Jan. 16, 1923. 1,442,791

W. L. BLISS.

AUTOMOBILE STARTER AND GENERATOR.

FILED MAY 27, 1915.

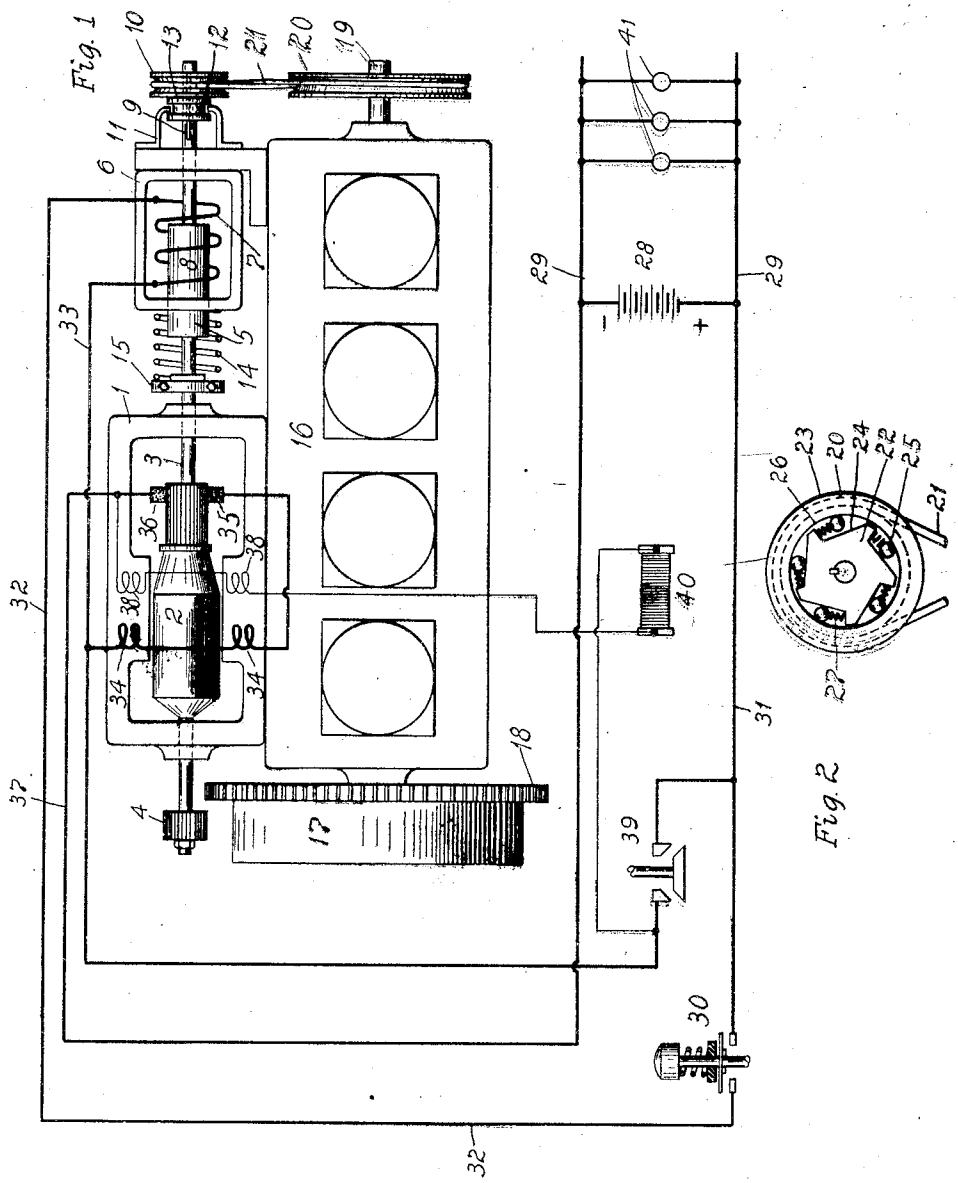


Fig. 1

Fig. 2

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Patented Jan. 16, 1923. 1,442,791

UNITED STATES PATENT OFFICE.

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AUTOMOBILE STARTER AND GENERATOR.

Application filed May 27, 1915. Serial No. 30,727.

To all whom it may concern:

Be it known that I, WILLIAM L. BLISS, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented new and useful Improvements in Automobile Starters and Generators, of which the following is a specification.

This invention relates to automobile starters and generators.

It is one of the objects of the invention to provide reliable and practical means for starting the internal combustion engine of an automobile and subsequently generating current to recharge the storage battery and operate the lighting or ignition systems.

Another object of the invention is to provide in an apparatus of the above said character, practical and convenient means for establishing and interrupting the power transmissions between a dynamo-electric machine and an internal combustion engine.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in various features of construction, combinations of elements and arrangement of parts which will be exemplified by the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

One of the various possible embodiments of the invention is shown in the accompanying drawings wherein:—

Figure 1 is a diagrammatic illustration of the apparatus.

Figure 2 is a view of the cross belt and clutch mechanism forming a part of the power transmission.

The embodiment disclosed includes a dynamo-electric machine, the armature shaft of which is movable longitudinally under the influence of a solenoid. The armature shaft has a part adapted to complete or interrupt the train of transmission between the dynamo-electric machine and an internal combustion engine accordingly as the armature shaft is moved longitudinally in one direction or the other. A second train of transmission devices extends between the crank shaft of the engine and the aforesaid armature shaft and comprises means whereby under certain conditions, an interruption of the transmission takes place. A suitable device is provided for automatically connecting the dynamo as a generator in circuit with the battery and lamps.

There is indicated as at 1 a dynamo-electric machine comprising an armature 2 having an armature shaft 3. This shaft is provided with a pinion 4 and has also a magnetic portion 5, mounted in suitable bearings in the frame 6 and co-operatively arranged with respect to a winding 7 forming a solenoid indicated generally at 8. Splined on the end of the armature shaft 3, at 9, is a grooved pulley 10, and while rotary movement of the pulley is permitted, longitudinal movement thereof is restricted by a yoke 11, which plays in an annular groove 12 formed in a hub 13 of the pulley 10. A coiled spring 14 bears against a collar 15 fixed on the shaft 3 and reacts against a wall of the frame 6 to urge the armature shaft in a direction toward the left in Figure 1.

An internal combustion engine is shown at 16 provided with a fly-wheel 17, upon which is formed a gear 18. The fly-wheel is, of course, mounted on the crank shaft of the engine and on this crank shaft at 19 there is mounted a grooved pulley 20, which is connected to the grooved pulley 10 by means of a crossed belt 21. The pulley 10 comprises inner and outer clutch elements 22 and 23 respectively. The inner element is provided with cam faces 24 adapted under certain conditions to co-operate with rollers 25 for the purpose of wedging the same against the peripheral wall 26 of the clutch member 23. Suitable spring means 27 are provided to facilitate the clutching operation.

It will be obvious that the devices described permit the transmission of power between the engine and dynamo at different speed ratios.

A storage battery is shown conventionally at 28 and the main work circuit is indicated at 29. A starting switch is provided as at 30 and the operation and electrical circuits are as follows: From the positive side of the storage battery, current flows through the conductor 31, starting switch 30, conductor 32, solenoid 7, conductor 33, series field 34, positive brush 35, armature 2, negative brush 36, conductor 37, to the negative side of the battery. Instead of passing from the conductor 33 to the series field 34, a part of the current will flow through the carbon pile 40 and shunt fields 38 to the negative

side of the battery. Series fields 34 and shunt fields 38 will be wound to act cumulatively when the dynamo-electric machine is operating as a motor.

When the starting switch 30 is closed, the electrical circuit is completed as outlined. The solenoid winding 7 is energized and the armature shaft will be drawn toward the right against the action of the spring 14 until the pinion 4 is fully meshed with the gear 18 of the fly-wheel. The dynamo-electric machine operates as a motor and the engine is spun until compression and ignition take place and it commences to operate by its own fuel; thereupon a counter electro-motive force is developed in the dynamo, neutralizing the effect of the battery current in the solenoid winding 7. This will permit the spring 14 to urge the shaft 3 toward the left in Figure 1 and demesh the pinion 4 and gear 18. Of course, opening of the starting switch 30 would open-circuit the solenoid winding and have a similar effect on the pinion and gear mentioned. It is desired now to utilize the dynamo-electric machine as a generator, and while the over-running clutch of the pulley 10 has been ineffective during the starting operation, it now becomes effective because of the increased speed of the crank shaft.

The engine will now drive the dynamo electric machine as a generator through the belt 21. Current to excite the shunt fields 38 will flow from the positive brush 35, through the series fields 34, rheostat 40, shunt fields 38, to the negative brush. Series fields 34 will act differentially to the shunt fields 38 while the dynamo electric machine is operating as a generator. Before the automatic switch 39 has closed, however, the current passing through said series field 34 will be of such a low value that fields 34 will have no appreciable differential effect. After the automatic switch 39 has closed and when current is being delivered to the external circuit, series fields 34 will set up an opposing influence to shunt fields 38, limiting the current output of the dynamo-electric machine to a safe value. The rheostat 40, arranged in the shunt field circuit, may be controlled by any well known means to vary its resistance. The particular control for said rheostat forms no part of the present invention and none has been illustrated.

It will be obvious from the foregoing description that an apparatus is provided which is simple in construction, which will supply a high starting torque as a motor, and which will automatically resolve itself into a generator and be self-regulated.

As many changes could be made in the above construction and many apparently widely different embodiments of the invention might be made without departing from the scope thereof, it is intended that all matter contained in the foregoing, or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. An internal combustion engine having a main shaft, a starter having a main shaft, transmission means of one ratio normally connecting said shafts, transmission means of another ratio normally disconnected, and electro magnetic means to shift said starter shaft along its axis to cause said normally disconnected transmission means to be connected.

2. In combination, an internal combustion engine, a dynamo-electric machine adapted to operate as a motor or as a generator, two independent sets of transmission means between said engine and said machine, one of said sets including a shiftable gear, and electro-magnetic means for shifting said gear in response to current supplied to said machine for motoring.

3. In combination, an internal combustion engine, a dynamo-electric machine adapted to operate as a motor or as a generator, two independent sets of transmission means between said engine and said machine, one of said sets including a shiftable gear, and electro-magnetic means for shifting said gear, said electro-magnetic means being connected in series with the armature of said dynamo-electric machine only when current is applied to said machine for motoring purposes.

4. An internal combustion engine having a shaft, a starting dynamo-electric machine having a shaft, transmission means connecting said shafts to rotate at one ratio, said transmission means including an overrunning clutch, a positive transmission means including a shiftable gear for connecting said shafts at a different ratio, said latter means being normally disconnected, and electro-magnetic means for shifting said gear in response to current supplied to said machine for motoring.

5. An internal combustion engine having a shaft, a starting dynamo-electric machine having a shaft, said latter shaft being shiftable, transmission means connecting said shafts to rotate at one ratio, said transmission means including an over-running clutch, a positive transmission means for connecting said shafts at a different ratio, said latter transmission means being normally disconnected, and electro-magnetic means to shift said starting machine shaft to connect said latter transmission means.

In witness whereof, I have hereunto subscribed my name.

WILLIAM L. BLISS.