March 22, 1932. F. A. ATTWOOD 1,850,650

ELECTRIC CHARGING PLANT

Filed Aug. 11, 1930

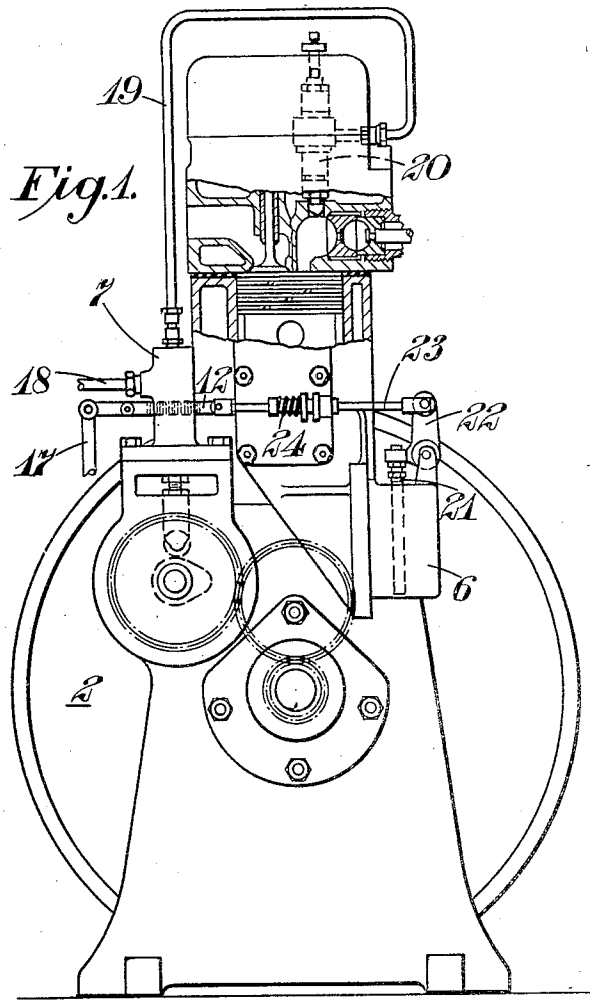


Fig. 1.

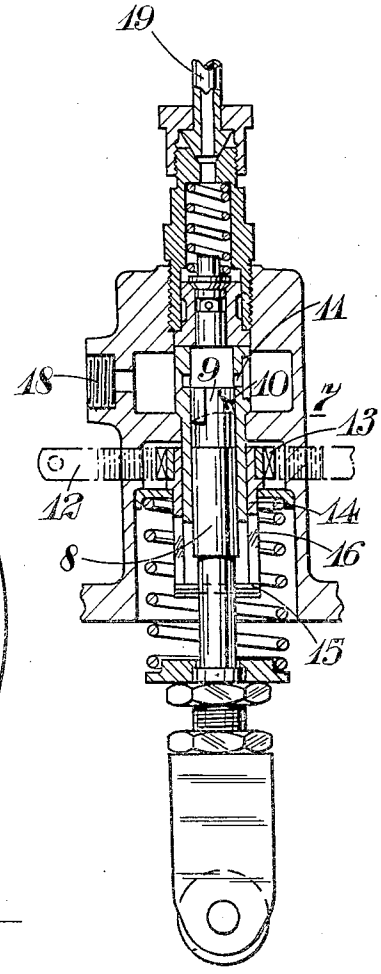


Fig. 2.

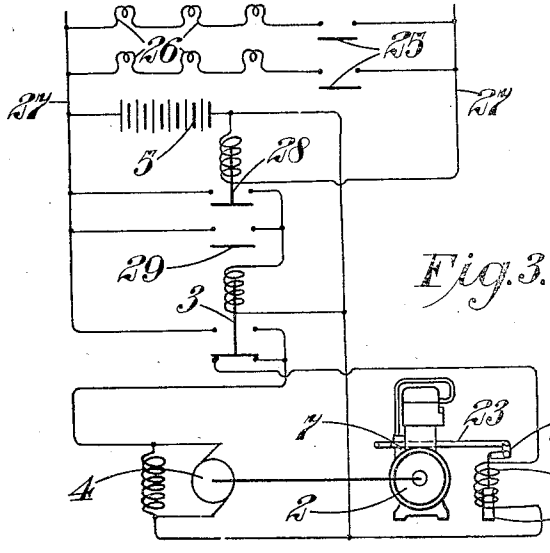


Fig. 3.

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Patented Mar. 22, 1932

1,850,650

UNITED STATES PATENT OFFICE

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ELECTRIC CHARGING PLANT

Application filed August 11, 1930, Serial No. 474,624, and in Great Britain April 2, 1930.

This invention relates to electric charging plants in which the prime-mover is an internal-combustion engine, preferably a compression-ignition engine.

Its chief object is to provide an improved arrangement whereby the engine will be automatically stopped as soon as the generator is disconnected from the battery.

A further object is to ensure that the fuel supply will be discontinued whilst the speed of the engine is falling and only restored when the engine becomes stationary or practically so.

According to the invention, an electro-magnetic device has its winding automatically connected across the generator on the disconnection of the generator from the battery, and this device is responsive to a relatively wide voltage range to close or render ineffective a fuel supply means adapted to return to the open or operative position on the de-energization of the electro-magnetic device. By this arrangement no current is taken from the battery to operate the stopping devices.

In the accompanying drawings,

Figure 1 is a part-sectional elevation of a compression-ignition engine embodying the invention,

Figure 2 is a sectional view of the fuel pump to a larger scale, and

Figure 3 is a diagram of connections.

Like numerals indicate like parts throughout the drawings.

In the construction illustrated, as applied to an electric charging plant in which the prime-mover is a compression-ignition engine 2, the main generator switch is a two-way switch 3 adapted in one position to interconnect the generator 4 and the battery 5 and in the other (as shown) to disconnect the battery from the generator and to short-circuit the latter by the winding of an electro-magnetic device 6. This device is arranged to operate in any suitable way to cut off the fuel supply to the engine. (For example, the fuel supply may be blanked at the pump by means connected with this device, but there are various ways of cutting off the fuel supply). In consequence, the speed of the engine falls off and the voltage of the generator falls correspondingly. The electro-magnetic device 6, however, is one that is adapted to respond to a relatively wide range of voltage, so that it remains in the operated position until the engine is practically stationary. At this point, when the generated voltage becomes a predetermined minimum, the device re-sets, thus again placing the fuel supply means in connection with the engine, but the engine by this time has stopped or is running too slowly to pick up.

In one arrangement for cutting off the fuel supply, as illustrated, the fuel pump 7 is of the kind having a rotatable plunger 8 with a cut-away portion 9 which has a helical or inclined edge 10. This cut-away portion 9 co-acts with the port 11 to determine the end of the pumping stroke. The plunger 8 is rotatable by means of the rack 12 engaging the pinion 13 on the sleeve 14 which has a sliding connection through the pin 15 and slot 16 with the plunger 8. The rack may be actuated axially by means of the engine governor (not shown) through the connection 17. Thus, in one extreme position of the rack, namely, to the left, the fuel delivery is a maximum, the fuel being taken in by the inlet pipe 18 and delivered along the pipe 19 to the injection nozzle 20 in the combustion chamber. In the other extreme position there is no delivery of fuel at all.

In the present instance, the electro-responsive device 6 is shown in Figure 1 supported on the side of the engine, with its armature 21 disposed below one arm of the bell-crank 22, the other arm of which is connected by the link 23 to the rack. When the device is energized, whilst the engine is slowing up, the armature 21 rises and rotates the bell-crank 22 clockwise, thus operating the rack to the right to a position in which the pump is blanked and ineffective to supply fuel to the engine. On the de-energization of the device the armature re-sets and the rack moves across to the left under the bias of the return spring 24, thus again placing the pump 7 in a condition to supply fuel as soon as the engine is re-started.

Figure 3 shows switches 25, 25 for controlling the loads 26, 26 connected across the

supply wires 27, 27, one of these wires being taken to the battery through the winding of a load-responsive switch 28. This switch controls the circuit for the winding of the main generator switch 3 as shown. The manual switch 29 is also provided in parallel with the switch 28 for allowing independent control of the main generator switch.

It will be seen that by the present invention the charging plant is automatically shut down as soon as the generator is disconnected from the charging circuit. This can be automatically effected in a well-known manner on the cessation of the battery load by the connections shown, or when the load falls below a minimum value. Furthermore, during the slowing up of the engine no fuel is being drawn into the engine but when the engine finally comes to rest the fuel supply is restored so that all will be in readiness for the subsequent re-starting of the engine. Moreover, no current is taken from the battery for these operations, the current used being supplied by the generator as it slows down.

Any form of starting device may be used. A suitable form of automatic starting device is described in the specification of my copending patent application No. 474,624.

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

1. In combination, an internal-combustion engine, an electric generator connected to be driven thereby, a load circuit arranged to be supplied by said generator, electro-responsive means for cutting off the fuel supply to said engine, and load-responsive means for disconnecting said generator from said circuit when the load is below a predetermined value and connecting said generator to said electro-responsive means.

2. In combination, an internal-combustion engine, a generator coupled therewith, electric storage means, an electrically-controlled device for cutting off the fuel supply to said engine, and means for selectively connecting said storage means and said device to said generator in predetermined conditions.

3. In combination with a Diesel-electric charging plant for a battery connected to a load circuit, electro-responsive means for rendering said Diesel inactive, and load-responsive means for controlling the energization of said electro-responsive means, said energization being effected from said generator while the same is slowing down independently of said battery.

4. In combination, an internal-combustion engine, a fuel supply means therefor, an electrical generator mechanically coupled to said engine, a battery, a load circuit adapted to be connected to said battery, electro-magnetic means for connecting said generator to said battery when said load circuit is closed and disconnecting the same when said load circuit is open, and electro-responsive means which is connected across the generator by said electro-magnetic means when said generator is disconnected from said battery, said electro-responsive means being adapted on energization to control the fuel supply to said engine.

5. The combination with an electric battery-charging plant driven from an internal-combustion engine having a fuel supply means, of an electrically-controlled device adapted for cutting off the fuel supply to said engine, means for selectively connecting to said generator, in predetermined conditions, either said battery or said device, said device being adapted to respond to a relatively wide voltage range extending from normal generator voltage down to quite a low voltage.

In testimony whereof I affix my signature.

FRANK ALBERT ATTWOOD.