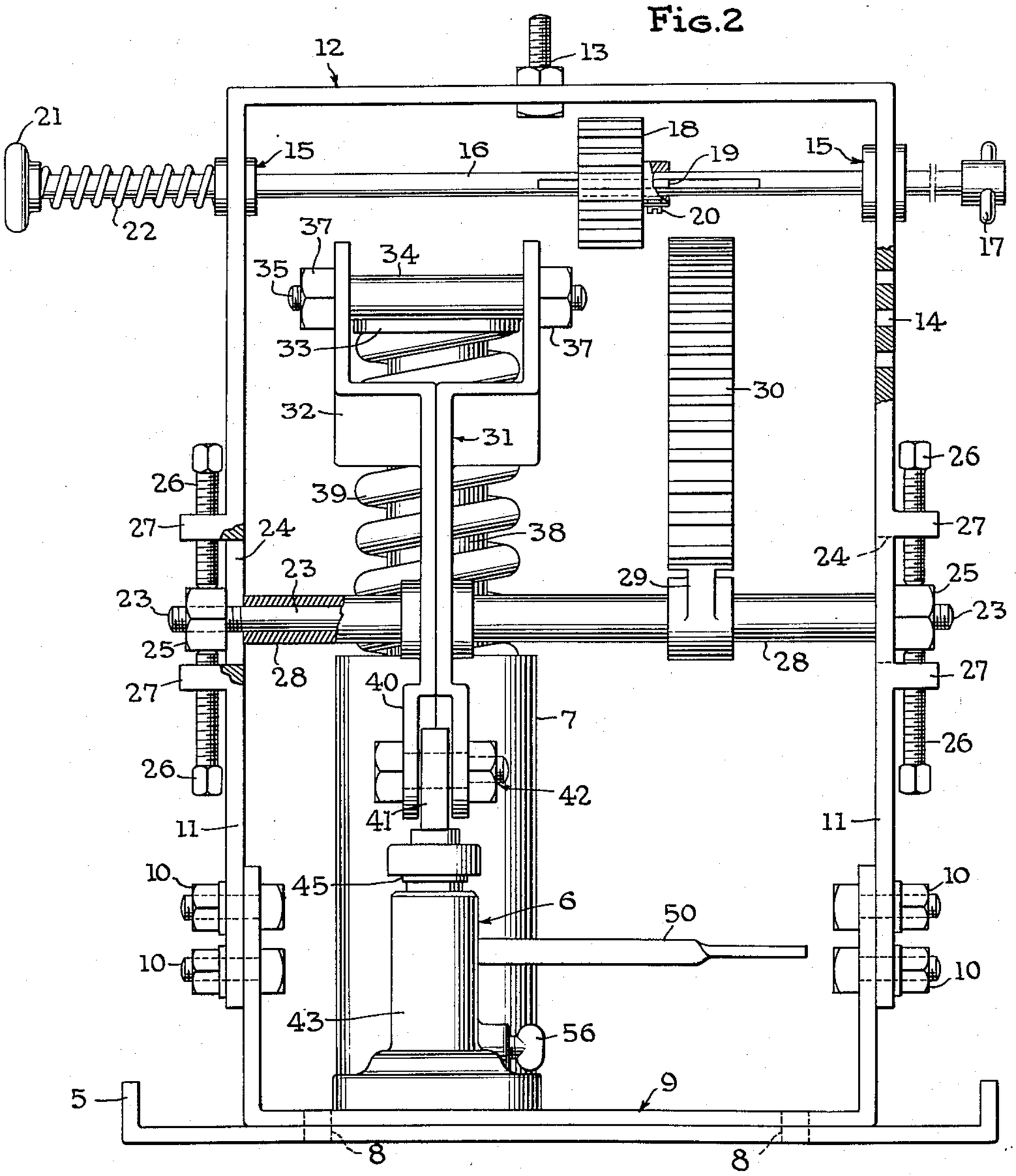
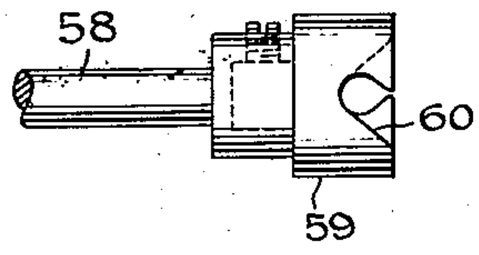


Fig. 4



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ENGINE STARTER

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9 Claims. (Cl. 185—40)

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The invention relates generally to engine starters and primarily seeks to provide a novel starter structure which is simple in construction and adaptable for use in imparting the partial rotation to an engine shaft which is essential in the starting of the engine, efficiently and without any danger of injury to the person attempting the starting of said engine.

It is well known that in attempting the starting of automobile or stationary engines of the internal combustion type by hand cranking, many persons have been seriously injured as a result of the unexpected "kicking" or reverse turning of the cranking devices as the engine is started. A purpose of the present invention is to provide a simple and efficiently operating engine starter which will eliminate all danger of injuries of the character stated.

An object of the invention is to provide an engine starter of the character stated in which the starting torque is applied to the engine through the medium of stored and released spring energy, and in which novel jack means is included for storing the energy in the spring means.

Another object of the invention is to provide an engine starter of the character stated in which the spring energy storing jack means comprises a hand operated hydraulic jack means.

Another object of the invention is to provide an engine starter of the character stated wherein there are included a longitudinally shiftable starter shaft having provision at one end for temporary coupling connection with an engine shaft, a pinion on said shaft, a driving gear sector with which said pinion moves into mesh as the couple between the starter shaft and the engine shaft is effected by longitudinal shifting of said starter shaft, a rocker arm connected for movement with said sector, spring means engaged by one end of the rocker arm for having energy stored therein as the arm is moved in one direction, jack means engaged by the other end of the rocker arm and adapted to move said arm in said one direction, means for shifting the starter shaft for meshing the pinion with the gear sector and effecting the couple between the starter and engine shafts, means for releasing the jack to release the energy stored in the spring and cause it to impart rocking movement to the rocker arm and rotation of the pinion through the gear sector, and means for retracting the starter shaft as the engine starts so as to move the pinion out of mesh with the gear sector and release the couple between the starter and engine shafts.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

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In the drawings:

Figure 1 is a side elevation illustrating the invention.

Figure 2 is an end elevation of the structure shown in Figure 1, parts being broken away and in section.

Figure 3 is a somewhat diagrammatic sectional view illustrating one form of hydraulic jack means.

Figure 4 is a fragmentary view illustrating an optional couple head for use on the starter shaft.

In the example of embodiment of the invention herein disclosed, there is included a base beam 5 whereon is mounted at one end a jack means generally designated 6, and at the other end a compression spring receptacle 7. Provision may be made at 8 for securing the beam to the floor. Secured to the beam 5 in any approved manner, as by welding, is a U-member 9, the uprightly extending legs of which are adjustably secured as at 10 to the depending legs 11 of an inverted U-member 12. The U-member 11, 12 may have provision as at 13 at the top and as at 14 at one leg for connection with an engine mounting (not shown) so as to secure the starter structure in proper position with relation to the engine to be started thereby. It is preferred that the starter structure herein disclosed be used in conjunction with an internal combustion engine of the stationary type, although it is to be understood that said structure is adaptable for use in connection with other types of engines.

The depending legs 11 of the inverted U-member 12 are provided with bearings 15 in which to longitudinally slidably receive the starter shaft 16. The starter shaft is equipped with a couple pin 17 transversing its free end and disposed for coupling engagement with the shaft of the engine which is to be started, and said starter shaft also has a pinion 18 adjustably connected thereon as at 19. A set screw 20 serves to secure the pinion in properly adjusted position on the starter shaft. At the other end opposite the end equipped with the couple pin 17 the starter shaft is equipped with a hand knob 21 through the medium of which said shaft may be longitudinally shifted to engage the couple pin 17 with the engine shaft, and a compression spring 22 interposed between the knob 21 and the adjacent inverted U-member leg 11 is effective to retract the starter shaft 16 to the position illustrated in Figure 2 of the drawings after each starting operation is completed.

A cross shaft 23 extends across between the upright legs 11 of the inverted U-member 12, the ends of said shaft being passed through upright slots 24 in said legs in the manner clearly

illustrated in Figures 1 and 2. Nuts 25 secured on the ends of the shaft 23 outwardly of each inverted U-member leg 11 are engaged above and below by adjuster screws 26 which are passed through threaded bores in anchor blocks 27 secured to the legs 11. It will be apparent that by proper manipulation of the adjuster screws 26 the position in space of the cross shaft 23 can be suitably adjusted.

A sleeve 28 is rockably mounted on the cross shaft 23, and it will be noted by reference to Figures 1 and 2 that a starter arm 29 is secured on said sleeve, as by welding, to project radially therefrom. At its outer end the arm 29 carries a gear sector 30 disposed to intermesh with and impart rotation to the starter shaft pinion 18 whenever rocking motion is imparted to the sleeve 28 with said pinion in position for intermeshing with the gear sector 30.

A rocker arm 31 also is secured on the rocker sleeve 28, as by welding, and the place of connection of the arm 31 on the sleeve 28 is such as to provide long and short arm portions projecting at opposite sides of said sleeve. The long arm portion projected toward the right as viewed in Figure 1 is bifurcated at its free end as at 32 to straddle a spring abutment plate 33 to which a cross sleeve 34 is secured, as by welding. A pin 35 passes through the sleeve 34 and through slots 36 in the bifurcated arm end, nuts 37 serving to secure the arm end and the plate 33 in assembly relation. A guide pin 38 depends from the plate 33 within the upper end of a heavy compression spring 39, the lower end of said spring being seated within the previously mentioned spring well 7.

At the other or shorter end, the arm 31 is bifurcated as at 40 to straddle an actuator member 41 which is pin and slot connected as at 42 with the bifurcated end 40 of the rocker arm. The jack means generally designated 6 includes a hydraulic cylinder 43 wherein a plunger 44 is reciprocably mounted, said plunger having socket connection as at 45 with the actuator member 41 so that upward movement of the piston or plunger 44 will serve to swing the shorter end of the rocker arm 31 upwardly and the longer arm portion downwardly, and upward swinging movement of the longer arm portion of the rocker arm 31 will be attended by a downward movement of the shorter arm portion which will serve to force said piston or plunger 44 downwardly.

The jack means also may include a reservoir 46 and a pressure cylinder 47 wherein a pressure pump piston 48 is reciprocably mounted. The actuator or pressure piston 48 may be connected as at 49 with a handle or treadle member 50 which may be pivoted as at 51 to the casing structure in the manner illustrated in Figure 3. A fluid inlet is provided as at 52 and affords communication between the reservoir 46 and the interior of the cylinder 47, and said cylinder also communicates through the duct 53 with the interior of the cylinder 43, said duct being provided with a suitable check valve 54 which will permit pressure fluid to be forced into the cylinder 43 but will prevent any forcing of said fluid back into the cylinder 47. A pressure fluid outlet from the cylinder 43 is provided as at 55, and release of pressure through said outlet is prevented or permitted accordingly as the control valve 56 is positioned for closing or opening said outlet. It will be apparent that when the valve 56 is opened, pressure fluid may flow freely out of the cylinder 43, and when this is released the pressure fluid may return through the bypass 57 into the reservoir 46.

While one acceptable form of hydraulic jack means is shown herein, it is to be understood that other acceptable forms of hydraulic jack means, or jack means of other types may be employed.

In Figure 4 of the drawings there is illustrated a modified starter shaft end portion 58 which is equipped with a couple head 59 having recesses 60 therein adapted to engage in coupling relation with suitable projections on the end of the engine shaft with which the starter shaft may cooperate.

In describing the operation of the herein disclosed engine starting apparatus it is to be assumed that the apparatus is securely mounted in proper cooperative relation with the engine to be started and that the parts are in the positions shown in Figures 1 and 2, the starter shaft 16 being longitudinally shifted so as to disengage the pinion 18 from the gear actuator 30 and the couple pin 17 from the usual fitting on the engine shaft. By now reciprocating the pressure plunger 48 through manipulation of the handle or treadle 50, pressure fluid will be forced into the cylinder 43 beneath the piston 44 so as to lift said piston and the connected shorter end of the rocker arm 31. The lifting of the shorter end of the rocker arm 41 will depress the longer end of said arm and bring about a compression of the spring 39. Thereafter the knob 21 is manipulated to shift the starter shaft 16 toward the right as viewed in Figure 2, thereby to cause the pinion 18 to mesh with the gear sector 30, and also to bring about a coupling engagement of the couple pin 17 with the fitting on the shaft of the engine to be started. With the parts in this position the valve 56 may be manipulated to release the pressure fluid beneath the piston 44, thus permitting the energy stored in the spring 39 to rock the arm 31 and the gear sector 30 so as to impart the rotation to the pinion 18 and the starter shaft 16 necessary to bring about the desired starting of the engine. As the engine starts, the driving contact pressure between the gear sector 30 and the pinion 18 will be momentarily relieved, and at this instant the energy stored in the compression spring 22 will be effective to shift the starter shaft 16 to the left as viewed in Figure 2 and bring about a disconnection of the couple pin 17 from the engine shaft.

It will be apparent that by starting the engine in the manner stated, said starting can be effected with an expenditure of a minimum effort on the part of the operator, and without any danger that the person of the operator will sustain injury in any manner.

While one form of the invention has been shown for purposes of illustration, it is to be clearly understood that various changes in the details of construction and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In an engine starter, a starter shaft, means for effecting a temporary couple between the starter shaft and the shaft of an engine to be started, compression spring means, manually operable jack means for storing energy in the compression spring means, a single manually operable means for releasing the stored energy in the spring means and for controlling the rate of release of

said stored energy, and means connecting the spring means with the driver shaft for imparting rotation thereto and therethrough to the engine shaft as said stored energy is released.

2. In an engine starter, a starter shaft, means for effecting a temporary couple between the starter shaft and the shaft of an engine to be started, compression spring means, manually operable jack means for storing energy in the compression spring means, a single manually operable means for releasing the stored energy in the spring means and for controlling the rate of release of said stored energy, means connecting the spring means with the driver shaft for imparting rotation thereto and therethrough to the engine shaft as said stored energy is released, means for manually shifting the starter shaft for temporarily coupling it with said engine, and means for automatically retracting the starter shaft from its coupled position as the engine starts.

3. In an engine starter, a starter shaft, means for effecting a temporary couple between the starter shaft and the shaft of an engine to be started, spring means, manually operable hydraulic jack means for storing energy in the spring means, manually operable valve means for releasing pressure fluid from the jack means to provide for a controlled rate releasing of the stored energy in the spring means, and means for connecting the spring means with the driver shaft for imparting rotation thereto and therethrough to the engine shaft as said stored energy is released.

4. In an engine starter, a starter shaft, means for effecting a temporary couple between the starter shaft and the shaft of an engine to be started, spring means, manually operable hydraulic jack means for storing energy in the spring means, manually operable valve means for releasing pressure fluid from the jack means to provide for a controlled rate releasing of the stored energy in the spring means, means for connecting the spring means with the driver shaft for imparting rotation thereto and therethrough to the engine shaft as said stored energy is released, means for moving the starter shaft in the direction of its length for temporarily coupling it with said engine, and spring means for retracting the starter shaft from its coupled position as the engine starts.

5. In an engine starter, a rock shaft, a rocker arm secured to said rocker shaft and projecting in opposite directions transversely with respect to the rocking axis of said shaft, manually operable jack means engaging one free end of the rocker arm and spring means engaged by the other free end of the rocker arm whereby said jack means can be operated to move the rocker arm in a manner for storing energy in said spring means, a gear segment movable with the rocker shaft, a driver shaft having a pinion thereon disposed to mesh with and be driven by said gear sector, means for effecting a temporary couple between said starter shaft and the shaft of an engine to be started, means for releasing the stored energy in the spring means to bring about a reverse movement of the rocker arm effective to cause the gear sector to rotate the pinion in a direction for applying starting rotation to the engine shaft.

6. In an engine starter, a rock shaft, a rocker arm secured to said rocker shaft and projecting in opposite directions transversely with respect to the rocking axis of said shaft, manually operable jack means engaging one free end of the rocker arm and spring means engaged by the other free end of the rocker arm whereby said jack means can be operated to move the rocker arm in a manner for storing energy in said spring means, a gear segment movable with the rocker shaft, a driver shaft having a pinion thereon disposed to mesh with and be driven by said gear sector, means for effecting a temporary couple between said starter shaft and the shaft of an engine to be started, means for releasing the stored energy in the spring means to bring about a reverse movement of the rocker arm effective to cause the gear sector to rotate the pinion in a direction for applying starting rotation to the engine shaft, and means for shifting the starter shaft longitudinally in one direction to bring the pinion into meshing contact with the gear sector and the starter shaft into temporary couple with the engine shaft prior to the starting of the engine, and in the opposite direction to move the pinion away from the gear sector and to break said temporary couple as the engine is started.

7. In an engine starter of the character described, a longitudinally shiftable starter shaft having provision at one end for temporary coupling connection with an engine shaft, a pinion on said starter shaft, a driving gear sector with which said pinion moves into mesh as the couple between the starter shaft and the engine shaft is effected by longitudinal shifting of said starter shaft, a rocker arm connected for movement with said sector, spring means engaged by one end of the rocker arm for having energy stored therein as the arm is moved in one direction, jack means engaged by the other end of the rocker arm and adapted to move said arm in said one direction, means for shifting the starter shaft for meshing the pinion with the gear sector and effecting the couple between the starter and engine shafts, means for releasing the jack to release the energy stored in the spring and cause it to impart rocking movement to the rocker arm and rotation of the pinion through the gear sector, and means for retracting the starter shaft as the engine starts so as to move the pinion out of mesh with the gear sector and release the couple between the starter and engine shafts.

8. An engine starter as defined in claim 7 in which the jack means comprises a hydraulic jack including a piston connected with the rocker arm and a hand operated pump for applying pressure to the piston, and in which the release means comprises a valve for releasing pressure acting against said piston.

9. An engine starter as defined in claim 7 in which the jack means comprises a hydraulic jack including a piston connected with the rocker arm and a hand operated pump for applying pressure to the piston, and in which the release means comprises a bleed valve for releasing pressure fluid acting against said piston at a controlled rate, thereby to provide for a controlled rate releasing of the stored energy in the spring means.

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