F. E. FISHER.

STARTER FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED OCT. 27, 1911.

1,159,752.

Patented Nov. 9, 1915.

2 SHEETS—SHEET 1.

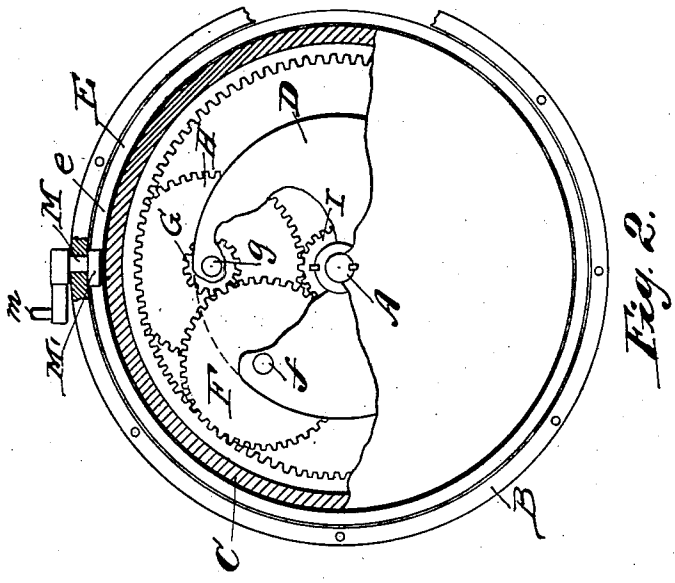


Fig. 2.

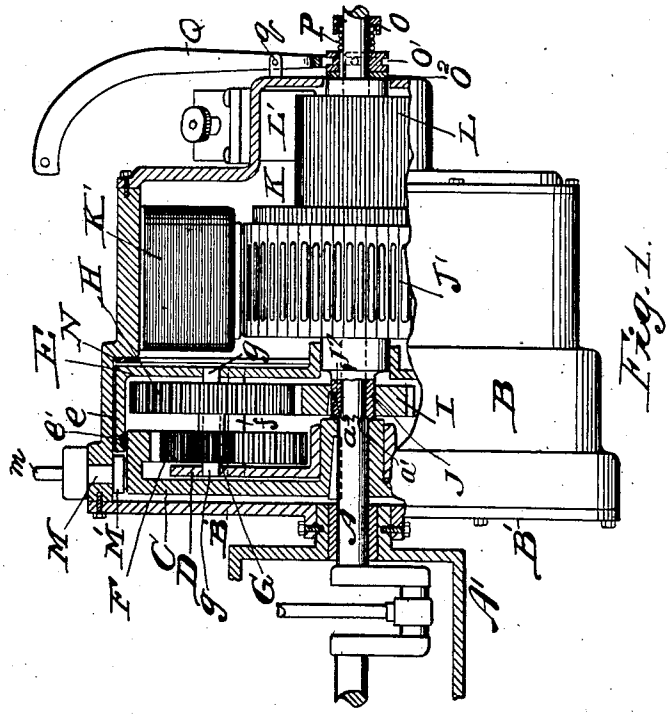


Fig. 1.

Witnesses

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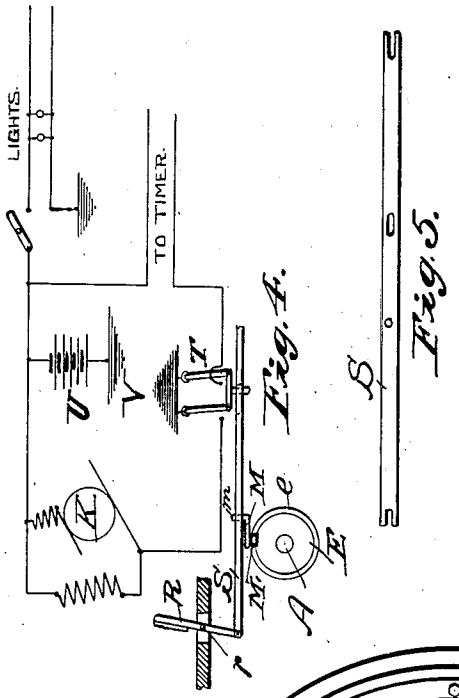


Fig. 4.

Fig. 5.

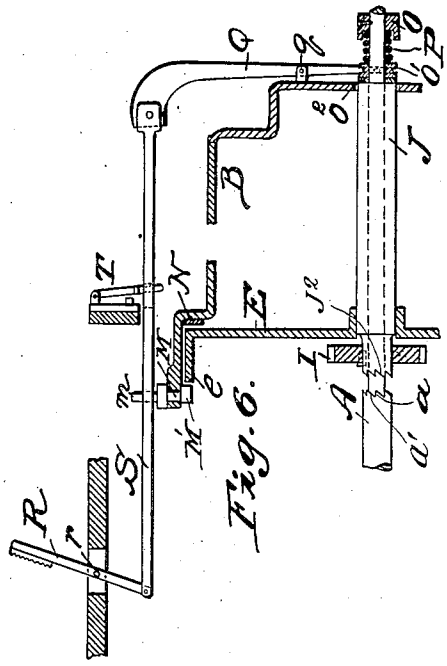


Fig. 6.

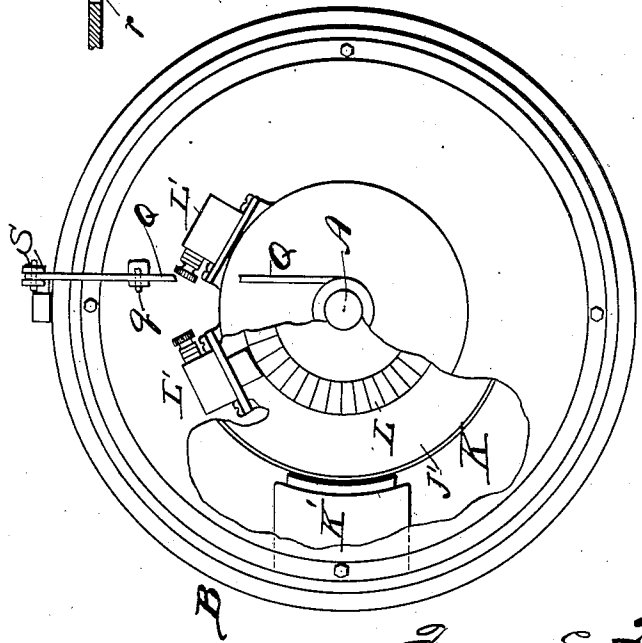


Fig. 3.

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UNITED STATES PATENT OFFICE.

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STARTER FOR INTERNAL-COMBUSTION ENGINES.

1,159,752. Specification of Letters Patent. Patented Nov. 9, 1915.

Application filed October 27, 1911. Serial No. 657,130.

To all whom it may concern:

Be it known that I, FRANK E. FISHER, citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Starters for Internal-Combustion Engines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which is pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to an improvement in means for the self-starting of internal combustion engines and is more especially designed for automobile or motor boat installations.

My invention includes a motor-dynamo mounted on an extension of the engine shaft,—the arrangement being such that the engine is started by the dynamo through current from a storage battery in turn recharged by the dynamo when operated as a generator.

A further object of the invention is to provide for discontinuing the operation of the dynamo as a motor, simultaneously with the independent operation of the engine,—the arrangement being such that the motor then becomes a generator to recharge the storage battery.

A further object is to provide means whereby in the event of the engine "back firing" there will be no danger of stripping the train of gears employed to start the engine through any undue shock or sudden reversal of the parts,—the arrangement being such that the frictional driving connection provided between the motor and engine will slip relieving the gearing of any undue strain.

Other advantages and improvements will hereafter appear.

In the drawings accompanying this specification: Figure 1 is a longitudinal central section of the starting device (with parts broken away and in elevation). Fig. 2 is an end elevation of a train of gears supported upon the engine shaft actuated by the dynamo when operating as a motor, the end wall of the inclosing case shown in Fig. 1, being removed and parts broken away to more clearly disclose the construction. Fig. 3 is an elevation of the opposite end of the device with parts of the casing broken away to show the construction. Fig. 4 is a diagrammatic view of the electric connections, to indicate the manner of closing the circuit between battery and motor to start the engine and to operate the motor as a generator. Fig. 5 is an elevation of the lever indicated in the diagrammatic view for operating the switch for closing the circuit, the friction ring cam, and the lever controlling the lateral movement of the armature sleeve. Fig. 6 is a diagrammatic view of the engine shaft and armature sleeve mounted thereon indicating means for forcing said armature sleeve into contact with the shoulder formed on the engine shaft whereby it may operate as a unit,—also means employed to release it from said operating relation.

In carrying out my invention it is obvious that changes may be made in the details of construction without departing from the spirit of the invention.

Referring now to the letters of reference placed upon the drawings: A indicates an extension of an engine shaft. A′ a fragment of the engine case.

B is a case inclosing a dynamo and the train of gears supported on the extension of the engine shaft, its end wall B′ being bolted to the engine case A′.

C is an internal annular gear keyed to the engine shaft.

D is an annular plate sleeved on the hub of the internal annular gear C.

E is an annular plate spaced from the plate D having an annular flange *e* overlapping the flange of the internal gear C, in which is set a gasket *e′* to prevent the entry of dust into the gear case. Between the annular plates D and E are supported a train of gears mounted on a plurality of stub shafts supported in said plates and by which the plates are held apart.

F denotes a gear free to turn on the shaft *f* and meshing with the internal annular gear C and pinion G, the latter being integral with the gear H mounted on the shaft *g* on which they are free to turn. The gear H in turn meshes with a pinion I keyed on the sleeve J of the armature J′.

K is the motor, and K′ are its field magnets supported in the case B.

L is the commutator, and L′ its brushes.

M indicates a rock shaft journaled in the case B.

M′ is a cam mounted on the end of the shaft adapted to bear against the rim *e* of the annular plate E whereby it may be moved laterally.

N is an annular friction disk or ring secured to a shoulder formed in the case B designed to receive the thrust of the annular plate E when brought into frictional relation by the cam M′. Upon the engine shaft adjacent to the commutator of the generator, is secured a fixed collar O. Spaced from the fixed collar O is a sliding collar O′ keyed to the engine shaft that it may rotate therewith.

O^2 is a disk secured to the collar adapted to bear against the sleeve J of the armature. Between the collar O and the sliding collar O′, is a spring P adapted to force the sleeve J of the armature against the shoulder *a* on the engine shaft to assist in causing it to rotate therewith when operating as a generator as will be hereafter more fully explained.

Q is a lever fulcrumed at *q*, its lower end formed with a yoke to engage the sliding collar O′ by which it may be moved against the action of the spring P.

R is a lever, preferably a foot lever, pivoted at *r* to a suitable supporting frame.

S is a rod connecting the lever R with the lever Q.

m is a stud projecting from an arm carried by the rock shaft M into an aperture provided in the rod S for its reception.

T is a two-pole electric switch, the arms T′ and T″ of which are adapted to be moved to engage the contact points 1 and 2 or 3 and 4, upon movement of the rod which is actuated by the foot lever.

In the diagrammatic views the rod S is shown slotted to receive the arm of the switch, indicating that the cam M′ and the lever Q may be actuated after the switch T is closed without opening said switch. The dynamo K is preferably of the compound wound type having the series coil *x* and the shunt coil *x′*. The circuit starts from generator K through series coil to storage battery U, to charge battery, thence to ground V, through switch T back to generator K. To start the motor current flows from storage battery U to series coil thence to motor K, to switch T, to ground V, back to battery U. In the ignition circuit, current starts from the battery U to the timer, back to switch T, to ground V, to battery U. The lighting circuit starts from the battery U, to the switch, thence to lights and back to ground.

Having denoted the several parts by reference letters, I will now describe the operation of my invention: To start the motor, the two-pole switch T is operated to close the circuit through the storage battery U to the timer and to the motor K, by means of the foot lever R. Upon operating the foot lever R, the rock shaft M is also actuated forcing the cam against the rim of the annular plate E which in turn is thrust into frictional contact with the annular disk N secured to the case B. As the casing B is bolted to the engine case, the frictional relation obtained between the annular plate E and the frictional disk N through the operation of the cam, secures the annular plates D and E against rotation. The motor having been started by closing the circuit through the storage battery, the pinion I keyed on the sleeve J of the dynamo drives the gear H and through it the pinion G, mounted on the shaft *g*, which meshes with the gear F, in turn meshing with the internal annular gear C keyed to the engine shaft A, by the operation of which the engine is started;—the dynamo running as a motor until the engine operates independently. Upon the engine starting from the explosion of gas in its cylinders, the shock due to the explosion causes the plate E to slip with respect to the frictional disk N, thereby eliminating any excessive strain upon the mechanism. The engine having now begun to operate independent of the motor, the operator fully releases the cam M′ from contact with the rim of the annular plate E, by withdrawing pressure upon the foot lever R. The dynamo which is of a type adapted to rotate in the same direction when operating either as a motor or as a generator is now driven by the engine, the internal gear C keyed to the engine shaft acting as a unit with the gears F, G, H (which remain stationary on their shafts) to drive the pinion I keyed to the armature sleeve, thereby rotating the armature J′. The spring P on the end of the engine shaft through the release of the levers R and Q forces the teeth J^2 at the end of the armature sleeve into engagement with the teeth *a′* of the shoulder *a* on the engine shaft, thus serving as a means to insure the rotation of the armature by the engine, guarding against any tendency there may be of the gears F, G, and H, turning on their shafts when the dynamo is operating as a generator. The current produced by the dynamo operating as a generator passes to the battery through the circuit closed by the switch T and ground V. When it is desired to stop the engine the switch T is opened, breaking the ignition and battery circuit.

It will be seen from an inspection of the drawing taken in connection with the accompanying description that the train of gearing does not drive the generator but simply acts in coöperation with the clutch teeth at the end of the sleeve J and merely assists in driving the generator which is actuated through the medium of the shaft A by its coöperation with the notched end of the said sleeve.

Having thus described my invention, what I claim is:—

1. In an apparatus such as described, a casing, an engine shaft and a generator shaft extending into said casing in alinement, means for connecting the engine and generator shafts, whereby the generator shaft will be rotated upon rotation of the engine shaft, a disk slidably located upon the generator shaft, means for sliding said disk, a train of gears mounted upon the disk, a gear keyed to the engine shaft and meshing with the aforesaid train of gears carried by the disk, said disk being slidable relative to the gear carried by the engine shaft, means carried by the casing for engaging the first mentioned disk and sliding the same within said casing, a means engaging the disk for retracting the same as and for the purposes set forth.

2. In an apparatus such as described, a casing, an engine shaft and a generator shaft mounted in said casing, said shafts being disposed in alinement, interlocking means provided upon the engine and generator shafts whereby the said generator shaft will be rotated upon the rotation of the engine shaft, a generator supported by the casing and generator shaft, means for sliding the generator shaft longitudinally of the casing into and out of engagement with the engine shaft, a disk slidable upon the generator shaft, a peripheral flange formed upon said disk, a ring carried by the casing for engagement with said disk upon the sliding movement of the disk, a train of gears carried by the disk, one of the gears of said train being keyed to the generator shaft, a gear keyed to the engine shaft and meshing with said train of gears, said disk having a flange within which the gear carried by the engine shaft is located and the said disk being slidable relative to the gear, and means carried by the casing for engaging the disk to slide the same upon the generator shaft.

3. In an apparatus such as described, a casing, an engine shaft and a generator shaft extending therein, an internal gear keyed to the engine shaft, a disk mounted on the hub of said internal gear, a disk slidable upon the generator shaft within said casing, a train of planetary gearing carried by the disks and engaging the internal gear, a gear keyed to the generator shaft and meshing with said train of planetary gearing, a friction ring supported within the casing in the path of said sliding disk, an annular flange formed upon the sliding disk and surrounding the internal gear, a gasket carried by the flange and engaging the internal gear, a rock shaft journaled in the casing, means for actuating the same, and a cam carried by said rock shaft and engaging the flange of the sliding disk whereby the latter will be moved to engage the friction ring.

In testimony whereof, I sign this specification in the presence of two witnesses.

FRANK E. FISHER.

Witnesses:
GRACE E. WYNKOOP,
SAMUEL E. THOMAS.