

June 27, 1944.

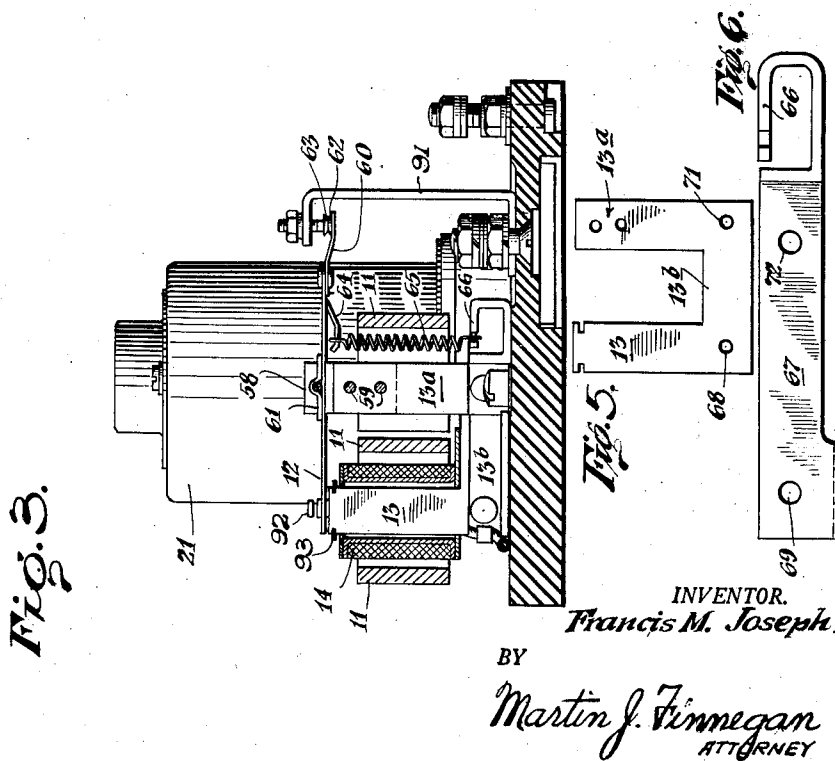
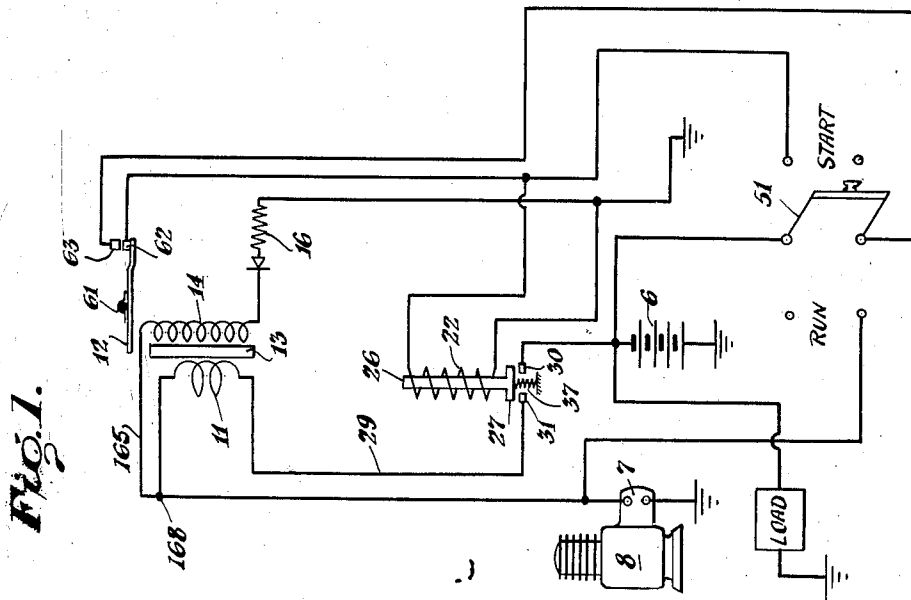
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2,352,550

POWER PLANT

Filed Jan. 22, 1943

3 Sheets-Sheet 1



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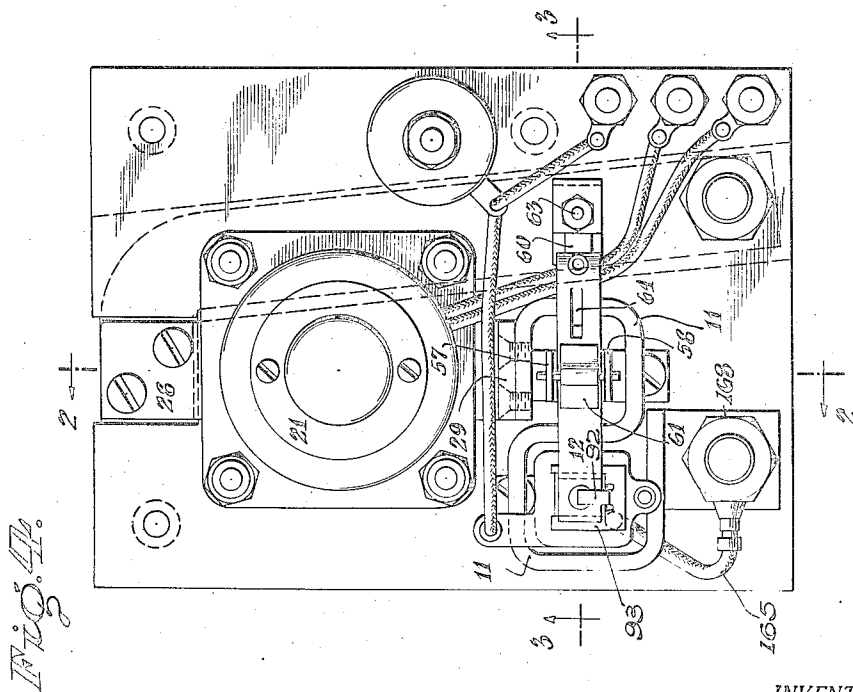
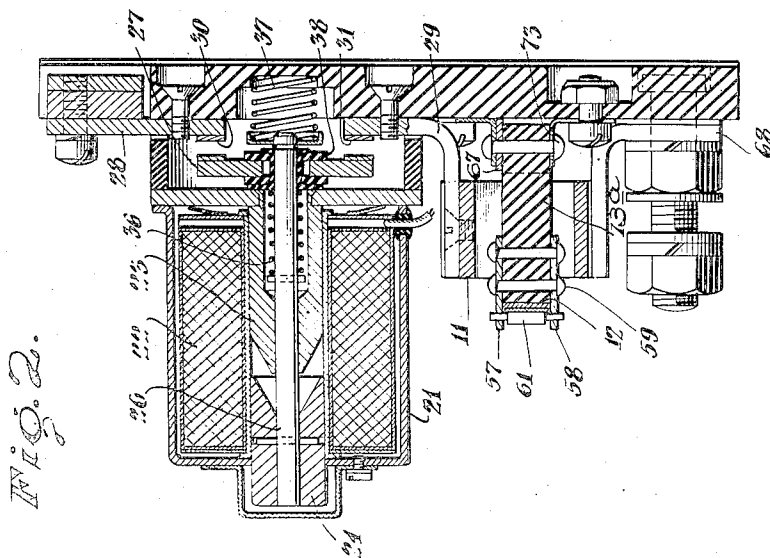
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3 Sheets-Sheet 2



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Fig. 7.

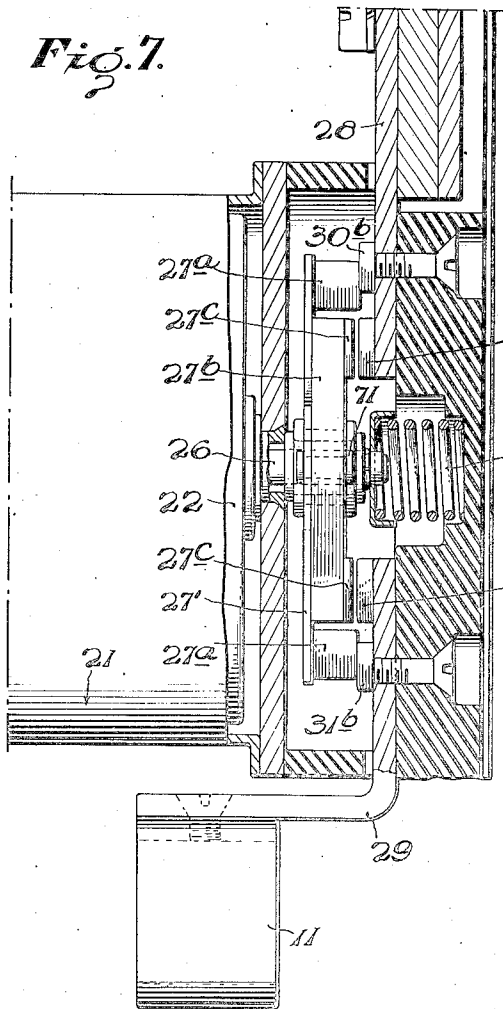


Fig. 8.

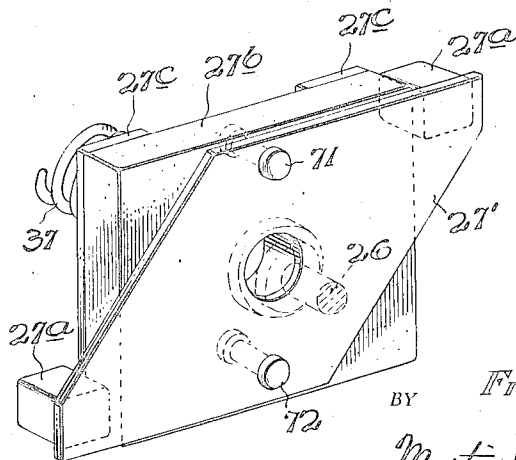
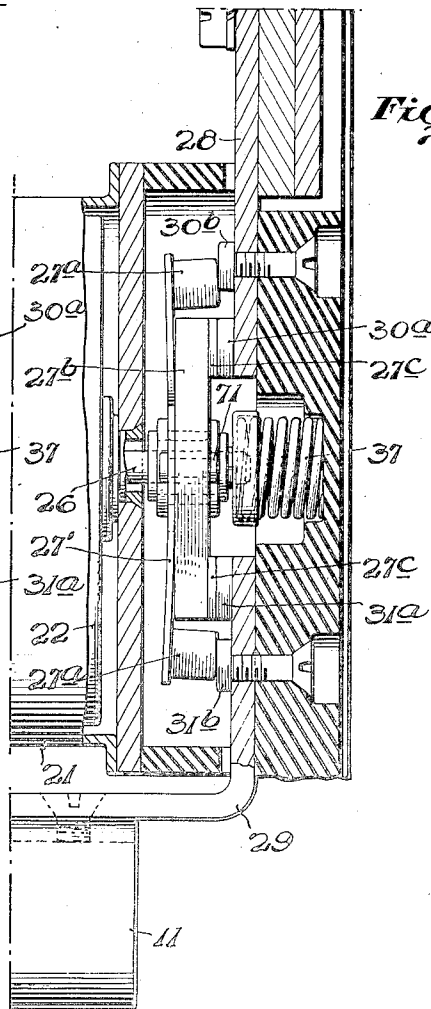


Fig. 9.

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POWER PLANT

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a corporation of Delaware

Application January 22, 1943, Serial No. 473,240

1 Claim. (Cl. 290—31)

This invention relates to power plants, and particularly to power plants of the electrically started type.

An object of the invention is to provide a novel electrical control of the starting of, and subsequent generation of electrical energy by, an internal combustion engine or equivalent power unit which requires the application of externally derived energy for starting.

Another object is to provide electrical control units of novel construction for use in a system of the character indicated.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawings wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had to the appended claim for this purpose.

In the drawings:

Fig. 1 is a diagrammatic view of the system;

Fig. 2 is a sectional view along line 2—2 of Fig. 4;

Fig. 3 is a sectional view along line 3—3 of Fig. 4;

Fig. 4 is a view in elevation of the control panel, with the two electromagnetic control units mounted thereon;

Figs. 5 and 6 show details; and

Figs. 7, 8 and 9 show an alternative sub-assembly.

One of the two electromagnet controls units just referred to is a solenoid type switch and the other is a reverse current relay, in which the series winding 11 is in the form of a strip of conducting metal (e. g. copper) so bent as to become, in effect, a coil of two turns, acting on the iron circuit of the relay to create a magnetic pull upon the armature 12 tending to draw said armature 12 against the upper end of the powdered metal core 13 when current passes through the said looped strip 11 in one direction, and acting oppositely when current passes oppositely. The other winding 14 on the core 13 is the usual shunt winding, but a rectifier 16 is inserted in series therewith in order to protect the circuit against possible damage due to reversal of generator polarity.

The solenoid switch includes a shell 21, a coil 22, a fixed pole-piece 23, a movable pole-piece 24, and a plunger 26 secured to pole-piece 24 and carrying a conducting plate 27 movable to bridge

conductors 28 and 29. Each of these fixed conductors has a silver alloy contact material (30, 31) to provide low millivolt drop and non-welding characteristics.

When the solenoid coil 22 is energized, the plunger pulls to the right, closing the contacts. The plunger continues to the right until member 24 reaches member 23, and this additional travel compresses the spring 36, thus providing contact maintaining pressure. This assures a constant contact pressure independently of the pull of the plunger. When the coil is de-energized the plunger is driven back by spring 37, and a shoulder 38 on the plunger assembly strikes the bridge plate 27. This combined lost-motion and striking action produces a very rapid break, and reduces the arcing tendency, as well as further minimizing the possibility of "welding" of the contacts.

When the toggle switch 51 is thrown to the "start" position the coil 22 is energized, permitting current to flow from the battery 6 to the generator 7, motorizing this unit and thus starting the engine 8. With the switch in the "run" position, current flows from the generator and charges the battery. When the engine is shut down, the potential of the generator will drop below that of the battery, permitting current to flow back through the series coil 11. This reversal of line current will oppose the action of the shunt coil 14, whereupon spring 65 becomes effective to move armature 12 in a clock-wise direction, thus moving contact 62 away from contact 63. Separation of contacts 62 and 63 breaks the circuit of the coil 22 of the main solenoid, and the line is thus opened at the contact plate 27.

In Figs. 7, 8 and 9 I show a switch assembly having certain important advantages in the matter of absorption of the electrical shock of initial closure and initial breaking of the circuit; the assembly of Figs. 7, 8 and 9 being alternative to the switch assembly 27, 30 and 31 of Figs. 2, 3 and 4. In this alternative form the solenoid plunger carries two plates (27' and 27b) riveted together (as at 11, 12) one of which plates has oblique sides and carries square contact blocks 27a, 27a, at its outer corners. The other plate, shown at 27b, has rectangular contact blocks 27c, 27c, adapted to engage stationary contacts 30a and 31a, but only after contact blocks 27a, 27a, have engaged stationary contacts 30b and 31b; the contacts 30a and 30b being integral parts of terminal strip 28 and the contacts 31a and 31b being integral parts of terminal strip 29.

Due to the fact that the "arcing" tips 27a, 27a extend beyond the rectangular contact blocks 27c, 27c, the former make contact with stationary blocks 30b, 31b before blocks 27c 27c can touch the stationary blocks 30a, 31a; the differential spacing being best shown in Fig. 7. Having reached this Fig. 7 position, the contacts 27c, 27c continue to the right (under the continuing pull of the energized magnetic field, and against the yielding opposition of spring 37) until they reach their circuit closing position (Fig. 8). During this final stage of the movement the relatively thin, resilient plate 27' is flexed, as shown in Fig. 8, as the outer ends are prevented from going forward by the obstructing action of contacts 30b, 31b.

When the flow of current to coil 22 is interrupted, spring 37 moves the contact blocks 27c, 27c from contacts 30a, 31a before contacts 27a, 27a leave the blocks 30b, 31b; the latter being held in engagement by the resiliency of plate 27' until the blocks 27c, 27c are safely clear of the contacts 30a, 31a. Hence the electrical shock of disengagement, like the electrical shock of initial closure, is taken by the "arcing" tips 27a, 27a. It follows that "arcing" tips 27a, 27a take substantially, all the wear, and therefore the main contacts 27c, 27c, 30a, and 31a will remain in excellent condition for a much longer period than would otherwise be possible.

The spring anchoring plate 67 is shown in Fig. 6 on a scale that is double the scale of Fig. 5. In Fig. 5 is shown the U-shaped core 13, 13a, 13b of the relay 11-14; the said U-shaped core being of compressed powdered metal of approximately 47 per cent ferro-nickel composition. Holes 68 and 71 of the core align with holes 69 and 72 of the spring anchoring plate, and receive rivets 73 (Fig. 2) to hold said plate and core to angle brackets clamped to the supporting frame.

The spring anchoring plate 67 includes a

hooked portion 66 which is apertured to receive the lower hooked end of the coiled spring 65, and the upper hooked end of the coiled spring 65 is hung upon a tongue 64 struck down from the armature 12, as shown in Figs. 3 and 4; the tongue 64 being intermediate the hinge plate 61 and the flexible arm 60 which bears the contact tip 62. The pin of the hinge assembly is journaled in plates 57, 58 riveted to opposite sides of core section 13a, as shown at 59 in Figs. 2 and 3.

Contact 63, adjustable in bracket 91, limits the swing of armature 12 and contact arm 60 in one direction, and stop 92 (Figs. 3 and 4) limits the swing in the other direction; the stop 92 having an integral base 93 that is held in a notched portion of the core section 13, as shown in Fig. 3.

What is claimed is:

In combination with an engine, a dynamo-electric machine mounted thereon, a storage battery and a hand switch controlling the flow of energy between the battery and dynamo-electric machine, a reverse current relay including a winding in series relation to said battery and machine, and means responsive to movement of said hand switch to the "start" position to cause current to flow from said storage battery to said dynamo-electric machine, by way of said relay winding, to rotate said dynamo-electric machine and thereby cause initial rotation of the engine, and means responsive to movement of said hand switch to the "run" position to cause current generated in said dynamo-electric machine to be delivered to said storage battery, to re-charge said battery, said last-named means including contacts that are closed by the magnetic action resulting from reversal of the direction of current flow in said relay winding, which reversal in turn occurs when the engine driven dynamo-electric machine develops voltage in excess of battery voltage.

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