No. 842,627. PATENTED JAN. 29, 1907.

C. J. COLEMAN.

STARTING MEANS FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED SEPT. 17, 1903.

3 SHEETS—SHEET 1.

Fig. 1

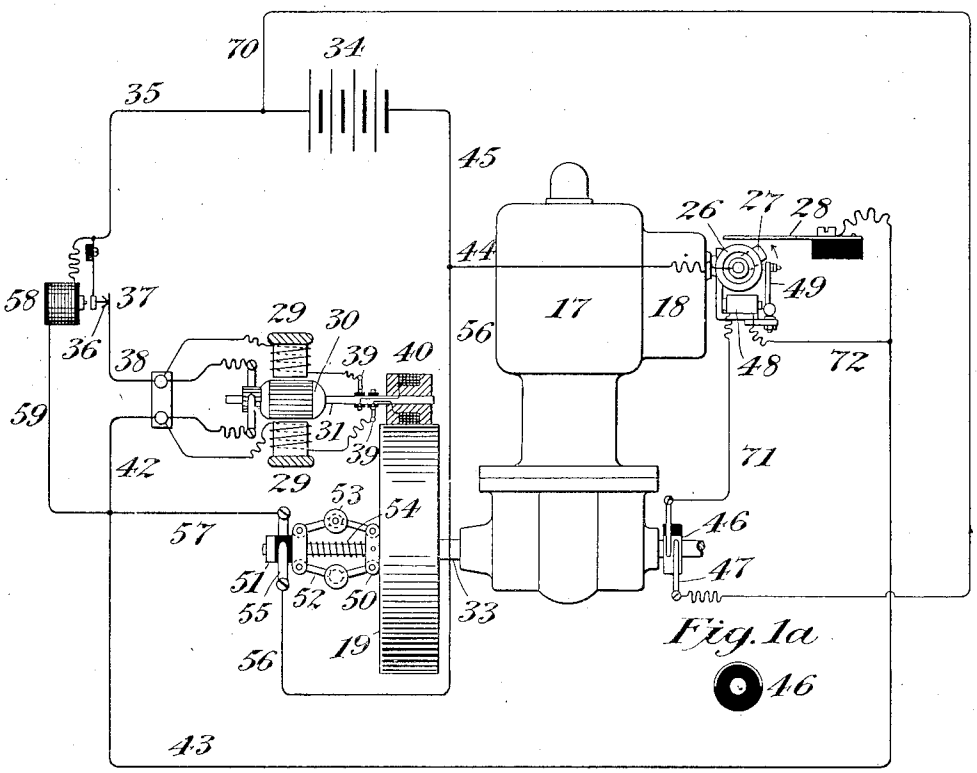


Fig. 1a

Fig. 3

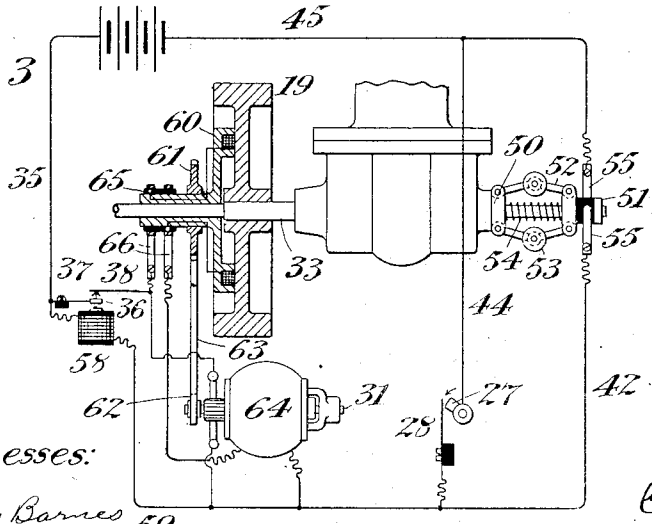
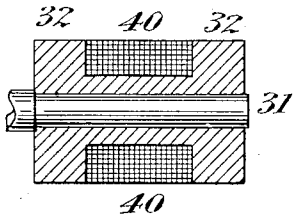


Fig. 2



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3 SHEETS—SHEET 2.

Fig. 4

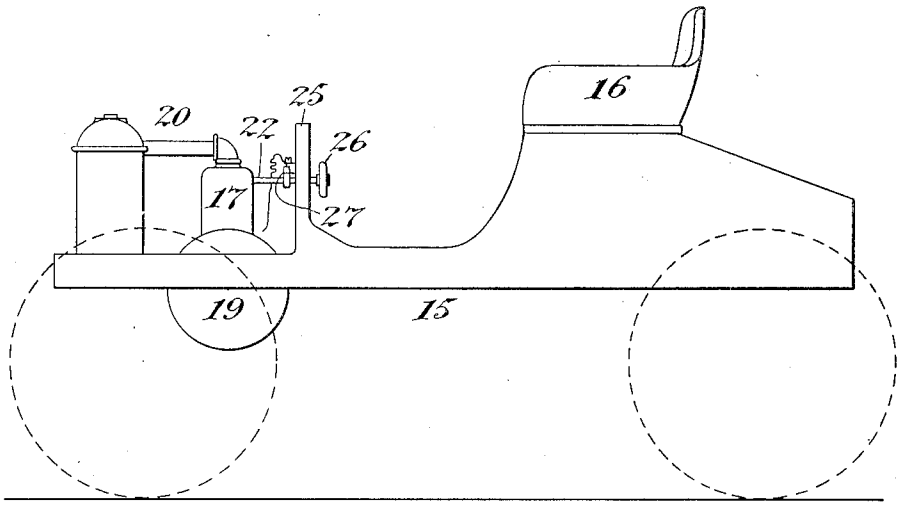


Fig. 5

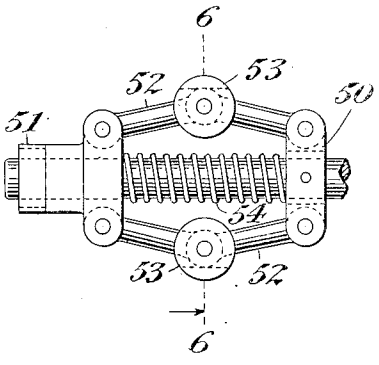


Fig. 6

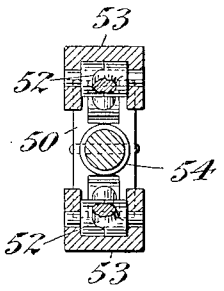
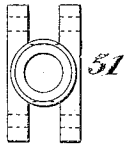


Fig. 7



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3 SHEETS—SHEET 3.

Fig. 8

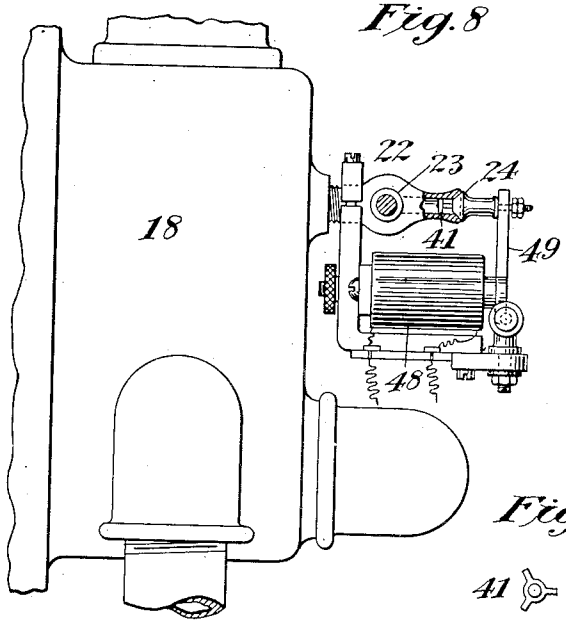

Fig. 9

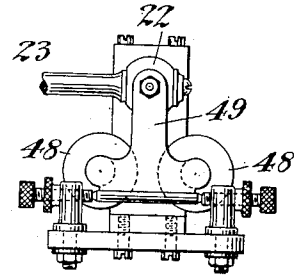

Fig. 10

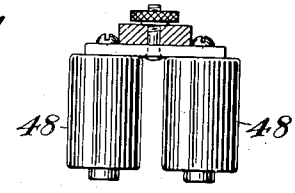

Fig. 11

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UNITED STATES PATENT OFFICE.

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STARTING MEANS FOR INTERNAL-COMBUSTION ENGINES.

No. 842,627. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed September 17, 1903. Serial No. 173,497.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Starting Means for Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to starting means for internal-combustion engines or engines which are not self-starting and which require the application of external force to initiate their operation, and has for its objects simplicity of construction, reliability and economy of operation, and simplicity and ease of control.

According to my invention a magnetic clutch is provided connecting the engine with a self-starting motor and acting as a connecting means to drive the engine from the motor in the starting operation.

According to my invention the motor is also a power charging or storing means and is driven by the engine by means of the magnetic clutch-driving connection when the engine is self-actuated at a desired charging or power-storing speed.

According to my invention a magnetic friction-clutch is provided for effecting such driving connection, and the combined frictional and magnetic grip are utilized to effect the driving connection.

According to my invention relief-controlling means are provided, controlled by the moving parts of the engine, so as to close a relief-vent during the charging stroke of the engine to compel the engine to draw in a proper charge and to open the relief-vent during the compression-stroke to relieve the work of compression and to close the relief-vent during the combustion or explosive stroke to permit of a full utilization of the force of the combustion or explosion of the residual charge.

According to my invention the relief-controlling means also includes a relief-closure adapted for manual operation, and a single controlling means is provided for the starting and relief controlling means.

My invention includes various improvements in the construction and combination of parts. I will now describe the means embodying my invention illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a diagrammatic view of the circuits and apparatus embodying my invention. Fig. 1ª is an end view of the circuit making and breaking collar on the engine-shaft. Fig. 2 is a longitudinal central section of the magnetic friction-clutch. Fig. 3 is a diagrammatic view of a modified construction. Fig. 4 is a side elevation of a motor-vehicle or automobile provided with means embodying my invention. Fig. 5 is a side elevation of the circuit-controlling governor. Fig. 6 is a vertical section of the governor on the line 6 6, Fig. 5. Fig. 7 is a detail end elevation of the sliding collar of the governor. Fig. 8 is a detail side elevation showing the relief-controlling means in place upon the valve-chest of the engine. Fig. 9 is a detail end elevation of the relief-controlling means. Fig. 10 is a detail plan of the controlling-electromagnet. Fig. 11 is a detail of the spider-guide for the controlling-valve stem.

The motor-vehicle shown in Fig. 4 comprises a body 15, having a seat 16 and dash-board 25. The vehicle is driven by an engine which is indicated as of the ordinary four-cycle explosive type and which is located at the front of the vehicle, where it is readily accessible for inspection, control, and repair. The engine is shown only in outline and has a cylinder 17, valve-chest 18, and fly-wheel 19 and receives its supply of explosive medium through the supply-pipe 20 from a carbureter. (Not shown.) Suitable means are provided (not shown) for opening and closing the connection of the engine with the source of explosive medium.

With an engine which performs the work of compressing its charge it is desirable that during the starting operation the engine shall be to a large extent relieved of the work of compression, and this I provide by relief-controlling means, which also control the starting means. This relief-controlling means comprises a relief-cock 22 upon the valve-chest 18 of the engine and adapted to be manually operated and an automatic controlling-valve 24, which is electrically controlled in the construction shown in the drawings. The stem 23 of the relief-cock 22 is extended rearwardly through the dash-board 25 of the vehicle and has an operating-

wheel 26 located in rear of the dashboard and in convenient position for manipulation by the operator of the vehicle. The stem 22 also carries a circuit-closing projection 27, which coöperates with a contact-spring 28 to close the power-circuit for the starting means.

The starting means comprise an electrodynamic machine adapted to act both as a motor and dynamo, having field-magnets 29 and an armature 30 and carryin gon its driving-shaft 31 a magnetic clutch or power connecting and disconnecting means, which in the construction shown in the principal views of the drawings is a magnetic friction-clutch. This clutch comprises a rotating electromagnet having circular end pole-pieces 32 32 and a middle portion or core of reduced diameter, upon which the exciting-coils 40 are wound. This magnetic clutch is secured upon the driving-shaft 31 of the electrodynamic machine and is rotated in frictional contact with the fly-wheel 19 of the engine. When the coils of this clutch are excited, the magnetic circuit is closed through the fly-wheel of the engine and the combined frictional and magnetic contact therewith causes the clutch to tightly grip the fly-wheel and enables the rotation of the driving-shaft 31 of the electrodynamic machine to be imparted to the main shaft 33 of the engine, the desired reduction of speed resulting from the small diameter of the clutch relative to the fly-wheel.

The energizing-current for the electrodynamic machine is supplied from a storage battery 34, and the circuit for the motor-current is closed at the contacts 27 28 by the actuation of the operating hand-wheel 26 of the relief-cock, and flows as follows: from battery 34 by wire 35, contacts 36 37, and wire 38, and then in one path through the field-coils of the electrodynamic machine, the brushes 39 and collecting-rings and the coils 40 of the magnetic friction-clutch and in another path through the commutator and armature of the electrodynamic machine, these paths uniting in the wire 42 and flowing through wires 42 43, contact 28, circuit-closing projection 27, and wires 44 and 45 back to battery. A powerful current will flow through this circuit and will energize the electrodynamic machine and cause it to operate as a motor and will energize the magnetic friction-clutch and cause it to grip the fly-wheel, and the relief-cock having been opened by the movement which closed this motor-circuit the engine will be started by the power of the motor. As the engine is thus driven it will open and close the controlling-circuit of the relief-valve by means of the circuit opening and closing collar 46 on the engine-shaft, this circuit-controlling collar coöperating with the brushes 47 to close and open the controlling-circuit, and thereby to cause the controlling-valve to be closed during the charging stroke of the engine, so that the engine will draw in the proper mixture through the carbureter, and to be opened during the compression-stroke, so as to materially relieve the engine from the work of compression, and to be closed during the explosive stroke of the engine, so as to permit of the full utilization of the explosion of the residual charge, and again to be opened during the scavenging stroke, and so on. This circuit-controlling collar 46 is shown in elevation in Fig. 1ª and has a conductive plate, which makes contact at the desired phases of the movement of the engine. The controlling electromagnet 48 controls an armature-lever 49, which engages with the stem of the valve 24 and actuates the valve. The valve-stem is guided at its inner end in the spider 41. When the electromagnet is energized to attract its armature, the valve is closed, and when the electromagnet is deënergized the valve may freely open to relieve compression.

The circuit for energizing the controlling-electromagnet 48 flows from the battery 34 through wire 70, from one brush 47 to the other through the conductive plate of the collar 46, and through wire 71, electromagnet 48, wires 72 43, contacts 28 27, and wires 44 45 back to battery.

When the engine has acquired sufficient power and momentum, the operator closes the relief-cock 22, and thereby opens the motor and relief-controlling circuits at the contacts 27 28. Independently of this manual control, however, a charging-circuit is closed through the electrodynamic machine when the engine has attained a sufficient speed to properly actuate the electrodynamic machine as a dynamo to charge the storage battery by means of a circuit-controlling governor actuated by the engine and shown as located upon the main shaft 33 of the engine. This governor comprises a collar 50, fixed on the shaft 33, a sleeve or sliding collar 51, fitted to slide longitudinally on the shaft 33, pivoted weight-carrying arms 52, weights 53, carried by these arms, and a compression-spring 54 between the fixed collar 50 and the sliding collar 51. The sliding collar has an insulated portion and a conducting-ring thereon, and fixed brushes 55 are so arranged that when the engine is at rest and until the predetermined charging speed is attained these brushes are in contact with the insulated portion, but upon the attainment of the predetermined speed the sliding collar 51 is moved toward the fixed collar 50, so that the conductive ring is in contact with the brushes 55 and a charging-circuit is closed which flows from the armature of the electrodynamic machine through wire 38, contacts 37 36, wire 35, battery 34, wires 45 56 from one brush 55 to the other through the conductive ring of the sliding

collar 51, and wires 57 42 back to the armature of the electrodynamic machine. The field-coils of the electrodynamic machine and the coils of the magnetic friction-clutch are in series with each other and in multiple with the storage battery with respect to current generated in the armature. Another branch in multiple with the battery is from the wire 35 through the coils of a controlling-relay 58 and wire 59 to the junction of wires 42 and 57. The resistance and attractive power of this controlling-relay are so adjusted that when the storage battery has received its maximum charge the current flowing through the relay in multiple with the charging-current of an electrodynamic machine will cause the armature of this relay to be attracted, thereby opening the charging-circuit at the contacts 36 37 and arresting the charging operation.

In the modified construction shown in Fig. 3 the magnetic clutch is of the ordinary magnetic clutch construction with an iron-clad electromagnet 60 on a sleeve 65, fitted to rotate loosely on the main shaft 33 of the engine and connected with the driving-shaft 31 of the electrodynamic machine 64 by a sprocket-wheel 61 on such sleeve, a sprocket-pinion 62 on the shaft of the electrodynamic machine and a chain 63, running over such sprocket-wheel and pinion.

The controlling-circuits in this modified construction are substantially the same as those heretofore described, the current-collecting rings for the clutch being upon the sleeve 65 of the clutch and coöperating with brushes 66 66 and interposed in the field-coil multiple circuit of the electrodynamic machine in advance of the connection with the field-coils.

It is obvious that various modifications may be made in the constructions shown and above particularly described within the spirit and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a non-starting engine, a self-starting motor and a magnetic clutch connecting the engine and motor.

2. The combination of a non-starting engine, a self-starting motor and a magnetic friction-clutch connecting the engine and motor.

3. The combination of an engine, an electrodynamic machine and a magnetic clutch connecting the engine and electrodynamic machine.

4. The combination of an engine, an electrodynamic machine and a magnetic friction-clutch connecting the engine and electrodynamic machine.

5. The combination of an internal-combustion engine, an electromotor and an electromagnetic clutch connecting the engine and electromotor.

6. The combination of an internal-combustion engine, an electromotor and an electromagnetic friction-clutch connecting the engine and electromotor.

7. The combination of a non-starting engine having a rotating wheel thereon, a self-starting motor, and an electromagnetic friction-clutch having circular pole-pieces fitted to rotate in peripheral contact with the rotating wheel of the engine.

8. The combination of a non-starting engine, an electromotor having field and armature coils connected in multiple, and an electromagnetic clutch connecting the engine and motor and having energizing-coils connected in series with the field-coils of the electromotor.

9. The combination of a non-starting engine having a rotating wheel thereon, an electromotor having field and armature coils connected in multiple, a magnetic friction-clutch having circular pole-pieces fitted to rotate in peripheral contact with the rotating wheel of the engine and having energizing-coils connected in series with the field-coils of the electromotor.

10. The combination of an internal-combustion engine, an electrodynamic machine, connecting means for the engine and electrodynamic machine, electrically-controlled means connecting the engine and electrodynamic machine, electric power and storing means, means for connecting the power and storing means and the electrodynamic machine for the starting operation and speed-controlled means actuated by the engine and including other means for connecting the electric power and storing means and the electrodynamic machine, such other connecting means being operative at a speed adapted for charging the power and storing means.

11. The combination of an internal-combustion engine, an electrodynamic machine, connecting means for the engine and electrodynamic machine electric power and storing means, means for connecting the power and storing means and the electrodynamic machine, speed-controlled means actuated by the engine and including other means for connecting the electric power and storing means and the electrodynamic machine such other connecting means being operative at a speed adapted for charging the power and storing means, and automatic controlling means controlled by the condition of the power and storing means for interrupting the charging-circuit.

12. The combination of an internal-combustion engine, an electrodynamic machine, connecting means for the engine and electrodynamic machine including an electromagnetic friction-clutch having circular pole-pieces fitted to rotate in peripheral contact with a rotating part of the engine, means for connecting the power and storing means and

the electrodynamic machine for the starting operation, means controlled by the speed of the engine for connecting the electrodynamic machine and the power and storing means for the charging operation, such means being operatable at a speed adapted for the power and storing means.

In testimony whereof I have affixed my signature in presence of two witnesses.

CLYDE J. COLEMAN.

Witnesses:
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