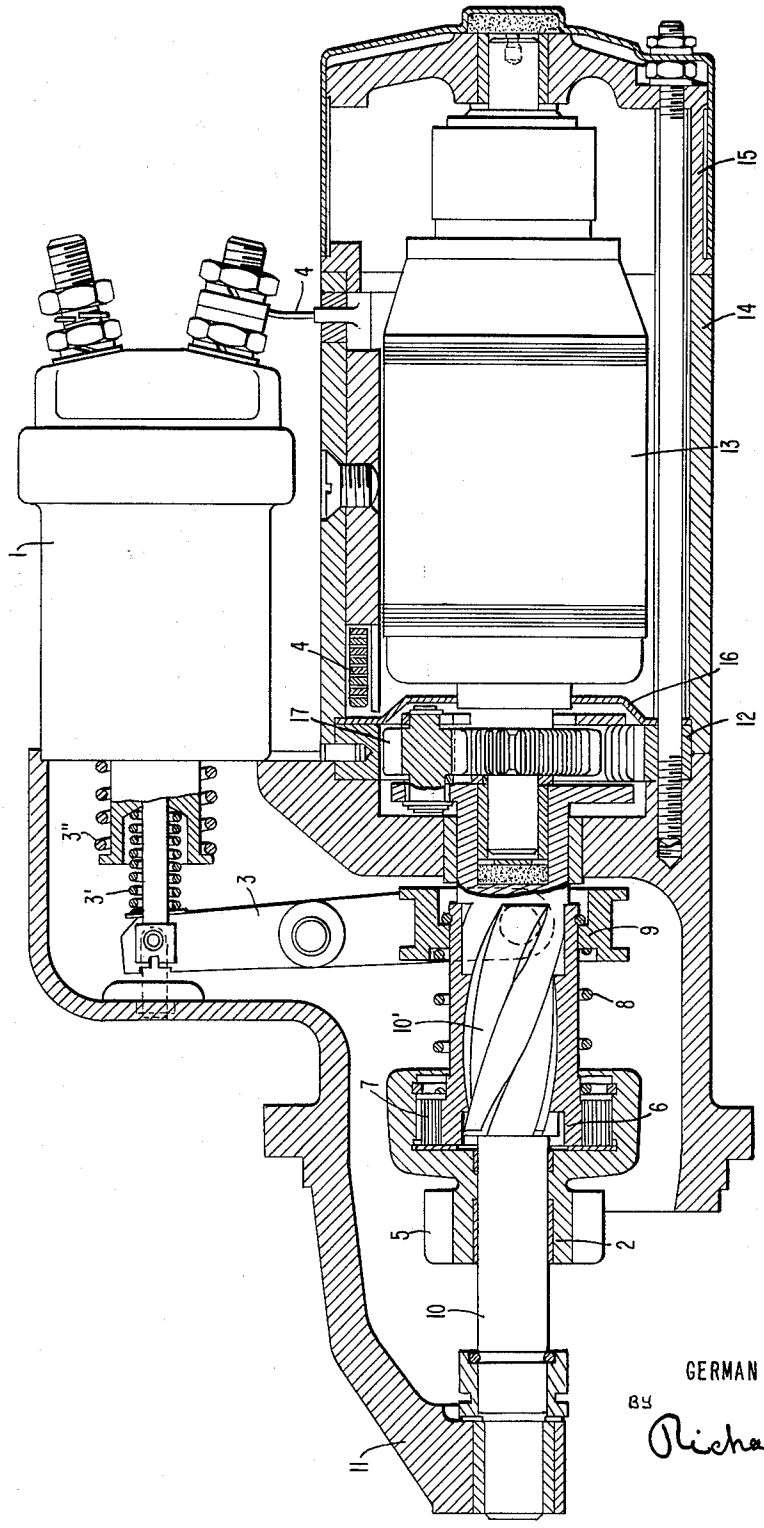
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STARTER MOTORS

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1

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STARTER MOTORS

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1 Claim. (Cl. 74—7)

Starter motors in existence at the present time require a very large torque for starting diesel and petrol internal combustion engines and this is achieved with very considerable dimensions and weight and at a very considerable cost.

It is known that the power of an electric motor divided by the speed is proportional to the dimensions of the motor. That is to say, with a very fast small motor it is possible to achieve a relatively high power.

The invention relates to improvements in starter motors whereby the starting characteristics of large motors are obtained, but with very small dimensions, a weight lower than that of existing motors and a cost which is also more economic.

The main characteristics of this starter motor reside in that between the armature of the starter motor and the driving pinion there is interposed a reduction gear train which reduces the speed of rotation and thereby increases the starting torque of the driving pinion, in such manner that, starting from an electric motor, the torque of which is substantially small, its dimensions being therefore extremely reduced, it is possible with this reduction system of gears to reduce the revolutions of the driving pinion and increase the starting torque sufficiently to make it possible to start the most powerful diesel engine.

In order to detail clearly the special features of these improvements in starter motors which are the object of this invention, reference is made to the accompanying drawing showing a cross-section of one type of starter motors, the different forms and dimensions which may be adopted not being shown in detail since this is independent of the object of the invention.

In the drawing, the reference **1** designates the contactor or electromagnet which, while it is causing the complete pinion **2** to advance by means of the fork **3**, bridges the battery terminal and the motor terminal, causing the battery current to flow directly to the induction coils **4**. The movement of advance of the pinion is synchronised with the closing of the circuit in such manner that it prevents the flow of current to the motor until the pinion is in mesh with the engine of the vehicle, thus preventing in this way any strong shock on engagement and also any excessive wear of the faces of the pinion teeth.

The complete pinion **2** is of the free wheel type and consists of a pinion **5**, a supporting shaft **6** in which there are formed inclined surfaces the slope of which is produced in the direction of rotation of the motor, rollers **7**, a spiral spring **8** and a collar **9**.

The planetary gear shaft **10** carries three planet gears **17** and is supported in two sintered sleeves and mounted in the support **11** at the driving end. A ring **12** is the intermediate adjusting member between the driving-end support **11** and the casing or frame. An armature **13** is provided with a shaft at the end of which there are teeth which mesh with the planet gears. The toothed end of the armature shaft is in other words, the sun gear of a

2

planetary gear set. The reference **14** designates the frame or casing and the reference **15** the support at the collector end. The dished plate **16** serves as a means for retaining the grease in the planetary gear housing.

The operation of the entire driving pinion assembly takes place as described hereinafter.

The above-described rollers **7** bind on the inclined surfaces of the supporting shaft **6** when a movement is imparted in the direction of rotation of the armature, rendering the suporting shaft and the driving pinion fast with one another, and, consequently, the torque developed by the armature is transmitted to the teeth of the driving pinion and in this way achieves the starting of the internal combustion engine of the vehicle. The helicoidal surfaces **10'** of the shaft **10** which mesh with the inner surfaces of the shaft **6**, facilitate the movement of the pinion **5** in and out of engagement with the ring gear of the vehicle (not shown). Actually, the fork **3** moves the pinion **5** from its withdrawn position to a position in which it is lightly meshing with the ring gear. The rest of the movement is accomplished by the helicoidal surfaces.

Once the internal combustion engine has started, the speed of the ring gear of the engine is greater than the speed of the armature of the starter motor and at this moment the free wheel system operates. The rollers **7**, which were binding on the inclined surfaces of the supporting shaft **6**, are disengaged and the rotary movement of the ring gear of the internal combustion engine is rendered independent of that of the armature, so that the driving pinion rotates at the speed of the ring gear and the supporting shaft at the speed of the armature, a receding movement of the rollers consequently occurring, said rollers becoming disengaged and preventing dangerous overspeed of all the rotating parts of the starter motor. The return movement of the pinion **5** is effected essentially by the fork **3** through recovery springs **3'** and **3''** with the help of the helicoidal surfaces.

As has been explained above, the assembly formed in this way offers the advantages of a small, very fast motor of relatively great power.

The nature of the invention and the manner of carrying the same into effect in practice having been sufficiently described, it is pointed out that the arrangements indicated above are open to modifications of detail, without the fundamental principle of the invention being thereby altered, that which constitutes the essence of the same being characterised by the following claims.

What I claim is:

A starter motor, comprising an electromagnetic device, a fork actuated by said electromagnetic device, a return spring connected with said fork, a shaft having inclined surfaces, a collar connected with said shaft and said fork, rollers engaging said shaft, an engine-starting pinion having surfaces adapted to engage said rollers, a spring engaging said collar and said pinion, an armature operatively connected with said electromagnetic device and having a shaft with teeth thereon, said teeth constituting a sun gear, a plurality of planet gears meshing with said gun gear, a fixed ring gear in meshing engagement with the planet gears, another shaft, and means drivingly connecting said other shaft with said planet gears, the last-mentioned shaft slidably supporting said pinion and having helicoidal surfaces meshing with the inclined surfaces of the first-mentioned shaft.

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