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ENGINE STARTER

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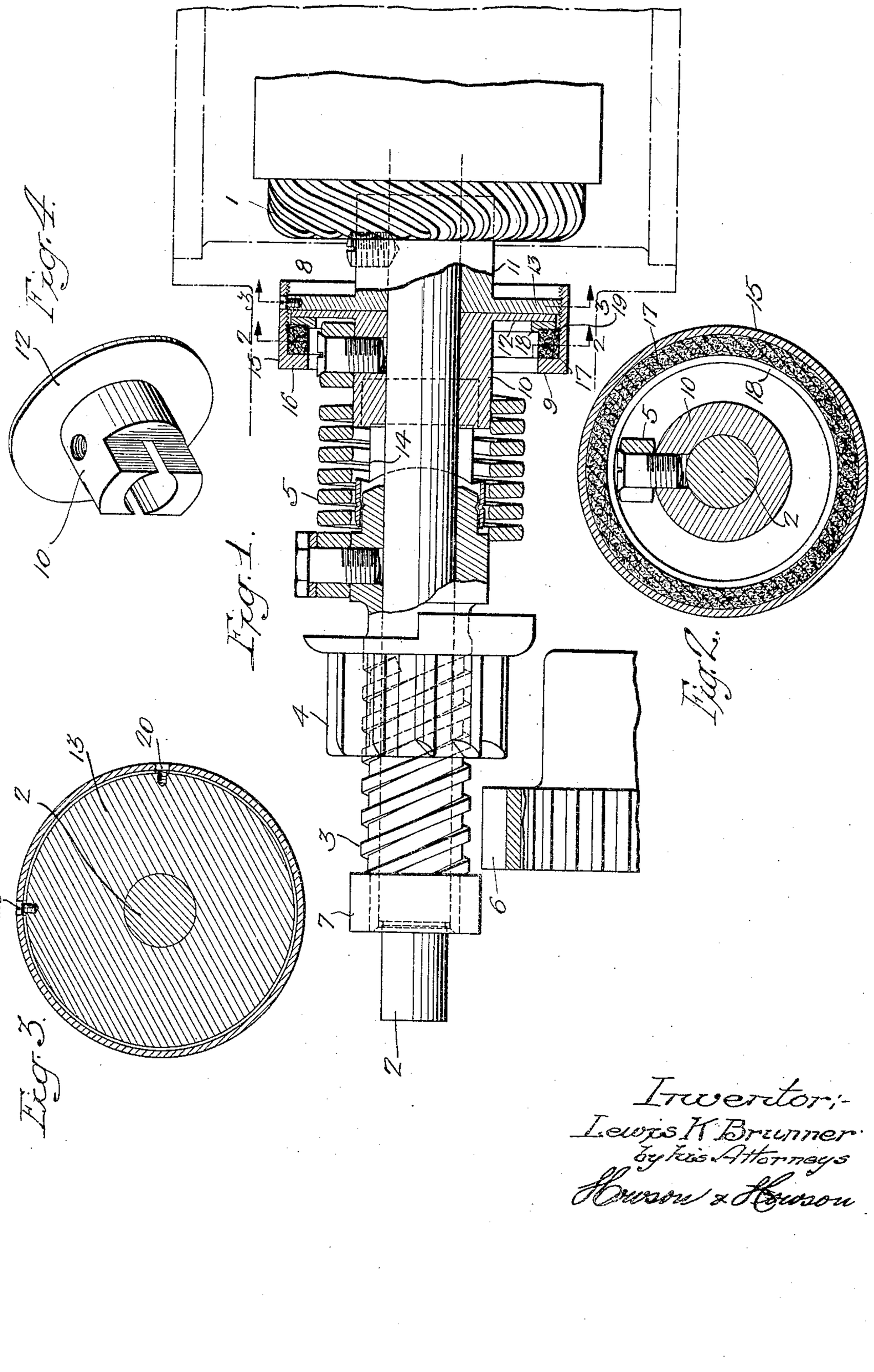

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ENGINE STARTER

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This invention relates to engine starters and particularly to such starters as are used for the purpose of starting internal combustion engines. The general object of the invention is to provide an engine starter of this type which embodies novel means for preventing injury to the starter parts when sudden excessive torque is imparted thereto by the kicking back of the engine.

More specifically, the object of the invention is to provide a safety device on a standard starter drive, which device is adjustable to adapt it to normally transmit the necessary engine starting torque but to slip when the engine kicks back and subjects the various starter parts to terrific shock in the nature of an instantaneous torque reaction. The device is somewhat like a friction clutch, but it is not a working clutch, as will appear more clearly hereinafter.

An important feature of the invention is that the safety device is so designed and constructed as to be particularly adapted for use in a drive of the type known as a Bendix drive, although a device similarly constructed could be used with any other standard type of drive. As is well known, the flexible spring of the widely used Bendix engine starter drive is often broken due to the kicking back of the engine, and the other parts of the drive are sometimes likewise seriously damaged thereby. The device of my invention functions to prevent such damage of the starter parts and its value is greatly enhanced by the fact that it is so designed as to be readily mountable on an existing standard drive without alteration or modification of the construction thereof.

Other objects and features of the invention will become more apparent as the description proceeds. The details of construction of a specific embodiment of the device of the invention may be readily understood from the detailed description to follow, reference being made to the accompanying drawing illustrating the invention.

In the drawing:

Fig. 1 is a partial sectional elevation of a standard starter drive of the Bendix type;

Fig. 2 is a sectional view along line 2—2 of Fig. 1;

Fig. 3 is a sectional view along line 3—3 of Fig. 1; and

Fig. 4 is a perspective view of one of the coupling members of the safety device.

Referring particularly to Fig. 1 of the drawing, there is disclosed a standard Bendix engine starter drive which is now widely used for starting internal combustion engines. As generally known, such drive comprises essentially an electric starting motor 1, a driving shaft 2 connected to or integral with the motor, a driven shaft 3 in the form of a hollow screw shaft, a fly-wheel driving pinion 4 carried by shaft 3 and adapted to move axially therealong, and a yielding driving connection in the form of a heavy coil spring 5 connected between the driven shaft 3 and the driving shaft 2. The operation of this drive is generally known but it might be well to describe briefly the manner in which the parts normally operate. When it is desired to start the engine with which the drive is associated, the starting motor 1 is set into operation and the rotating shaft 2 drives shaft 3 through the flexible spring connection. Due to the weight of pinion 4, it does not revolve with shaft 3, but moves axially therealong until it engages the fly-wheel gear 6. Upon the meshing of the pinion with the fly-wheel, the engine is cranked and starts on its own power, it being understood, of course, that the axial movement of the pinion ceases when it meshes with the fly-wheel gear and engages the collar 7 at the end of shaft 3. Upon the starting of the engine on its own power, the pinion is automatically demeshed due to the greater rate of speed of the fly-wheel gear teeth than that of the pinion teeth. The pinion moves back along shaft 3 to its home position.

With the general principles of operation of the Bendix drive clearly in mind, it is apparent that the occasional kick-back of an engine may and often does seriously damage the starter parts. Usually, the flexible spring of the drive is broken, but sometimes other parts are also seriously damaged. When it is considered that the kicking back of the engine causes an opposing of two forces, viz.,

the quick explosive force caused by the reversed rotation of the engine and the steady force caused by rotation of the starting motor, it is easily conceivable that the starter parts are subjected to enormous strain at this time. When an engine kicks back, it causes the imparting of a sudden and terrific torque to the starter parts, as can well be imagined.

As is clearly apparent from the drawing, in the usual Bendix drive with the essential parts thereof disposed axially adjacent one another, there is a space 8 between the armature winding of the starting motor and the coil spring coupling. In accordance with my invention, I take advantage of the space and provide a novelly designed safety device designated generally by numeral 9 which is disposed within the said space axially adjacent the coil spring and motor and which device may be readily mounted upon a standard Bendix drive without material alteration thereof. At the same time, due to the radial space available for the device when thus located, I am enabled to obtain the desired and necessary frictional bearing areas on the power transmitting parts of the device to normally enable it to transmit the necessary engine starting torque. The safety device comprises a pair of coupling members 10 and 11 having engaging annular flanges 12 and 13, respectively. Coupling member 10 takes the place of the usual spring anchoring member of the standard drive and for this reason has its end formed, as clearly illustrated in Fig. 4, to function in the same manner as does the usual spring anchoring member in connection with loosely mounted sleeve 14 of the drive. While it forms no part of this invention, it might be well to state that sleeve 14, which is rotatably mounted on the end of shaft 3, is formed at its end so as to coact with the end of the spring anchoring member to guide shaft 3 in the occasional slight longitudinal motion of such shaft when the driving pinion abuts against the fly-wheel gear instead of immediately engaging the same. This is the usual construction and operation of the Bendix drive and forms no part of the present invention, it being desired only to clearly bring out the fact that coupling member 10, in addition to functioning as a part of my device in a manner to be set forth hereinafter, also replaces an element of the standard Bendix drive and functions in the manner of that element. It is to be noted, however, that coupling member 10 is not fastened to shaft 2. Coupling member 11 is fastened to the shaft and power is imparted to spring 5 through the engaging coupling members.

The annular edge of flange 13 threadedly carries a cap 15 having an annular flange 16. The cap is readily adjustable by merely turning the same to screw it further on or off flange 13. A suitable resilient pressure ring 17 is provided, which ring is preferably formed of rubber or a suitable rubber composition. This ring is interposed between the flange 16 of the cap and a retainer ring 18 which is suitably recessed as at 19 to receive a seating portion of the resilient ring. It will be apparent that the pressure ring will exert pressure upon its retainer ring and, therefore, upon flange 12 to maintain the flanges of the coupling members in the desired frictional engagement. Obviously, a spring or springs could be used instead of a resilient ring but I prefer to use the ring because its frictional engagement with the cap and retainer ring is advantageous in that it prevents turning of rings relative to the cap and to each other. The pressure exerted upon the engaging flanges may be varied by adjusting cap 15 in the manner previously stated. It is essential that the frictional engagement between the coupling members be such that they will normally transmit the desired starting power but will slip when the excessive torque due to kicking back of the engine is imparted to the drive. The proper adjustment can be easily made by holding the armature stationary and adjusting cap 15 until the device can just be made slip by turning the drive by hand. After cap 15 has been suitably adjusted to obtain the desired pressure between the coupling members, such adjustment may be maintained by means of suitable set screws 20 which serve to firmly affix the cap to flange 13.

It is important to note that a device constructed and positioned as described herein enables a desired large frictional area of contact between the coupling members thereof. It is obvious from inspection of Fig. 1 that a substantial area of contact between the flanges of the coupling members is obtained. It is also to be noted that this desired structural characteristic of the device is had without resort to a large diameter of the safety device. In other words, the diameter of the device is of such dimension that it can be readily utilized in the space available. The dot-and-dash outline of Fig. 1 represents the contour of the casing or housing which surrounds the standard Bendix drive, and it will be apparent that the safety device fits snugly within the housing. It is also important to note that the device while it resembles somewhat a friction clutch is not a working clutch, since the parts thereof are normally stationary with respect to each other and move relatively to one another only when the excessive torque previously mentioned is imparted to the drive and causes the engaging coupling members to slip.

The fact that the device of the invention is adapted for mounting on the usual Bendix drive without modification thereof is very important especially from a practical standpoint. The device necessitates the removal of only the usual spring anchoring member of

the Bendix drive and, as set forth above, coupling member 10 is adapted to function in the same manner and take the place of such member. It is, therefore, readily apparent that the drive may be readily and quickly associated with an existing drive with ordinary tools at low cost. The simple construction of the device itself also enhances its value from a commercial standpoint since it may be economically manufactured. As an example of the utility of the device, when the driving spring of the Bendix starter of an automobile breaks, as it sometimes does, and the owner takes the car to a garage or repair shop to have the spring replaced, it would be a simple matter to incorporate the device of the invention at the same time.

From the foregoing description, it will be obvious that the device contemplated by my invention has many advantages, only a few of which have been pointed out. Persons skilled in the art will readily appreciate that changes and modifications may be made without departing from the principles of the invention. Such changes are, of course, deemed to be within the scope of the invention and are, therefore, contemplated.

I claim:

1. In an engine starter provided with a pair of shafts connected by a yielding member, a readily detachable device having one portion attached to said member and another portion attached to one of said shafts, and means whereby said portions will be normally coupled together under all normal conditions of load and whereby said portions will become operatively disengaged by reverse rotation of the engine due to kicking back thereof.

2. In an engine starter provided with a pair of shafts connected by a yielding member, a unitary device comprising one portion attached to said member and another portion attached to one of said shafts, and means whereby said portions will be normally coupled together under all normal conditions of load and whereby said portions will become operatively disengaged by reverse rotation of the engine due to kicking back thereof.

3. In an engine starter provided with a pair of shafts connected by a helical spring, a readily detachable device axially adjacent said spring, said device having one portion attached to said spring and another portion attached to one of said shafts, and means whereby said portions will be normally coupled together under all normal conditions of load and whereby said portions will become operatively disengaged by reverse rotation of the engine due to kicking back thereof.

4. In an engine starter provided with a pair of shafts connected by a yielding member, a readily detachable device comprising a pair of adjacent disks, a cap carried at the peripheral edge of one of said disks, and resilient pressure means between said cap and the other of said disks and arranged to exert a predetermined pressure, whereby said disks will be normally coupled together under all normal conditions of load and whereby said disks will become operatively disengaged by reverse rotation of the engine due to kicking back thereof.

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