E. V. HARTFORD.

ELECTRICAL STARTER.

APPLICATION FILED MAR. 12, 1913.

1,185,197.

Patented May 30, 1916.

2 SHEETS—SHEET 1.

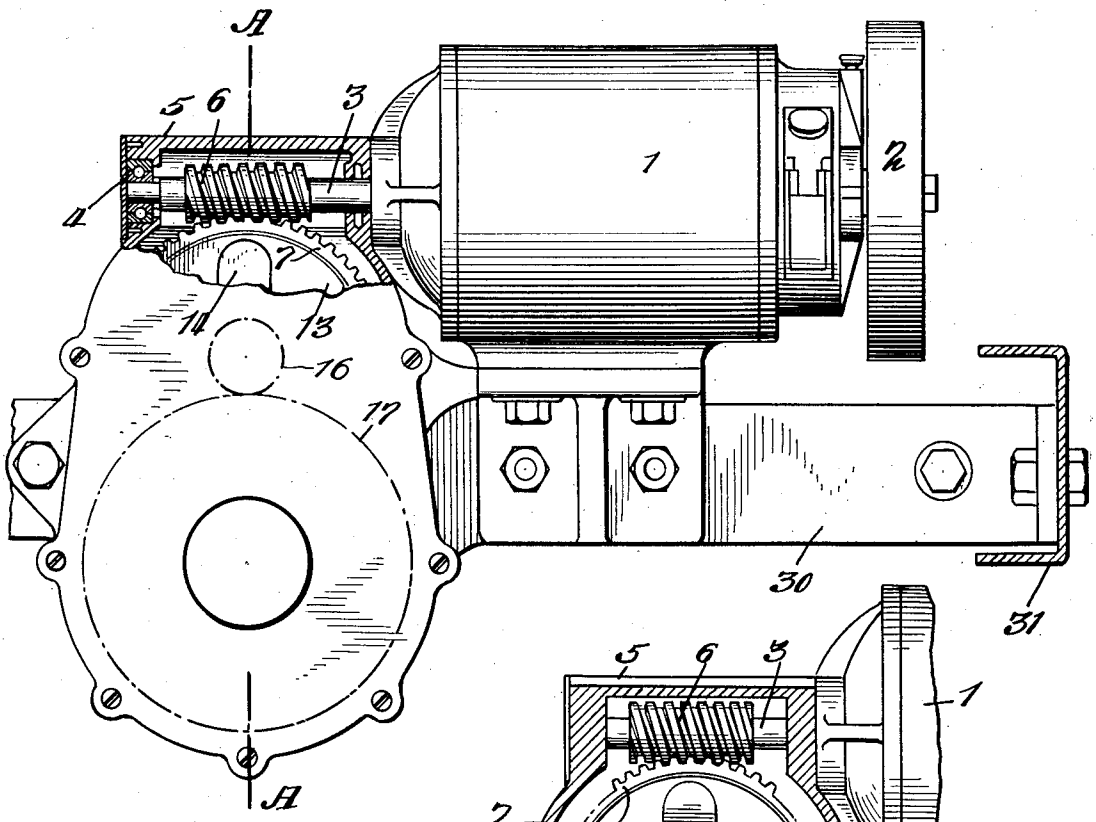


Fig. 1.

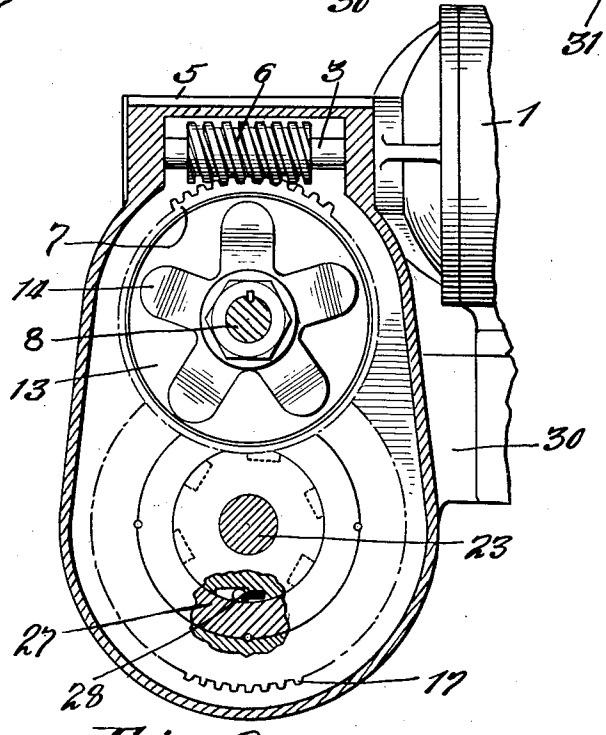


Fig. 2.

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Wm. C. Dunn

Inventor
Edward Vassallo Hartford
By his Attorney
Clifford E. Dunn

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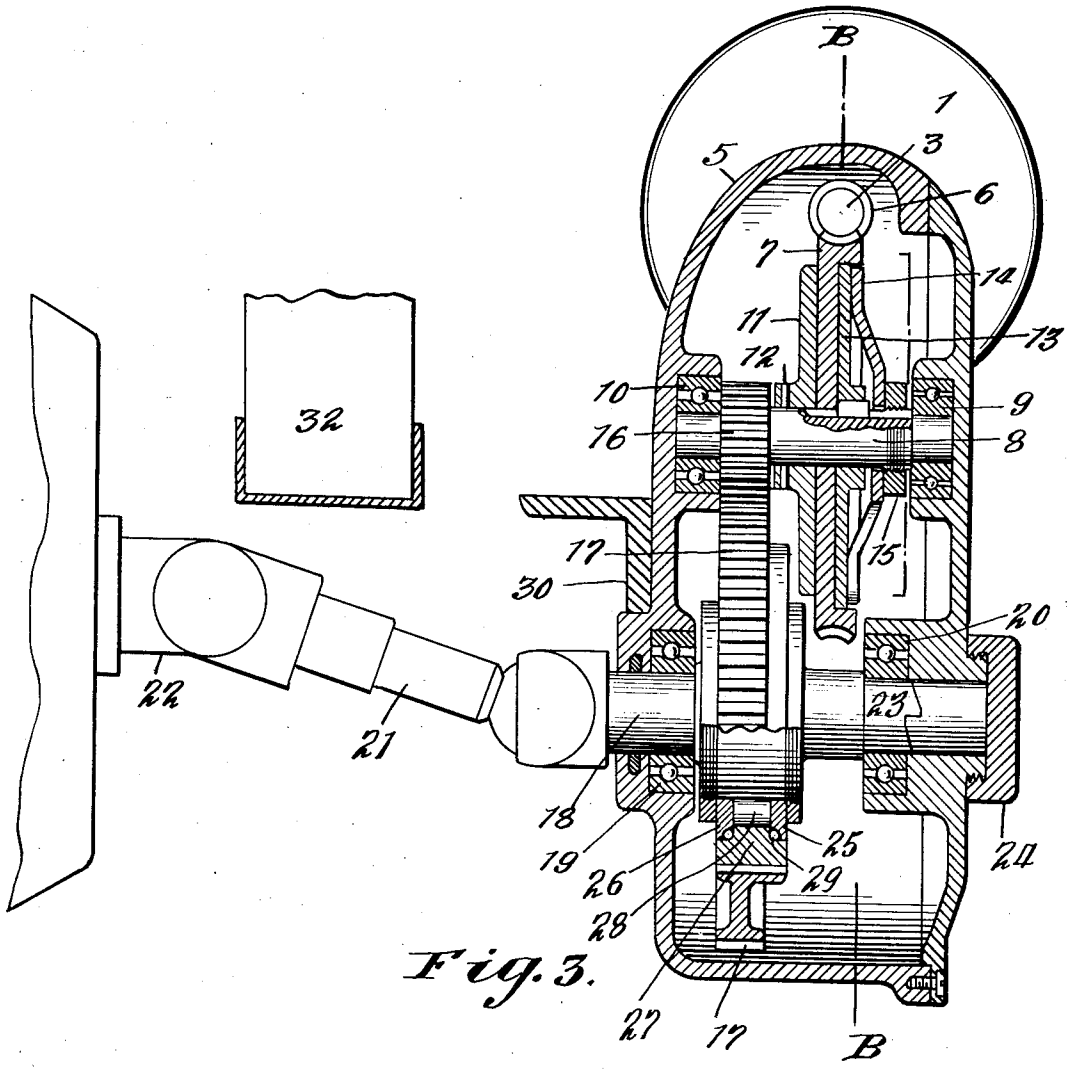


Fig. 3.

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UNITED STATES PATENT OFFICE.

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ELECTRICAL STARTER.

1,185,197. Specification of Letters Patent. Patented May 30, 1916.

Application filed March 12, 1913. Serial No. 753,718.

To all whom it may concern:

Be it known that I, EDWARD V. HARTFORD, a citizen of the United States, residing at Deal, in the county of Monmouth and State of New Jersey, have invented certain new and useful Improvements in Electrical Starters for Motor-Vehicles and the like, of which the following, taken in connection with the accompanying sheet of drawings, is a full, clear, and concise description thereof.

My invention has for its object the production of an electrical starter of small dimension, which may be readily coupled to the end of the crank shaft of an automobile engine at the front end of the machine in advance of the radiator, in such a way so as to require no material change or alteration in the motor vehicle.

My present invention comprehends the employment of a small high-speed motor adapted to be operably associated with the front end of the crank shaft of an internal combustion motor through a train of intermediary reduction gears so that the high speed of the motor may transmit a slow crank-shaft movement to the engine.

In carrying my invention into practice, I arrange the motor and its transmission mechanism within a casing or housing so that the entire starter mechanism is in the form of a unit adapted to be readily applied to the front of a motor car and which facilitates handling and transportation thereof.

Referring to the drawings, Figure 1 is a view in front elevation of a starter motor and transmission encased ready for application to the front end of a motor vehicle. Fig. 2 is a cross-sectional view taken on lines B—B of Fig. 3, of the transmission mechanism illustrating in fragmentary detail of so much of a motor car as will serve to illustrate the application of the invention thereto. Fig. 3 is a similar view taken on lines A—A of Fig. 1.

In detail, 1 indicates a small high-speed electrical motor having a fly-wheel 2 carried upon one end of its armature, the purpose of which will hereinafter be fully explained. The opposite end of the armature of the motor carries a driving shaft 3 keyed or made fast thereto, this outer end is journaled in a suitable bearing 4 and is supported in the upper part of the casing 5, in which the transmission mechanism is housed. The driving shaft 3 carries a worm gear 6 which meshes with a large gear wheel 7, the latter being freely mounted on a shaft 8, journaled within suitable bearings 9 and 10 in the casing 5, as shown. A disk or plate 11 is carried by the shaft and is keyed thereto by means of keys or pins 12 this plate serves the purpose of providing a rest and an alining member for the gear wheel 7. On the opposite side of the gear wheel and within a pocket or cut-out space provided for the purpose, is an oppositely opposed disk or plate 13 which is keyed to the shaft 8, but is not fast thereon, a slight lateral movement being permitted in order that a variable amount of frictional contact between the gear wheel 7, and plates 11 and 13 may be obtained. This variable friction is obtained by means of a spider spring 14 carried on the shaft 8 having radially disposed fingers which bear against the outer zone of the plate 13 at equidistant points, thus distributing the spring tension at the zone where greater extent of frictional contacting surface of the parts exists. The plates 11 and 13, and spring 14, form the adjustable yielding connection between the starter-motor and the transmission mechanism, which is connected to the crank shaft of the engine and controls the degree of motive power imparted through the associated gears to the crank shaft of the engine, also providing a yielding shock-absorbing connection that will take care of any possible back-kick due to premature explosions which may impart a reverse motion to the crank shaft of the engine and mechanism connecting it with the starter motor. It is to be understood that the sudden and abrupt generation of power by the engine in a reverse direction due to back-firing will impart a reverse movement to that at which the starter motor is running and unless some means is provided for taking care of this, a derangement or destruction of the motor and its mechanism will result.

An adjusting nut 15 is provided on the screw threaded end of the shaft 8 by means of which the spider spring may be put under more or less tension as may be found desirable. Fast to the shaft 8 is a gear wheel 16, which meshes with a large gear wheel 17, carried by a clutch mounted on a shaft 18. The gears 7, 16 and 17 constitutes a reduction gearing, the ratio of which is 100 to 1 so that while the starter motor itself is actuating at a high speed of six thou-

sand to ten thousand revolutions per minute, the crank shaft of the engine rotates at but sixty to one hundred revolutions per minute. This slow crank-shaft movement of the engine has been found to be just as effective in starting an internal combustion engine as a rapid crank-shaft movement. This shaft 18 is journaled in the casing in suitable ball bearings 19 and 20 and extends rearwardly, where by means of a suitable coupling 21 is fastened to the crank shaft 22 of the engine, thus by this arrangement the starter may be readily attached to the front end of the automobile. The front end of the shaft 18 is of usual clutch-like formation as at 23 so that if need be a hand crank may be used to start the engine in the event that the electrical starter should be rendered inoperative from any cause. A suitable opening in the casing is provided for the reception of the hand crank and this opening is covered with a convenient removable cover 24. The connecting coupling 21 is made up of parts which are somewhat universal in movement so as to render a flexible joint to take up or provide for variations in alinement of the parts. The gear 17 is connected with the shaft 18 through a clutch mechanism 25, which is provided for the purpose of releasing the connected train of mechanism between the starter motor and the crank shaft of the engine upon the engine becoming self-actuated. It will be understood that the initial impulse caused by an explosion will cause the crank shaft of the engine to move at a speed in excess of that imparted by starter, so that it will be necessary that the crank shaft be permitted to rotate free of the gear wheel 17 and the mechanism with which it is in positive connection. The clutch comprises a pair of rings 26, in which are mounted a pair of ball cups which coöperate with a ring 27 for forming suitable ball-races. The gear wheel 17 is made fast to the ring 27. A ring 28 is provided with a series of pockets which open toward the inner face of the ring 27, the bottoms of these pockets are inclined in a common direction and each pocket has a ball-bearing 29 which is slightly pressed up the incline toward the friction-face of the ring 27 by means of a suitable spring. Upon rotation of the gear wheel 17 under actuation of the starter motor, the rollers will couple the parts together and the crank shaft of the engine will rotate in unison with the gear wheel 17. Upon the speed of the crank shaft exceeding the speed of the gear wheel 17 when the engine becomes self-actuated, the rollers will be forced and dislodged from their coupling position, thus permitting the crank shaft to rotate independently of the gear-wheel. This construction of clutch permits the starter motor to always be in position to regain control of the crank shaft automatically when a series of misses follows an explosion. As the speed of the crank shaft becomes reduced to below the point where the speed imparted to the gear-wheel by the starter motor, it will, of course, be carried under the power of the latter. By this means the crank shaft will not be permitted to halt after its rotation has been inaugurated by the starter motor.

The fly wheel 2 on the armature of the motor 1 is provided for the purpose of storing up energy to provide against the reduction of power when the piston of the engine reaches the maximum point of compression, the momentum of the fly wheel serves to carry the piston over this point at substantially undiminished speed and thus loss of compression and failure to fire is largely avoided.

The starter motor and transmission is mounted on a cross-bar 30 which may readily be coupled to the side frame of a chassis 31, the whole unitary apparatus extending across the front end of the machine in advance of the radiator 32.

By means of my invention, I have provided an electrical starter, which may be readily applied to automobiles now in use without any material change being made in the same. The whole starter is bolted to the forward end of the machine and fastened to shaft of the engine, and therefore the necessity of special designs, which when applied elsewhere to a machine require considerable alteration in the mechanism of the power plant is entirely obviated by the use of my invention, which comprehends a starter which is universal in its application or installation to machines of different makes in use or to be manufactured.

While I have illustrated and described one embodiment of my invention, I desire it to be understood that I do not restrict myself to the exact details of construction shown and described, as they may be departed from and still come with the scope and tenor of my invention as covered by the appended claims.

Having thus described my invention what I claim as new herein and desire to secure by Letters Patent is:

1. The combination with the frame of an automobile, of an engine-shaft mounted at the front of said frame, a forward extension for said shaft, a clutch member on said extension, a motor hung on brackets fastened to said frame, the armature shaft of said motor having associated therewith a clutch member to coöperate with the clutch member on the engine-shaft extension.

2. The combination with the frame of an automobile, an engine-shaft having a forward extension mounted at the front of said frame, said extension having a swiveled cou-

pling to said engine-shaft, a clutch member on said extension, a motor hung on brackets fastened to said frame and in front of the engine-shaft, the armature shaft of said motor having associated therewith a clutch member to coöperate with the clutch member of the engine-shaft extension.

3. The combination with the frame of an automobile of an engine-shaft, of a forward extension for said engine-shaft, a clutch member on said extension, a motor supported by the frame in front of the engine hood and a clutch member to coöperate with the clutch member on the engine-shaft extension operably associated with the armature of the motor, said clutch members constituting an overrunning clutch which permits the motor to drive the engine and operating to automatically release the motor when the engine becomes self-actuated.

4. An electrical starter for automobiles driven by internal combustion engines comprising in combination an electrical motor, a transmission mechanism and means for operably connecting the same to the front end of the crank shaft of an automobile engine in advance of the radiator and means for detachably supporting the starter and transmission mechanism at the forward ends of the side bars of an automobile chassis.

5. An electrical starter for automobiles driven by internal combustion engines, comprising in combination an electrical motor, a transmission mechanism including an adjustable frictional drive mechanism, a clutch mechanism and speed reduction gears, said clutch mechanism adapted to be connected with the front end of the crank shaft of an automobile engine, a casing or housing for the electrical motor and transmission mechanism and means for supporting the motor and transmission mechanism at the forward ends of an automobile chassis.

6. An electrical starter for an automobile driven by an internal combustion engine, comprising in combination an electrical high-speed motor, a transmission mechanism, an extension for the engine-shaft operably associated with the transmission mechanism, means for supporting said motor, transmission mechanism and extension at the front end of the automobile in advance of the hood, said extension to the engine-shaft including a flexible coupling to compensate for variation in the alinement of said extension with respect to the engine shaft.

7. An electrical starter for automobile engines of the internal combustion type, comprising a unit including an electrical motor of high speed type and transmission mechanism driven thereby, a casing housing the motor and transmission mechanism and means for connecting the transmission mechanism with the crank shaft of the engine to operate the latter, said casing and transmission mechanism provided with means to allow of the manual operation of the engine to inaugurate a working impulse therein independent of the electrical motor.

8. The combination with the frame of an automobile, an engine-shaft, an extension for said engine-shaft mounted at the front of said frame, an electric motor operably associated with said extension, said motor supported at the front of said frame, a transmission mechanism including a worm driven by the motor armature, a worm-gear in positive connection with the said worm, adjustable friction means coöperatively associated with said worm-gear, a pinion in positive connection with the friction means, a spur gear in mesh with the pinion, an overrunning clutch mechanism coöperatively associated with the engine-shaft extension and the spur gear whereby the motor will drive the engine-shaft and automatically release the motor from the engine-shaft when the engine becomes self-actuated.

9. The combination with the frame of an automobile, of an engine crank-shaft, an extension for said crank-shaft, means for supporting said extension in operative position in advance of the engine, an electric motor in driving connection with said extension and means independent of said motor for manually operating said extension to start the engine.

10. The combination with the frame of an automobile, of an engine-shaft, of an extension for said engine-shaft coupled thereto by a swiveled connection, means for supporting said extension in position at the front end of the frame, said means including a suitable bearing and brackets supported by the frame, an electric motor supported by said brackets and in driving connection with said extension, transmission mechanism between the motor and extension including an overrunning clutch mechanism whereby the motor will drive the extension in one direction, and means independent of said motor for manually driving said extension to start the engine.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

EDWARD VASSALLO HARTFORD.

Witnesses:

W. P. MONTGOMERY,

H. C. KENSING.