T. W. TATTERSALL.

MEANS FOR STARTING INTERNAL COMBUSTION ENGINES.

APPLICATION FILED SEPT. 6, 1913.

**1,201,387.**

Patented Oct. 17, 1916.

2 SHEETS—SHEET 1.

*Fig. 1*

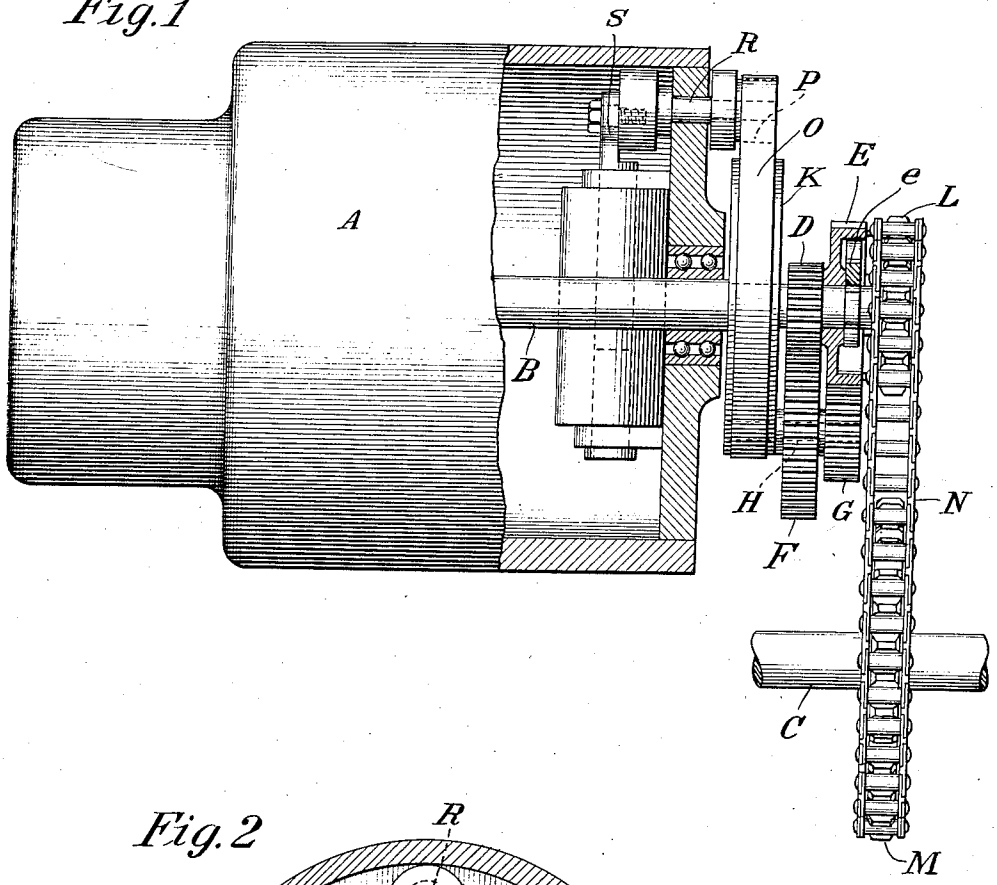



*Fig. 2*

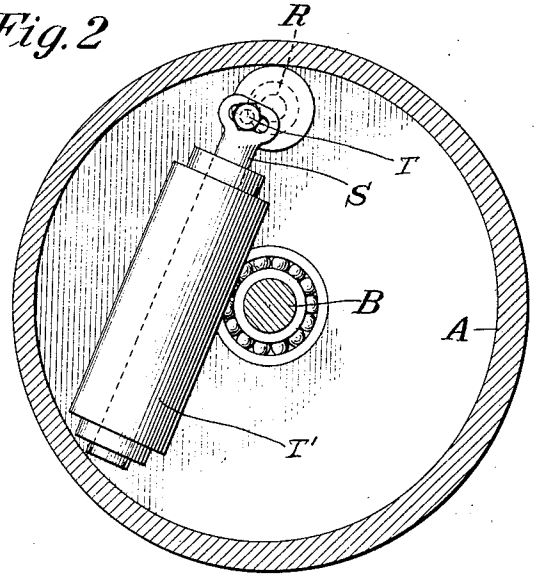
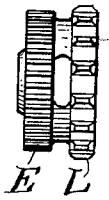



*Fig. 5.*




Witnesses:
Thomas J. Byrne.
William Johnson

Tom Whitaker Tattersall, Inventor.

By his Attorneys
Satterlee, Canfield & Stone.

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2 SHEETS—SHEET 2.

Fig. 3

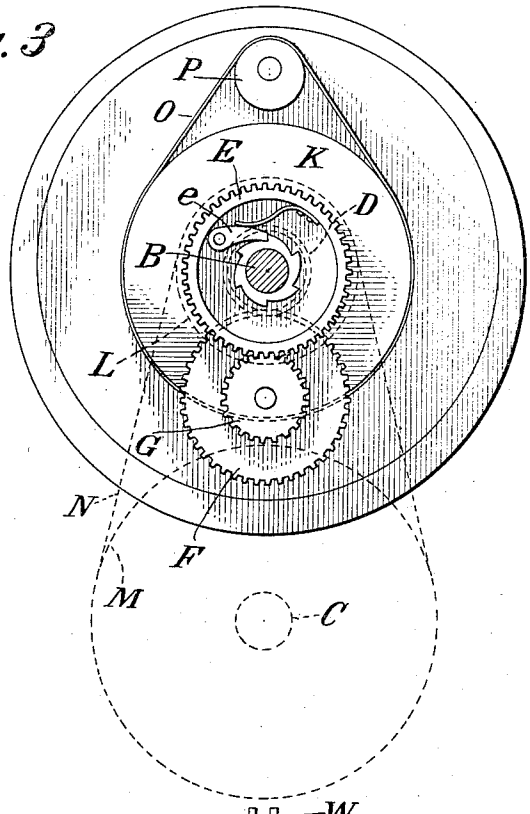
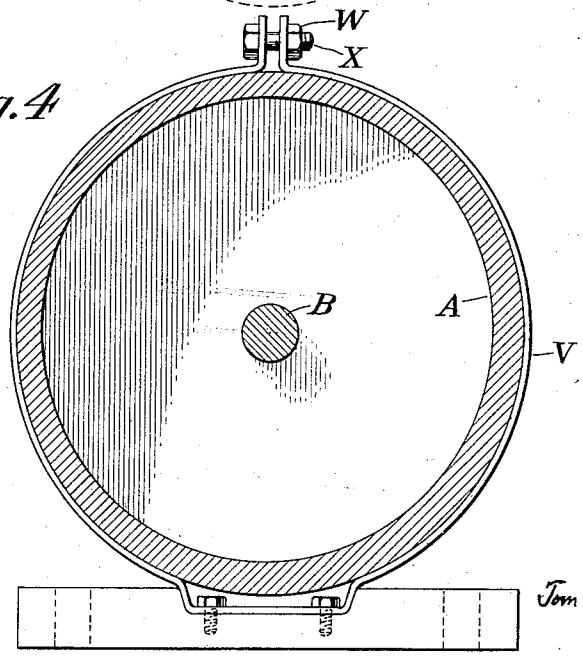



Fig. 4




Witnesses:
Thomas J. Byrne
William Johnson

Tom Whitaker Tattersall
Inventor.

By his Attorneys
Satterlee, Canfield & Stone

# UNITED STATES PATENT OFFICE.

TOM WHITAKER TATTERSALL, OF LONDON, ENGLAND, ASSIGNOR TO ERNEST HENRY SHACKLETON, OF LONDON, ENGLAND.

## MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES.

1,201,387. Specification of Letters Patent. Patented Oct. 17, 1916.

Application filed September 6, 1913. Serial No. 788,375.

*To all whom it may concern:*

Be it known that I, TOM WHITAKER TATTERSALL, a subject of the King of Great Britain, residing at London, England, have invented certain new and useful Improvements in Means for Starting Internal-Combustion Engines, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

This invention relates to means for starting internal combustion engines used on motor vehicles, in which a dynamo, capable of being also used as a motor and hereinafter referred to as a dynamo electric machine, a storage battery and incandescent lamps are employed and in which the dynamo electric machine is used for starting the engine.

In apparatus of this class it has been proposed to start the engine by means of the dynamo electric machine used as a motor, by connecting the shaft of the engine with that of the dynamo electric machine by two gears having different velocity ratio, one of which is operated when the power originates from the engine, and the other when the power originates from the dynamo electric machine, manually operating means being used for engaging and disengaging the last named gear by moving a part of the train in and out of mesh. It has also been proposed to move the gear into engagement by means of a solenoid or electromagnet through the coils of which a current is directed when the circuit of the dynamo is closed.

The object of the invention, subject of this application, is to provide improved means for operating and changing the velocity ratio when the source of power is changed, and to this end the invention consists in the combination with the dynamo electric machine and engine of a system of reducing gears comprising a wheel fixed to the shaft of said dynamo electric machine, a wheel connected to the shaft by a one-way clutch and always in mesh or gear with the engine shaft, and intermediate gear wheels adapted to rotate idly around the armature shaft when the engine is running normally, and so arranged that when it is desired to start the engine the intermediate gear wheels by the action of a solenoid are held against rotation about the armature shaft, so that when the dynamo electric machine is working as a motor, power is transmitted to start the engine, which after being started operates through the one-way clutch to drive the dynamo electric machine.

As the gearing between the dynamo electric machine and the engine is liable to wear, and a chain, when employed, is liable to stretch, means for adjustment are or may be provided and such adjustment may be effected by mounting the dynamo electric machine so that its shaft is movable toward and from that of the engine. To effect this the dynamo electric machine may be provided with a cylindrical casing which is eccentric to the armature shaft and mounted by means of a band or strap attached to the crank case or other part of the vehicle, means being provided for releasing the tension of the band or strap so that the dynamo machine may be turned around at will and its shaft moved toward or away from the engine crank shaft as desired.

The drawings hereto annexed illustrate the improvement in its preferred form.

Figure 1 is a sectional elevation of an apparatus constructed in accordance with the invention. Fig. 2 is a cross section of the dynamo electric machine casing showing the electromagnet or solenoid. Fig. 3 is a sectional elevation of the gears showing the one-way clutch connection. Fig. 4 is a section of the casing for the dynamo electric machine showing the means for its support and adjustment. Fig. 5 is a plan view of the gear and sprocket wheels showing the manner of their connection.

In the form of apparatus shown A designates the casing of a dynamo electric machine, the armature shaft B only of which is shown by the breaking away of a portion of the wall. The said shaft B projects through

a suitable bearing in the end of the casing and is connected with the engine crank shaft C by the system of gears which operates to drive the engine by the dynamo electric machine or conversely.

The gearing between the dynamo and the engine comprises a gear wheel D fixed to the shaft B and a larger gear wheel E mounted on the same shaft but connected therewith by a one-way clutch, represented conventionally in Fig. 3 as a pivoted pawl *e* engaging with ratchet teeth on shaft B, and gear wheels F and G mounted loosely on a hand H, projecting from a disk K on the armature shaft. The gear wheel E is integral with a sprocket wheel L which drives a sprocket M on the engine shaft C by means of a chain N. The gear wheels F and G are also integral or are rigidly connected together.

The disk K is surrounded by a brake strap or band O which passes over a crank pin P carried by a shaft R mounted in the casing of the dynamo electric machine. The said shaft is rotated through a limited angle by a crank-pin T, connected to the plunger armature S of the solenoid T' so that when the solenoid is energized the band O will be tightened and the disk K thereby prevented from rotating with the shaft B.

The details of the means for adjusting the shaft B to compensate for wear or stretching of the chain N are shown in Fig. 4. The casing A is made of varying thickness so that its exterior periphery is eccentric to the shaft B. The casing is secured to the desired part of the frame by a strap V which is adapted to be tightened or loosened by a nut W working on the threaded end of a bolt X passing through lugs at the meeting ends of the strap.

When it is desired to start the engine, current from a storage battery, not shown, is passed through the dynamo electric machine and the coil of the electromagnet T'. This prevents the disk K from turning on the armature shaft B and as the latter is set in rotation by the armature its movement will be transmitted through the sytsem of gears and the sprocket chain N to the engine shaft. The speed thus imparted to the shaft B develops sufficient power to rotate the engine shaft at the required speed to start the engine. When the latter is by this means started the operator opens the circuit of the electromagnet which releases the plunger armature and allows the disk K to run free. The engine shaft thereupon transmits power through the sprocket chain and wheels to the gear wheel E and from the same by the operation of the one-way clutch to the armature shaft B. The dynamo electric machine is thus driven by the generator to supply current for charging storage batteries, running incandescent lights and other purposes.

What I claim as my invention is:—

1. A starting device for internal combustion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected with said shaft by a one-way clutch and gears with the engine shaft, idle gears intermediate to the said gear wheels and capable of rotation about the motor-generator shaft and means for preventing and permitting such rotation as set forth.

2. A starting device for internal combustion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected to said shaft by a one-way clutch and geared with the engine shaft, idle gears intermediate to the said gear wheels and capable of rotation about the motor-generator shaft, means for preventing and permitting such rotation and a solenoid for controlling such means as set forth.

3. A starting device for internal combustion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected to said shaft by a one-way clutch and geared with the engine shaft, idle gears intermediate to the said gear wheels, a disk loosely mounted on the motor-generator shaft and supporting said idle gears and means for preventing and permitting the rotation of said disk on its shaft as set forth.

4. A starting device for internal combustion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected to said shaft by a one-way clutch and permanently geared with the engine shaft, a disk mounted loosely on the motor-generator shaft, idle gears meshing with the gear wheels and carried by said disk, means for preventing and permitting rotation of said disk on its shaft and an electromagnet for controlling the same as set forth.

5. A starting device for internal combustion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected with said shaft by a one-way clutch and permanently geared with the engine shaft, idle gears intermediate to the said gear wheels, a disk loosely mounted on the motor-generator shaft and supporting said idle gears, a brake band surrounding said disk and adapted when tightened to prevent the rotation of the same, a solenoid and means controlled thereby for operating said brake band as set forth.

6. A starting device for internal combus-

tion engines comprising in combination with the engine shaft and a motor-generator shaft, a gear wheel fixed to the motor-generator shaft, a gear wheel connected to said shaft by a one-way clutch and permanently geared with the engine shaft, idle gears intermediate to the said gears wheels, a disk loosely mounted on the motor-generator shaft and supporting said idle gears, a brake band surrounding the disk, a crank shaft mounted in fixed bearings and adapted by a partial rotation to tighten or loosen said brake band and a solenoid for imparting such rotation to the crank shaft.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

TOM WHITAKER TATTERSALL.

Witnesses:

T. L. STEWARD,

J. W. HAKBING.