March 10, 1959 R. L. CLIFTON 2,876,644

AUTOMOTIVE MECHANICAL STARTER

Filed Jan. 17, 1958 2 Sheets-Sheet 1

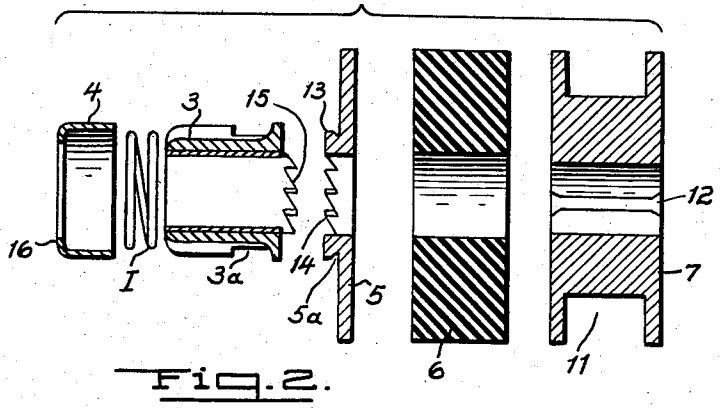


Fig. 2.

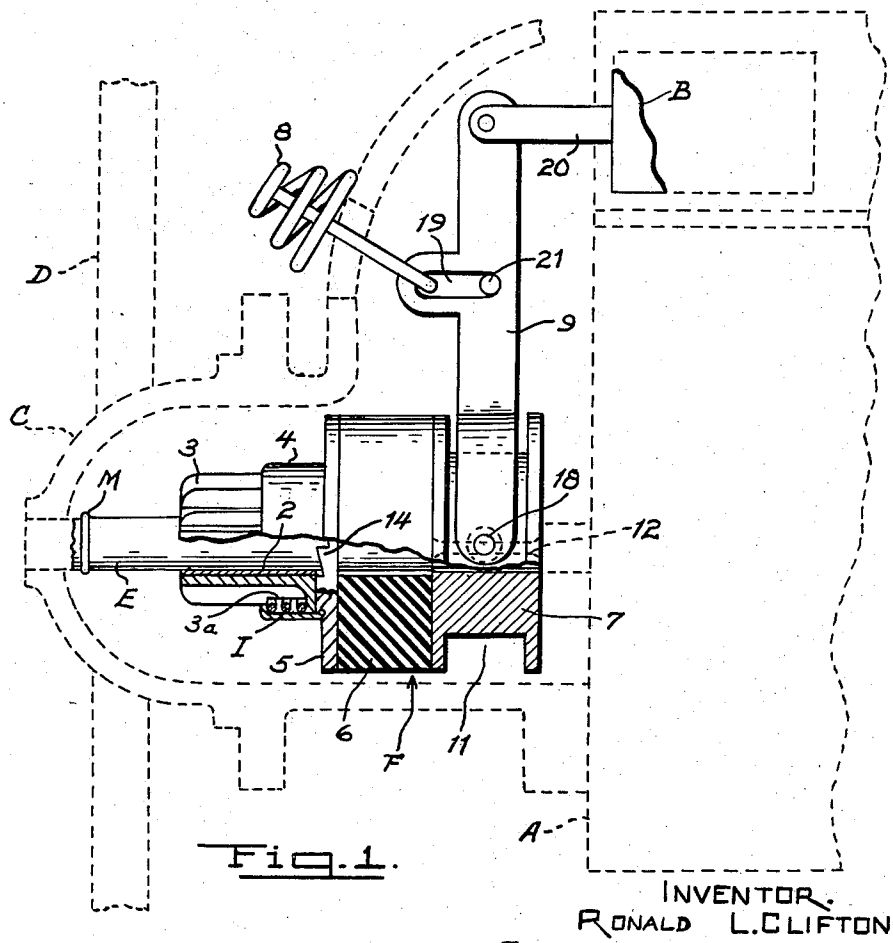


Fig. 1.

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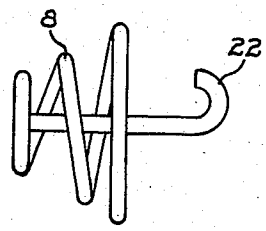


Fig. 6.

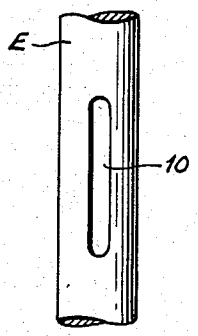


Fig. 3.

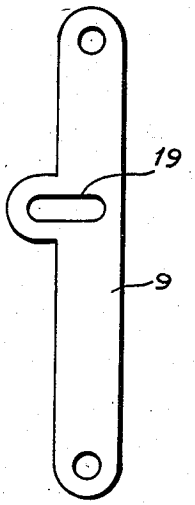


Fig. 5.

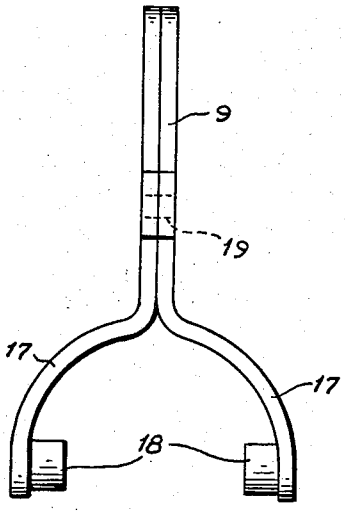


Fig. 4.

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2,876,644

AUTOMOTIVE MECHANICAL STARTER

Ronald L. Clifton, Windsor, Ontario, Canada

Application January 17, 1958, Serial No. 709,569

3 Claims. (Cl. 74—6)

My invention relates to mechanical starters for motor vehicles.

I am aware that mechanical starters have been used and have met with a fair measure of success, nevertheless they have certain drawbacks which reduce their efficiency. The large majority of these mechanical starters are constructed wholly of ferrous or like metallic parts, and jarring is all to frequent with the use of these known mechanical starters due to the poor or improper application of the torque transmitted from the drive shaft of the starting motor on which the starter mechanism is mounted to the several parts of the starter mechanism.

Where large numbers of co-operating parts are necessary and utilized in a mechanical starter this results in the construction or manufacturing costs being high, and should any of these parts cease to function properly, then the cost of repairs are correspondingly high.

These are some of the difficulties which I encountered when making my invention and I realize that to successfully solve the problem with which I was confronted, the following objects should be attained.

One of the objects of my invention is to eliminate jarring by transmitting the torque from the starting motor drive shaft to uniformly and easily rotate the starting mechanism, thus insuring a smooth starting action of the motor or prime mover of the vehicle on which my starter is installed.

A further object of my invention is to reduce the costs of construction and maintenance of my mechanical starter.

Another object of my invention is to construct my mechanical starter so that the several parts are readily accessible for inspection and renewal or replacement if and when required.

A further object still of my invention is to use a suitable rubber connector in lieu of metallic parts which are at present required between the structural members of known standard mechanical starters.

A further object still of my invention is to use a suitable rubber connector in lieu of metallic parts which are at present required between the structural members of known standard mechanical starters.

Another object still of my invention is to construct a mechanical starter which may be readily used on existing forms of motor vehicle construction.

Still a further object of my invention is to construct my mechanical starter as a self contained unit which is simple of construction and is strong and durable and of high efficiency. Other objects of my invention will be made clear as the specification develops.

So that the nature of my invention will be clearly understood, I have illustrated an embodiment of the same which I shall describe in detail, but I wish it to be understood that I do not limit my invention to this specific description or illustration, but reserve the right to modify such structure within the scope of my appended claims.

In the drawings:

Figure 1 is a plan view partly sectional of my mechanical starter designed to be mounted on the drive shaft of a starting motor, and a solenoid which controls the longitudinal movement of the starter mechanism on the drive shaft of the starting motor.

Figure 2 is a longitudinal section of the several mechanical parts of my starter which are designed to be mounted on the drive shaft of the starting motor, the several parts being in exploded position relatively to each other.

Figure 3 is a fragmentary plan view of a portion of the starting motor drive shaft, showing a multi-splined key on which the mechanical starter is splined.

Figure 4 is a plan view of the lever which is designed to move the starting gear mechanism longitudinally on the drive shaft of the starting motor.

Figure 5 is a side view of the lever shown in Figure 4.

Figure 6 is a view of the compensating spring.

Like characters of reference refer to like parts throughout the several figures of the drawing.

Referring to the drawings, A represents an electric starting motor, and B a solenoid associated therewith, the energizing of the starting motor and the solenoid being controlled by a key actuated switch located adjacent the dash board of the motor vehicle on which the starting motor A and the solenoid B are installed.

Projecting forwardly from the starting motor A and the solenoid B is a frame C illustrated by stippled lines, and a fly wheel gear D is located adjacent the front of the drive shaft E of the starting motor. The several instrumentalities so far described are conventional and are not (per se) my invention, so that further description of these parts is deemed unnecessary.

The drive shaft E is provided with a multi-splined key **10**, and on this shaft my mechanical starter F is mounted and is designed to be moved longitudinally along the shaft. The forward movement of the mechanical starter F on the shaft is limited by a retaining ring M mounted on the shaft E as will be seen by reference to Figure 1.

This mechanical starter consists of a cylindrical collar **7** of suitable material formed with a peripheral groove **11** which is channel shaped in cross section, and the central bore of the collar is formed with a keyway or keyways **12** which slidably engage the multi-splined key **10** on the shaft E.

A radially disposed flange **5** encircles the shaft E and is in spaced relation to the collar **7**, and between this flange and the collar a suitable rubber sleeve **6** is located which embraces the shaft E. The inner peripheral wall of the bore of the rubber sleeve **6** is slightly spaced from the periphery of the shaft E so that there is no possibility of the sleeve seizing on the shaft during the actuation of the mechanical starter.

The rubber sleeve **6** is rigidly bonded with the adjacent faces of the collar **7** and the flange **5**. The outer face of the flange **5** is formed with a central hub **13** provided with serrations or teeth **14** which constitute part of a clutch mechanism.

A gear **3** provided with a bushing **2** is slidably and rotatably mounted on the shaft E and that end of the gear **3** adjacent the flange **5** is provided with serrations or teeth **15** which co-act with the teeth **14** on the hub **13** of the flange **5**, so completing the clutch connection between the gear **3** and the said flange. The collar **7**, the rubber sleeve **6**, the flange **5** and the gear **3** are arranged in axial alignment.

That part of the gear **3** adjacent the flange **5** is encircled by an annular retainer ring **4** which is secured to the flange by crimping the end of the ring into the undercut groove **5a** formed around the circumferential wall of the

hub 13, and the other end of the ring is offset radially inwardly to form a flange 16. Within this annular ring 4 and underlying the flange 16 is a spring I which fits into the undercut groove 3ª in the lower portion of the gear 3, and thus the connection between the flange 5 and the gear 3 is flexible. This construction permits an overrunning of the gear 3 to take place under certain conditions.

The mechanical starter F is moved as a unit on the shaft E and this movement is controlled by the lever 9 which is provided at one end with a pair of oppositely disposed arcuate arms 17 adapted to partially embrace the collar 7, and these arms carry inwardly disposed pins 18 which are arranged diametrically opposite each other.

These pins operatively engage with one or other of the parallel walls of the channel shaped groove 11 depending on the direction of longitudinal movement of the collar 7, that is, the pins engage the upper wall (see Figure 1), when the mechanical starter is being moved into operative engagement with the fly wheel gear, and these pins engage the lower wall of the groove 11 when the mechanical starter is being retracted.

The lever 9 is provided intermediate of its length with a slot 19 which extends transversely across the arm of the lever at its pivotal point, and the end of the lever 9 remote from the arcaute arms 17 is pivotally attached to the projecting end of the connecting linkage 20 of the solenoid B.

The lever 9 is pivotally mounted on a pin 21 carried by the frame C, and this pin passes through the slot 19. Co-acting with the lever 9 is a conical spring 8 one free end of which extends through the axis of the spring and through an aperture in the frame C, and this free end of the spring is formed with a hook 22 which engages that end of the slot 19 remote from the pin 21. The base of the helical spring 8 contacts or engages the outer wall of the frame C, so that the spring exerts a pull on the end of the slot 19 in the lever 9.

When my mechanical starter is installed on a motor vehicle, and is in use, the operator of the vehicle closes a key actuated electric switch on the dash board of the vehicle, thereby closing an electric circuit through which electrical energy is transmitted to the starting motor A through solenoid B, so that the starting motor and solenoid are energized in sequence. The source of electrical energy is not shown, but it will be understood that such source is the vehicle battery.

As the connecting linkage 20 is pulled into the core of the solenoid B it exerts a pull on the end of the lever 9 which is rocked on the pin 21 to bring the pins 18 into engagement with the upper side wall of the channel groove 11 in the collar 7 (see Figure 1), and so move the mechanical starter F longitudinally along the shaft E.

The starting motor A is simultaneously rotated, so that the drive shaft E transmits rotary motion to the mechanical starter F splined on the shaft E. The longitudinal movement of the mechanical starter F causes the gear 3 to mesh with the fly wheel gear D and thus rotary motion is transmitted through the fly wheel to the prime mover of the vehicle. After this setting in motion of the prime mover of the vehicle the key operated switch controlling the operation of the starting motor A and the solenoid B is opened and the starting motor and solenoid are deenergized.

The connecting linkage 20 of the solenoid B is then moved outwardly so rocking the lever 9 and causing the pins 18 on the arcuate jaws 17 to engage the lower lateral wall of the channel 11 and so move the mechanical starter F to its retracted position in which the gear 3 is disengaged from the fly wheel gear D.

Should, for any reason, the disengagement of the gear 3 from the fly wheel gear D be impeded during the retraction movement of the mechanical starter F, then the spring I housed in the annular retainer 4 constitutes a flexible connection between the gear 3 and the flange 5, so that the clutch members are positioned to permit overrunning of the gear 3. In this way no damage can arise from the impeded disengagement above mentioned. The gear 3 on movement to the fully retarded position is in a position in which the clutch members are in intimate contact.

It may happen that as the mechanical starter F is being moved longitudinally to engage the gear 3 with the fly wheel gear D, that the teeth of these gears are not in the proper registering position, and under these circumstances there is a resistance to movement of the gear 3 which will abut the face of the fly wheel gear D, and the collar 6 with which the pins 18 engage resist the force exerted by the connecting linkage 20 on the end of the lever 9.

The lever 9 may at this time be regarded as floating, since the pin 21 will be out of contact with the lower end of the slot 19, but to compensate for the resistance to movement of the mechanical starter the conical spring 8 exerts a compensating pull on the end of the slot 19 remote from the pin 21, so allowing for completion of movement of the solenoid which allows electrical energy to pass to the starting motor.

As soon as the teeth of the gear 3 and the teeth of the fly wheel gear D are in their proper relative positions to each other, then the mechanical starter F is moved forwardly longitudinally on the shaft E to complete the meshing of the gear 3 with the fly wheel gear D and so start the prime mover of the motor vehicle in operation.

The properties of the rubber sleeve 6 particularly adapt it for use in my mechanical starter, since this rubber is not compressible and also resist permanent distortion, so that the torque from the shaft E is directly applied to the mechanical starter F, and further this rubber sleeve possesses sufficient elasticity to dampen out any jarring which might arise during the transmission of the torque from the shaft E to the mechanical starter F.

From the above description it will be clear that I have invented a mechanical starter in use on motor vehicles, in which the starter is in the form of a self contained unit, capable of being installed and utilized on standard types of motor vehicles, and in which the torque from the starting motor can be effectively applied through the mechanical starter to the prime mover of the motor vehicle without jarring.

Also when the mechanical starter is not in registering position to permit of its gear meshing with the fly wheel gear on the prime mover of the motor vehicle, then the momentary resistance to move of the mechanical starter is balanced by the automatic operation of a compensating spring as above described.

My mechanical starter is of simple construction in which the several co-acting parts are arranged in a manner to permit of easy inspection.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a starter for engines, the combination with the drive shaft of a starting motor, of a collar splined on the shaft and slidable thereon, a flange slidable on the shaft and spaced from the collar and formed on its outer face with a projecting hub provided with teeth, a rubber sleeve located between the collar and the flange and bonded thereto, a gear slidable on the shaft and formed with a flange provided with teeth co-acting with the teeth on the hub of the flange, the gear being displaceable axially outwardly from the first said flange, resilient means for normally retaining the teeth on the flange of the gear in engagement with the teeth on the hub of the first said flange, a pivoted lever formed with arcuate end members partially embracing the collar and provided with pins engaging the collar, and means for operating the lever.

2. In a starter for engines, the combination with the drive shaft of a starting motor, of a collar splined on the

shaft and slidable thereon, a flange on the shaft spaced from the collar and formed on its outer face with a projecting hub having its outer peripheral wall undercut, the hub being provided with teeth, a rubber sleeve between the collar and flange and bonded thereto, a gear slidable on the shaft and formed with a flange provided with teeth co-acting with the teeth on the hub, the periphery of the gear being undercut adjacent the flange of the gear, an annular ring embracing the undercut end of the gear and having one end rigidly connected to the undercut hub of the first flange, the other end of the ring being flanged radially inwardly, a spring encircling the undercut portion of the gear and located between the flange of the gear and the radial flange of the ring, pivoted lever co-acting with the collar and means for operating the lever.

3. In a starter for engines, the combination with the drive shaft of a starting motor, of a collar splined on the shaft and slidable thereon, a flange slidable on the shaft and spaced from the collar and formed with a projecting hub provided with teeth and having its peripheral wall undercut, a rubber sleeve between the collar and flange and bonded thereto, a gear slidable on the shaft and

formed with a flange provided with teeth co-acting with the teeth on the hub, the periphery of the gear being undercut adjacent its flanged end, an annular ring embracing the undercut end of the gear and having one end rigidly connected to the undercut hub, the other end of the ring being flanged radially inwardly, a spring encircling the undercut portion of the gear and located between the flange of the gear and radial flange of the ring, a lever co-acting with the collar and formed with a transverse slot intermediate of its length, a rigidly mounted pin engaging the slot, a spring co-acting with the lever, and means for operating the lever.

References Cited in the file of this patent

UNITED STATES PATENTS

2,353,904	Jones	July 18, 1944
2,370,649	Fitz Gerald	Mar. 6, 1945
2,657,557	Young	Nov. 3, 1953

FOREIGN PATENTS

1,091,477	France	Apr. 12, 1955