March 21, 1939. E. SCHAEREN 2,151,487

COMBINED ENGINE STARTER AND GENERATOR

Filed Aug. 31, 1937 4 Sheets-Sheet 1

Fig.1.

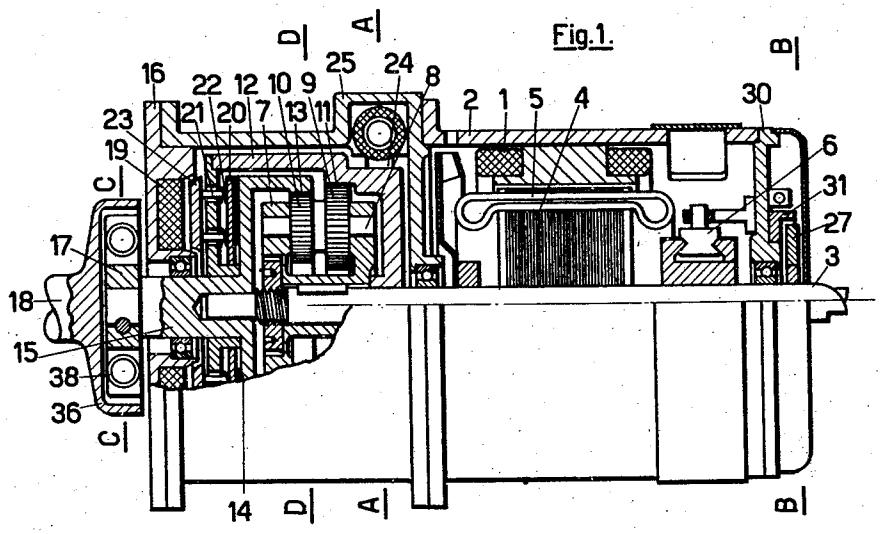


Fig.2.

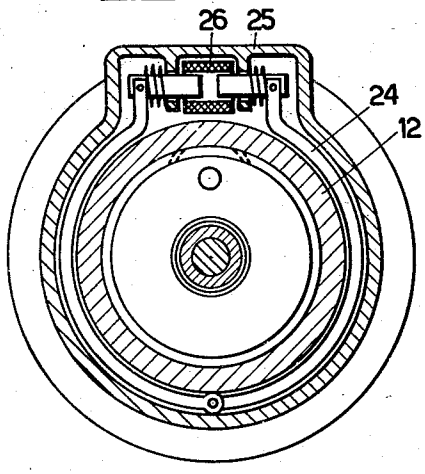
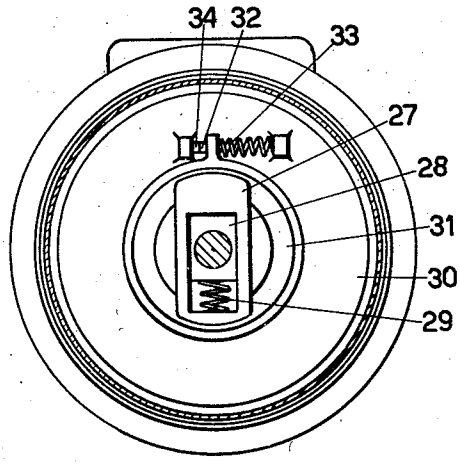


Fig.3.



Inventor :

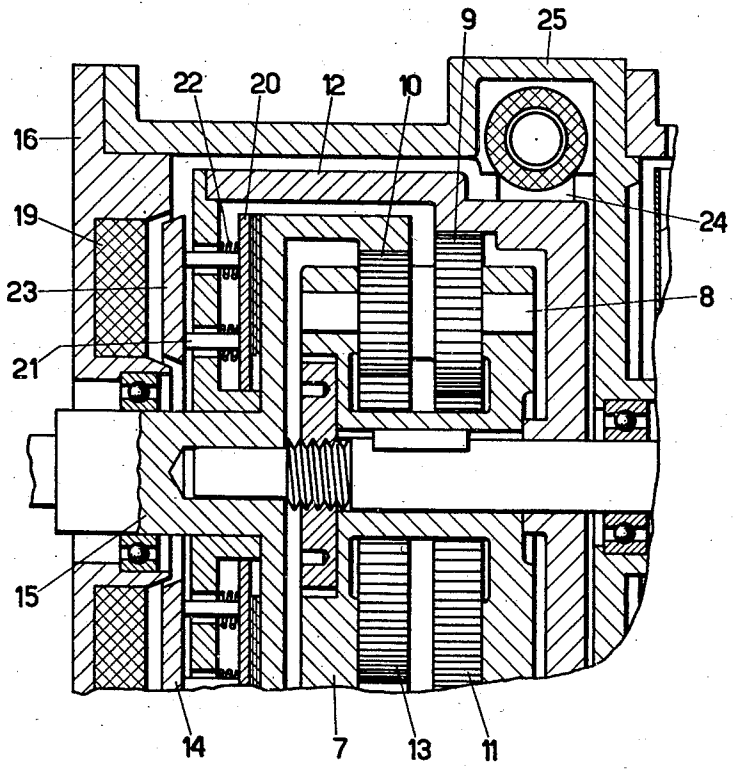
Ernst Schaeren

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COMBINED ENGINE STARTER AND GENERATOR

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Fig.4.



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COMBINED ENGINE STARTER AND GENERATOR

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Fig. 5.

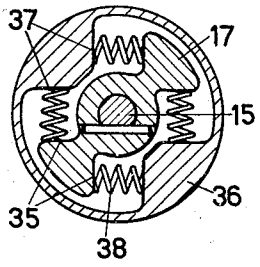


Fig. 6.

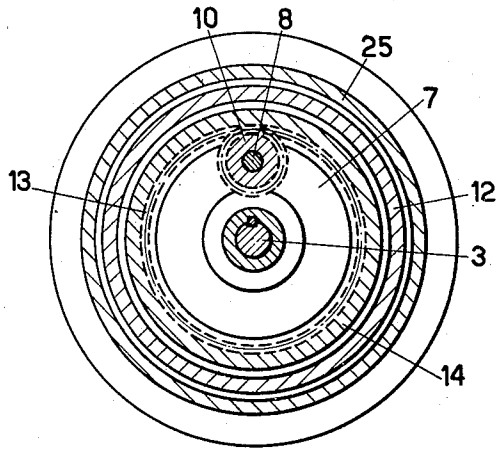
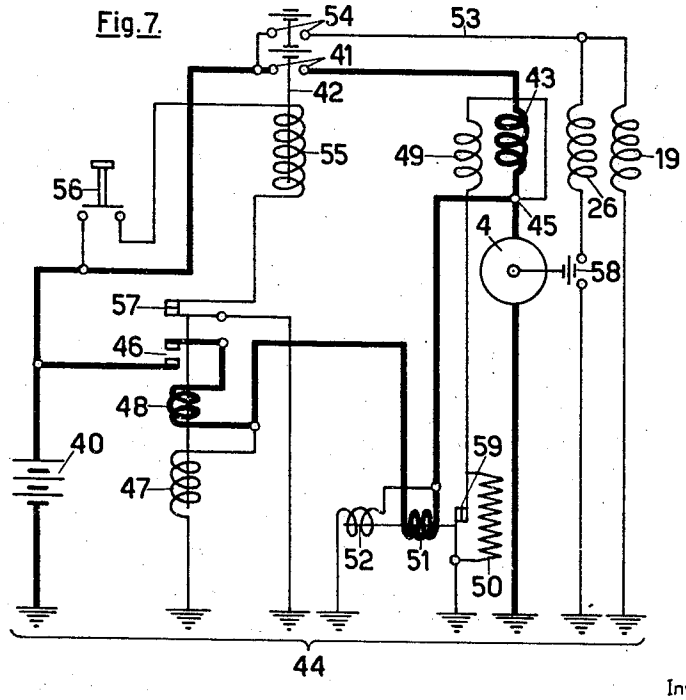


Fig. 7.



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Fig.8.

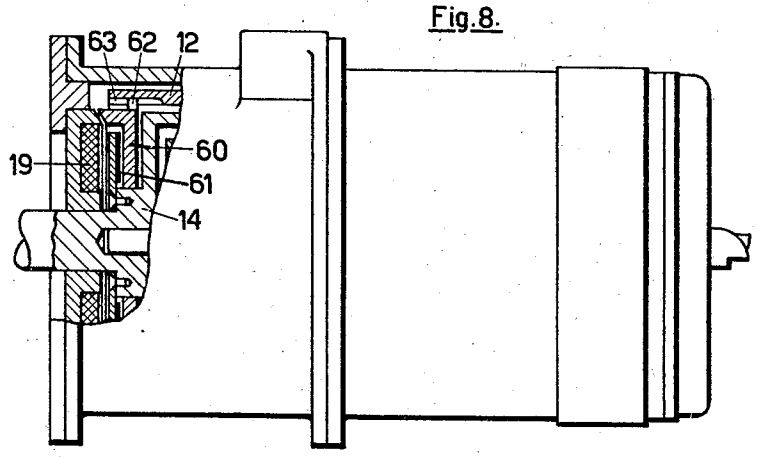
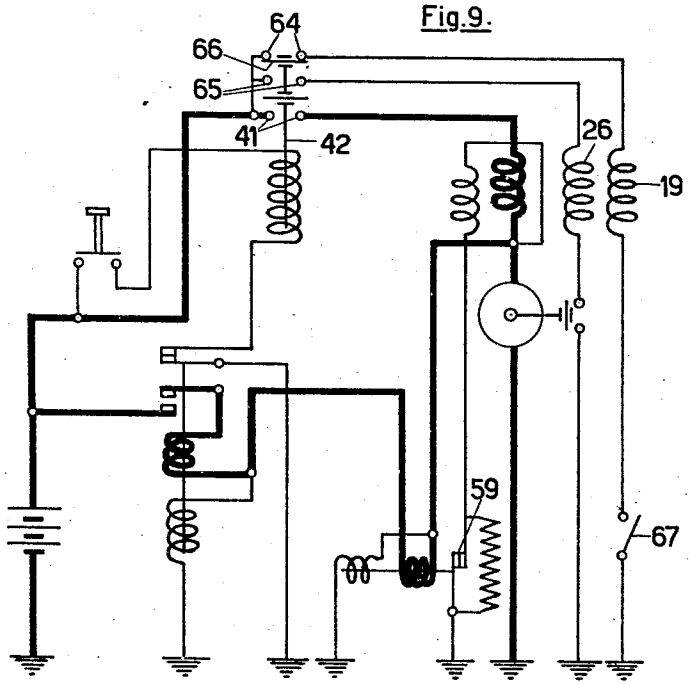


Fig.9.



Inventor :

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Patented Mar. 21, 1939 2,151,487

UNITED STATES PATENT OFFICE

2,151,487

COMBINED ENGINE STARTER AND GENERATOR

Ernst Schaeren, Soleure, Switzerland, assignor to Scintilla, Ltd., Soleure, Switzerland, a corporation of Switzerland

Application August 31, 1937, Serial No. 161,859
In Switzerland September 4, 1936

20 Claims. (Cl. 290—31)

This invention relates to electric motor and generator apparatus, and more particularly to electric starting and generating apparatus for internal combustion engines.

One of the objects of the invention is to provide an apparatus of this kind comprising a single dynamo electric machine adapted to function both as a motor and as a current generator, in which said dynamo electric machine is enabled to run at full speed and full power as a starting motor for the internal combustion engine without being compelled to run unduly fast when driven by the latter running at full speed.

Another of the objects of the invention is to provide means for changing the speed ratio between the internal combustion engine and the dynamo electric machine without engaging and disengaging gear members, ratchets, dental clutches and similar coupling means which are likely to cause shocks in the drive.

A further object of the invention is to provide means for automatically effecting in the correct sequence the several control steps necessary for operating such apparatus, and for preventing the latter from being damaged by improper operation.

With this general statement of the objects and purposes of my invention, I shall now proceed to describe one embodiment thereof and the manner in which my invention may be carried out, and it will be understood that while I have described what may be considered as preferable embodiments of my invention, I do not limit myself to the precise features, herein set forth, as they may be varied by those skilled in the art in accordance with the particular purposes for which they are intended and the conditions under which they are to be utilized.

In the drawings, Fig. 1 shows, partly in longitudinal section, the dynamo electric machine with the wheel gear, the electric connections and terminals being omitted.

Fig. 2 is a cross-section on the line A—A of Fig. 1.

Fig. 3 is another cross-section on the line B—B.

Fig. 4 shows a detail of Fig. 1 on a larger scale.

Fig. 5 is a cross-section on the line C—C of Fig. 1.

Fig. 6, a cross-section on the line D—D of Fig. 1.

Fig. 7 is a diagram of the electric connections of the installation shown in Figs. 1 to 6.

Fig. 8 represents a further embodiment of the invention.

Fig. 9 is a diagram of the electric connections of the installation according to Fig. 8.

In the embodiment shown in Figs. 1 to 7 the dynamo electric machine has a field-winding 1 fixedly mounted in the casing 2 and a rotating armature shaft 3 carrying the amature 4 and the commutator 6 connected to the armature winding 5. The pinion support 7 which is keyed to the shaft 3 carries a journal 8 supporting a pair of pinions 9 and 10 loosely rotatable thereon but rigidly connected to one another. The pinion 9, of larger diameter, meshes with the internal teeth 11 of a drum 12, and the pinion 10, of smaller diameter, meshes with the internal teeth 13 of a wheel 14. The hub 15 of the latter is rotatably supported by a bearing mounted in the end plate 16, and is journalled on the armature shaft 3. It is in driving relation with the internal combustion engine by means of an elastic coupling and a drive shaft 18. The said elastic coupling consists of an internal part 17 keyed to the hub 15 and carrying abutments 35, and a housing 36 integral with the shaft 18 and having abutments 37. These abutments 35 and 37 are arranged to form spring seats for the compression springs 38 which transmit the turning moment between the hub 15 and the housing 36.

The drum 12 is supported by and freely rotatable on the armature shaft 3 and the hub 15, and can be coupled with the wheel 14 by means of a coupling device controlled by a stationary electromagnet 19. This coupling device or electro-magnetic clutch operates as a friction clutch and consists of a disc 20 provided with a friction facing, which disc is mounted to turn with the drum 12 by pins 21 and held away from the bottom of the drum 12 and into contact with the wheel 14 by springs 22. The armature plate 23 connected to the disc 20 by the pins 21 is subject to the attraction of the electromagnet 19 when the latter is energized so that its movement uncouples the drum 12 from the wheel 14. The drum 12 may be arrested with reference to the gear casing 25 by means of the friction brake 24 which is actuated by an electromagnet 26 when the latter is energized.

The armature shaft 3 of the electric machine carries a centrifugal switch 58 (Fig. 7, also Figs. 1 and 3) which comprises a weight 27 mounted to turn with the shaft 3 by means of the guide 28 and radially displaceable against the resistance of the spring 29 which is under a suitable initial compression. The centre of gravity of said weight 27 is eccentrically located with reference to the axis of the shaft 3. Rotatably mounted on the casing cover 30 is a ring 31 carrying a switch

contact 32. The latter is pressed against the cooperating stationary contact 34 by the spring 33 in the direction opposite to the direction of rotation of the shaft 3.

The electrical connections of the installation shown in Fig. 7 will now be explained: The starting circuit leads from one pole of the storage battery 40 through a pair of contacts 41 controlled by the switch 42 to the winding 43 of the dynamo electric machine. This winding forms a part of the field winding 1 and is connected in series with the winding 5 of the armature 4. The starting circuit is completed through ground connection 44. A shunt winding 49 also generating the field winding 1 assists the winding 43 in its effect.

The main circuit of the generating operation of the dynamo electric machine leads from the terminal 45 through current coils 51 and 48 to an automatic switch 46 of known construction. This switch is under the influence of a potential coil 47 which is energized according to the potential delivered by the dynamo electric machine and closes the circuit only when said potential exceeds a definite minimum value. The switch 46 is also under the influence of a current coil 48 which is energized according to the flow of current through the armature 4. This current coil interrupts the circuit whenever the current reverses through the latter, whereby the battery would be discharged. From the switch 46, the circuit leads to ground 44 through the battery 40 which in this instance is the load. Additional current consuming devices not shown in the drawings, e. g. the ignition system of the internal combustion engine, a lighting installation etc. may be connected in parallel with the battery 40.

The field winding 49 used for the generator operation of the dynamo electric machine is connected in parallel with the winding of the armature 4 and is controlled by an automatic regulator. This regulator controls the excitation of the dynamo electric machine in known manner under the influence of the currents flowing through current coil 51 and a potential coil 52, by opening and closing a pair of contacts 59 shunted by a resistance 58.

The circuits of the two electromagnets 19 for actuating the clutch and 26 for actuating the brake, have a common connection 53 comprising a further pair of contacts 54 controlled by a multi-pole switch 42. Thus both said electromagnets are always connected in circuit at the same time, and the interruption of the current for the clutch electromagnet simultaneously causes interruption of the current for the brake electromagnet. Consequently the coupling of the drum 12 with the wheel 14 causes release of the brake 24, and the arresting of the drum by means of the brake causes its uncoupling from the wheel 14. The circuit of the brake electromagnet also includes the above described centrifugal switch 58.

The switch 42 is electromagnetically actuated by means of the coil 55. In addition to a manually operated switch 56, the circuit of this coil includes an auxiliary switch 57 which is coupled to the automatic switch 46 in such a way that it keeps the circuit of the coil 55 interrupted so long as the switch 46 is closed.

The operation of the mechanism just described is as follows: In starting the internal combustion engine the manually operated switch 56 is closed, so that current flows through the coil 55 to operate the switch 42 and thus to close the two electromagnet circuits at the contacts 54. Consequently the electromagnets 26 and 19 are energized, and the drum 12 is arrested by means of the brake 24 and at the same time uncoupled from the wheel 14. The switch 42 also closes the starting circuit of the dynamo electric machine at the contacts 41. The armature 4 begins to rotate and with it the pinion support 7 carried by the shaft 3. The pinion 9 rolls along the toothed rim 11 of the arrested drum 12, and the smaller pinion 10 revolving with the pinion 9 imparts to the wheel 14 and therefore to the shaft 18 a rotating movement of considerably reduced speed as compared with that of the shaft 3.

When the internal combustion engine starts, it accelerates the rotation of the armature 4. When a definite speed of rotation is exceeded the centrifugal force acting upon the flyweight 27 of the centrifugal switch overcomes the initial stress in the spring 29, the flyweight 27 is pressed onto the ring 31 and entrains the latter frictionally against the force of the spring 33. The contacts 32 and 34 are separated, so that the current in the coil 26 is interrupted and the brake released. The gearing then transmits no moment of rotation and the dynamo electric machine runs idle.

Thereupon the current flowing through the coil 55 is interrupted by opening the switch 56, and the switch 42 returns into the position indicated in Fig. 7. Consequently the starting circuit of the dynamo electric machine is interrupted, and the coil 19 is deenergized, so that the drum 12 is coupled to the wheel 24 by means of the disc 20 pressed thereagainst by the springs 22. As the toothed rims 11 and 13 are held against relative rotation, it is impossible for the pinions 9 and 10 to roll along them, so that the drum 12 and the wheel 14 and the shaft 18 must follow the pinion support 7 carried by the shaft 3 in its rotation, whereby the whole gearing forms a direct driving connection between the shafts 3 and 18.

The dynamo electric machine is now driven by the internal combustion engine and works as a generator as soon as the difference of potential between the terminal 45 and the ground 44 attains the necessary minimum value for closing the automatic switch 46. In its closing movement the latter opens the auxiliary switch 57 and thus prevents the electromagnet 55 from being switched in again. Hence, the energization of the clutch and the brake electromagnets, and, as a consequence, the arresting of the drum 12, and the disconnecting of the coupling between the shafts 3 and 18 is prevented when the dynamo electric machine works as a generator.

In the embodiment shown in the Figs. 8 and 9 the device for coupling the drum 12 to the wheel 14 is constructed in such a way as to cause the coupling of the said parts automatically when the coupling electromagnet 19 is energized. The latter then draws the armature plate 60 against the friction plate 61 which is rigidly connected to the wheel 14 so that it must follow the latter in its rotation. The armature plate 60 itself is splined to the drum 12 by means of splines 62 which engage grooves 63. In this disposition, the coupling electromagnet 19 should be energized and the brake electromagnet 26 should remain deenergized during the whole time of operation of the machine as a generator. Therefore, in this example the multi-pole switch 42 controls a separate pair of contacts for each of the electromagnet circuits, namely 64 for the coupling electro-

magnet 19, and 65 for the brake electromagnet 26. . For both said pairs of contacts the switch comprises only one contact bridge 66 so that when the contact 41 in the starting circuit is interrupted, the contact 64 for the coupling electromagnet is closed. In the opposed switch position the starting circuit and the circuit of the brake electromagnet are closed. Since the coupling electromagnet 19 must be energized during the current generating operation, a separate switch 67 is provided in its circuit for disconnecting it on stopping the internal combustion engine. Said switch 67 may be combined with the ignition switch of the internal combustion engine. With the exception of the parts which have been specifically described, the mechanism and the circuits shown and described in Figs. 8 and 9 correspond to those which have been described already in connection with Figs. 1 to 7.

The embodiments shown are given by way of example only, and it is to be understood that the basic concept of the invention may be carried out by other forms of mechanism within the scope of the claims.

What I claim is:

1. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, braking means adapted for arresting said gear member, coupling means adapted for coupling said gear member to one of said drive members, a toothed rim formed on one of the said three members, a toothed rim formed on another of the said three members, and toothed transmitting gear means in permanent engagement with both said toothed rims, said transmitting gear means being supported on the remaining one of the said three members.

2. Electric starting and current generating apparatus for internal combustion engines as claimed in claim 1 in which at least one of said teeth rims has internal toothing.

3. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, braking means adapted for arresting said gear member, coupling means adapted for coupling said gear member to one of said drive members, a toothed rim formed on one of the said three members, a toothed rim formed on another of the said three members, a pinion engaging one of the said toothed rims, a pinion engaging the other of said toothed rims, both said pinions being coaxial and angularly coupled to one another and rotatably supported on the remaining one of the said three members eccentrically to the common axis of the latter.

4. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a pinion supporting member connected in driving relation to said dynamo electric machine, an internally toothed gearwheel connected in driving relation to said internal combustion engine and coaxial with said pinion supporting member, an internally toothed rotatable member coaxial with said pinion supporting member and said gearwheel, braking means adapted for arresting said rotatable member, coupling means adapted for coupling said rotatable member to said gearwheel, a pinion engaging said gearwheel, a pinion engaging said rotatable member, both said pinions being angularly coupled to one another and rotatably supported on the said pinion supporting member eccentrically to the axis of the latter.

5. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, a coupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said coupling electromagnet is energized and to uncouple said gear member from said one drive member when said electromagnet is deenergized.

6. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said internal combustion engine, a drive member connected to said electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, a coupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said coupling electromagnet is energized and to uncouple said gear member from said one drive member when said coupling electromagnet is deenergized, a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and to release said gear member when said braking electromagnet is deenergized, a current source, a switching device, a coupling circuit comprising said current source, said coupling electromagnet and said switching device, a braking circuit comprising said current source, said braking electromagnet and said switching device, said switching device being arranged so, that in a first switch position, said braking circuit is closed and said coupling circuit is interrupted, and, that in a second switch position said coupling circuit is closed and said braking circuit is interrupted.

7. Electric starting and generating apparatus for internal combustion engines as claimed in claim 6 and comprising an electromagnet adapted for actuating said switching device.

8. Electric starting and generating apparatus for internal combustion engines as claimed in claim 6 and comprising a switching electromagnet adapted for actuating said switching device, a switching circuit including said switching electromagnet and said current source, and a manually operable switch in said switching circuit.

9. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function as a motor or as a generator, an armature winding in said dynamo electric ma-

chine, a starting field winding connected in series with said armature winding in said dynamo electric machine, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, a coupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said coupling electromagnet is energized and to uncouple said gear member from said one drive member when said coupling electromagnet is deenergized, a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and to release said gear member when said braking electromagnet is deenergized, a current source, a switching device, a starting circuit comprising said current source, said starting field winding, said armature winding and said switching device, a coupling circuit comprising said current source, said coupling electromagnet and said switching device, a braking circuit comprising said current source, said braking electromagnet and said switching device, said switching device being arranged so that in a first switch position said starting circuit and said braking circuit are closed and said coupling circuit is interrupted, and that in a second switch position said coupling circuit is closed and said starting circuit and said braking circuit are interrupted.

10. Electric starting and generating apparatus for internal combustion engines as claimed in claim 6 and comprising a switching electromagnet arranged in such a way that on being energized it moves said switching device into said first switch position, a switching circuit comprising said current source and said switching electromagnet, a relay responsive to the terminal voltage of said dynamo electric machine, said relay being interposed in said switching circuit and adapted to interrupt the latter when said voltage exceeds a predetermined value.

11. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, an armature winding in said dynamo electric machine, a starting field winding connected in series with said armature winding in said dynamo electric machine, an auxiliary field winding connected in parallel to said armature winding in said dynamo electric machine, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial to said other drive member, a gear member rotatable about the common axis of said two drive members, a coupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said coupling electromagnet is energized and to uncouple said gear member from said one drive member when said coupling electromagnet is deenergized; a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and for releasing said gear member when said braking electromagnet is deenergized, a battery, a switching device, a starting circuit comprising said battery, said starting field winding, said armature winding and said switching device, a coupling circuit comprising said battery, said coupling electromagnet and said switching device, a braking circuit comprising said battery, said braking electromagnet and said switching device, said switching device being arranged so that in a first switch position said starting circuit and said braking circuit are closed and said coupling circuit is interrupted, and that in a second switch position said coupling circuit is closed and said starting circuit and said braking circuit are interrupted, a switching electromagnet arranged in such a way that on being energized it moves said switching device into said first switch position, a relay responsive to the terminal voltage of said dynamo electric machine, a generating circuit comprising said armature winding, said battery and said relay, a switching circuit comprising said battery, said switching electromagnet and said relay, said relay being adapted to close the said generating circuit and to interrupt the said switch actuating circuit when the said terminal voltage exceeds a predetermined value.

12. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, an uncoupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said uncoupling electromagnet is deenergized and to uncouple said gear member from said one drive member when said uncoupling electromagnet is energized, a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and to release said gear member when said braking electromagnet is deenergized, a current source, a switching device, a braking circuit comprising said current source, said braking electromagnet and said switching device, an uncoupling circuit comprising said current source, said uncoupling electromagnet and said switching device, said switching device being adapted to close and to break simultaneously said uncoupling circuit and said braking circuit.

13. Electric starting and generating apparatus for internal combustion engines as claimed in claim 12 and comprising an electromagnet adapted for actuating said switching device.

14. Electric starting and generating apparatus for internal combustion engines as claimed in claim 12 and comprising a switching electromagnet adapted for actuating said switching device, a switching circuit including said switching electromagnet and said current source, and a manually operable switch in said switching circuit.

15. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, an armature winding in said dynamo electric machine, a starting field winding connected in series with said armature winding in said dynamo electric machine, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial to said other drive member, a gear member rotatable about the common axis of said two drive members, an uncoupling electromagnet, coupling means arranged so as to couple said gear member to one of said

drive members when said uncoupling electromagnet is not energized and to uncouple said gear member from said one drive member when said uncoupling electromagnet is energized, a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and to release said gear member when said braking electromagnet is deenergized, a current source, a switching device, a starting circuit comprising said current source, said starting field winding, said armature winding, and said switching device, an uncoupling circuit comprising said current source, and uncoupling electromagnet and said switching device, a braking circuit comprising said current source, said braking electromagnet and said switching device, said switching device being adapted to close or to break simultaneously said starting circuit, said uncoupling circuit and said braking circuit.

16. Electric starting and generating apparatus for internal combustion engines as claimed in claim 12 and comprising a switch actuating electromagnet arranged in such a way that on being energized it moves said switching device into its position where said uncoupling circuit and said braking circuit are interrupted, a switching circuit comprising said current source and said switching electromagnet, a relay responsive to the terminal voltage of said dynamo electric machine, said relay being interposed in said switching circuit and adapted to interrupt the latter when said voltage exceeds a predetermined value.

17. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, an armature winding in said dynamo electric machine, a starting field winding connected in series with said armature winding in said dynamo electric machine, an auxiliary field winding connected in parallel to said armature winding in said dynamo electric machine, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, an uncoupling electromagnet, coupling means arranged so as to couple said gear member to one of said drive members when said uncoupling electromagnet is deenergized and to uncouple said gear member from said one drive member when said uncoupling electromagnet is energized, a braking electromagnet, braking means arranged so as to arrest said gear member when said braking electromagnet is energized and for releasing said gear member when said braking electromagnet is deenergized, a battery, a switching device, a starting circuit comprising said battery, said starting field winding, said armature winding and said switching device, an uncoupling circuit comprising said battery, said uncoupling electromagnet and said switching device, a braking circuit comprising said battery, said braking electromagnet and said switching device, said switching device being adapted to close or break simultaneously said starting circuit, said uncoupling circuit and said braking circuit, a switching electromagnet arranged in such a way that on being energized it moves said switching device into its position where said uncoupling circuit and said braking circuit are interrupted, a relay responsive to the terminal voltage of said dynamo electric machine, a current generating circuit comprising said armature winding, said battery and said relay, said relay being adapted to close the said current generating circuit and to interrupt the said switch actuating circuit when the said terminal voltage exceeds a predetermined value.

18. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator; a drive member connected to said internal combustion engine; a drive member connected to said dynamo electric machine and arranged substantially coaxially with said other drive member; a gear member rotatable about the common axis of said two drive members; a braking electromagnet; braking means arranged so as to arrest said gear member when said braking electromagnet is energized and to release said gear member when said braking electromagnet is deenergized; a current source; a circuit breaker responsive to the speed of rotation of said electric machine; a braking circuit comprising said current source, said braking electromagnet and said circuit breaker, the latter being constructed so as to break said braking circuit when said dynamo electric machine exceeds a definite speed of rotation.

19. Electric starting and generating apparatus as claimed in claim 5 in which said coupling electromagnet is formed as a stationary coil.

20. Electric starting and generating apparatus for internal combustion engines comprising in combination a dynamo electric machine adapted to function either as a motor or as a generator, a drive member connected to said internal combustion engine, a drive member connected to said dynamo electric machine and substantially coaxial with said other drive member, a gear member rotatable about the common axis of said two drive members, an electromagnetically controlled clutch adapted for coupling said gear member to one of said drive members; electromagnetically controlled braking means adapted for arresting said gear member; a current source; a switching device; a clutch controlling circuit comprising said current source, said electromagnetically controlled clutch, and said switching device; a brake controlling circuit comprising said current source, said electromagnetically controlled braking means, and said switching device, said switching device being arranged in such a way that in a first switch position the said clutch controlling circuit and the said brake controlling circuit are switched for the braking means to arrest said gear member and the clutch to uncouple said gear member from said one drive member, and that in a second switch position the said circuits are switched for the braking means to release said gear member and the clutch to couple said gear member to said one drive member.

ERNST SCHAEREN.

CERTIFICATE OF CORRECTION.

Patent No. 2,151,487. March 21, 1939.

ERNST SCHAEREN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 14, for the word "generating" read forming a part of; and second column, line 34, for "wheel 24" read wheel 14; page 3, first column, line 48, claim 2, for "teeth rims has internal toothing" read "toothed rims has internal teeth; same page, second column, line 34, claim 6, after "said" insert dynamo; line 74, claim 9, after "function" insert either; page 5, first column, line 2, claim 15, for "not energized" read deenergized; line 14, same claim, for "and" before "uncoupling" read said; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of May, A. D. 1939.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.