

Aug. 8, 1944.

G. C. DEVOL ET AL

2,355,208

MOTOR-GENERATOR

Filed July 5, 1943

6 Sheets-Sheet 1

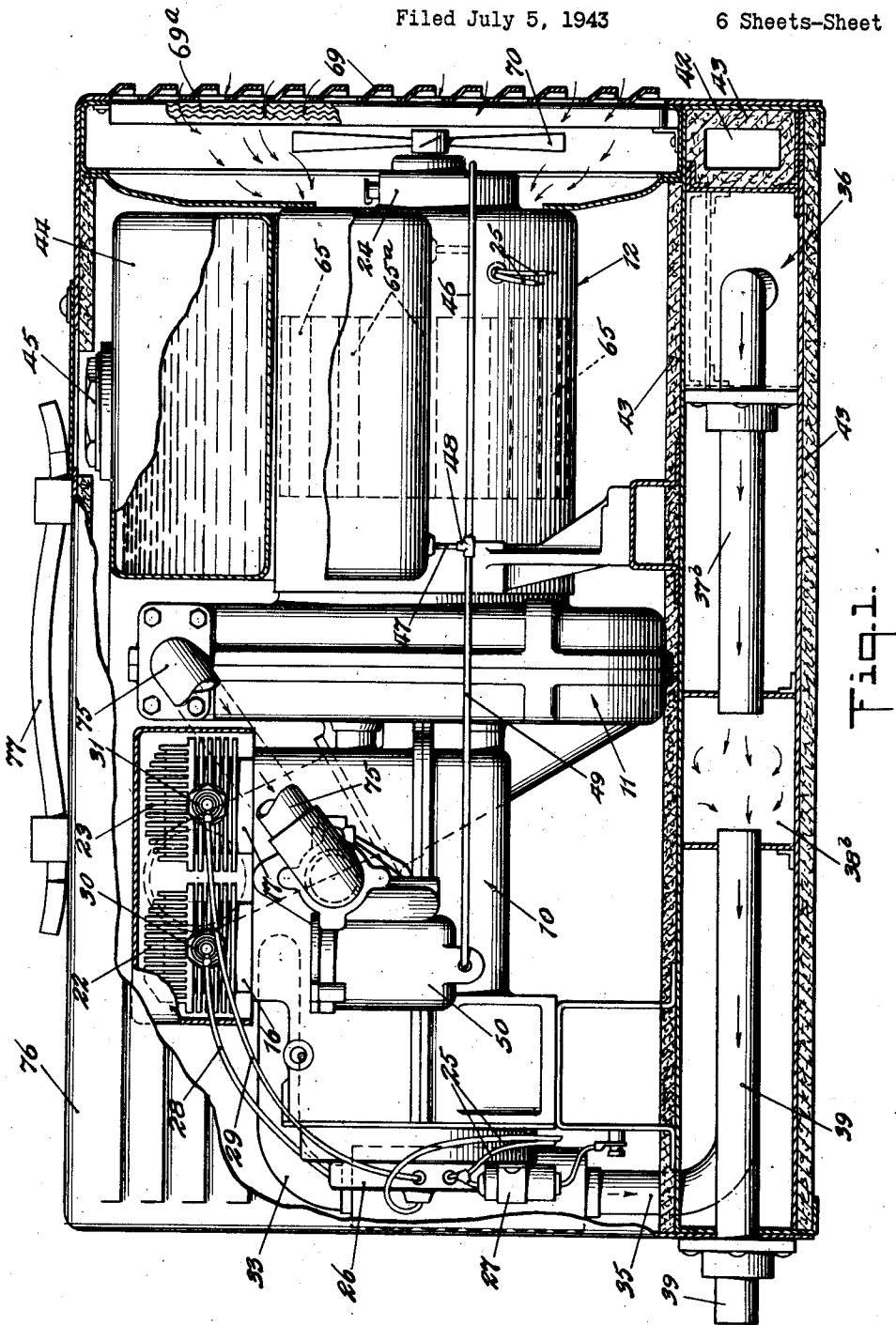


Fig. 1.

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6 Sheets-Sheet 2

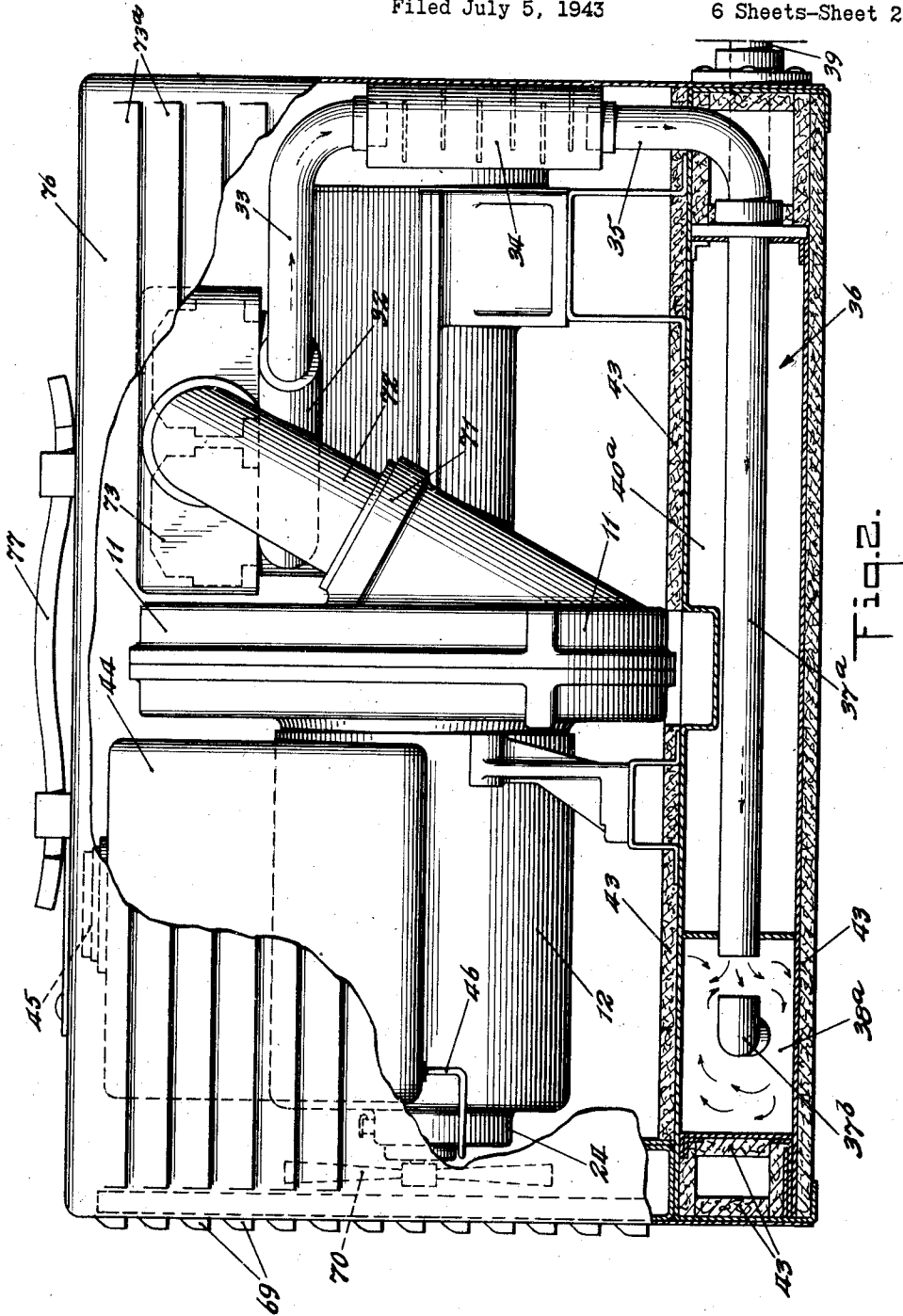


FIG. 2.

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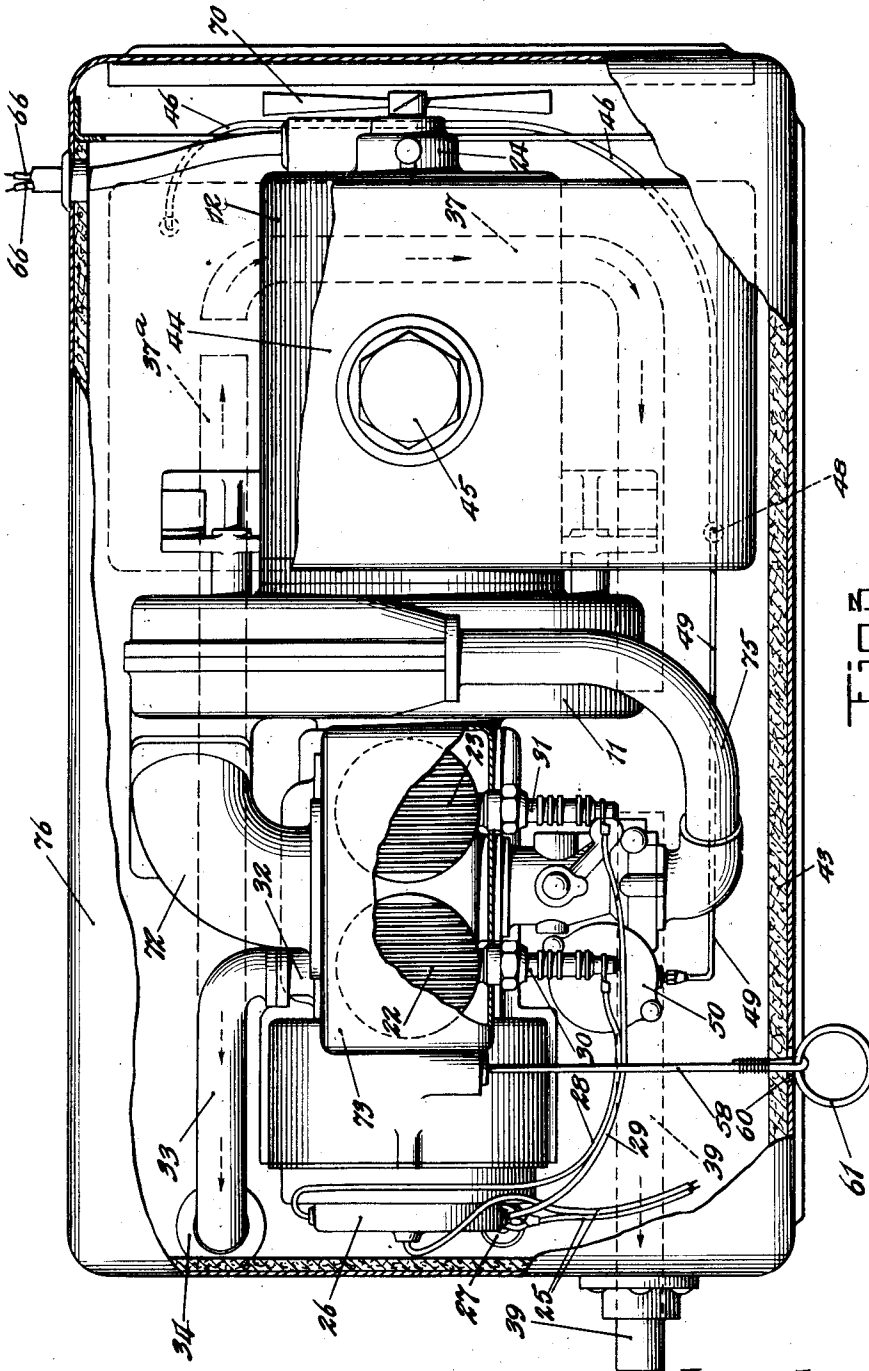
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6 Sheets-Sheet 4

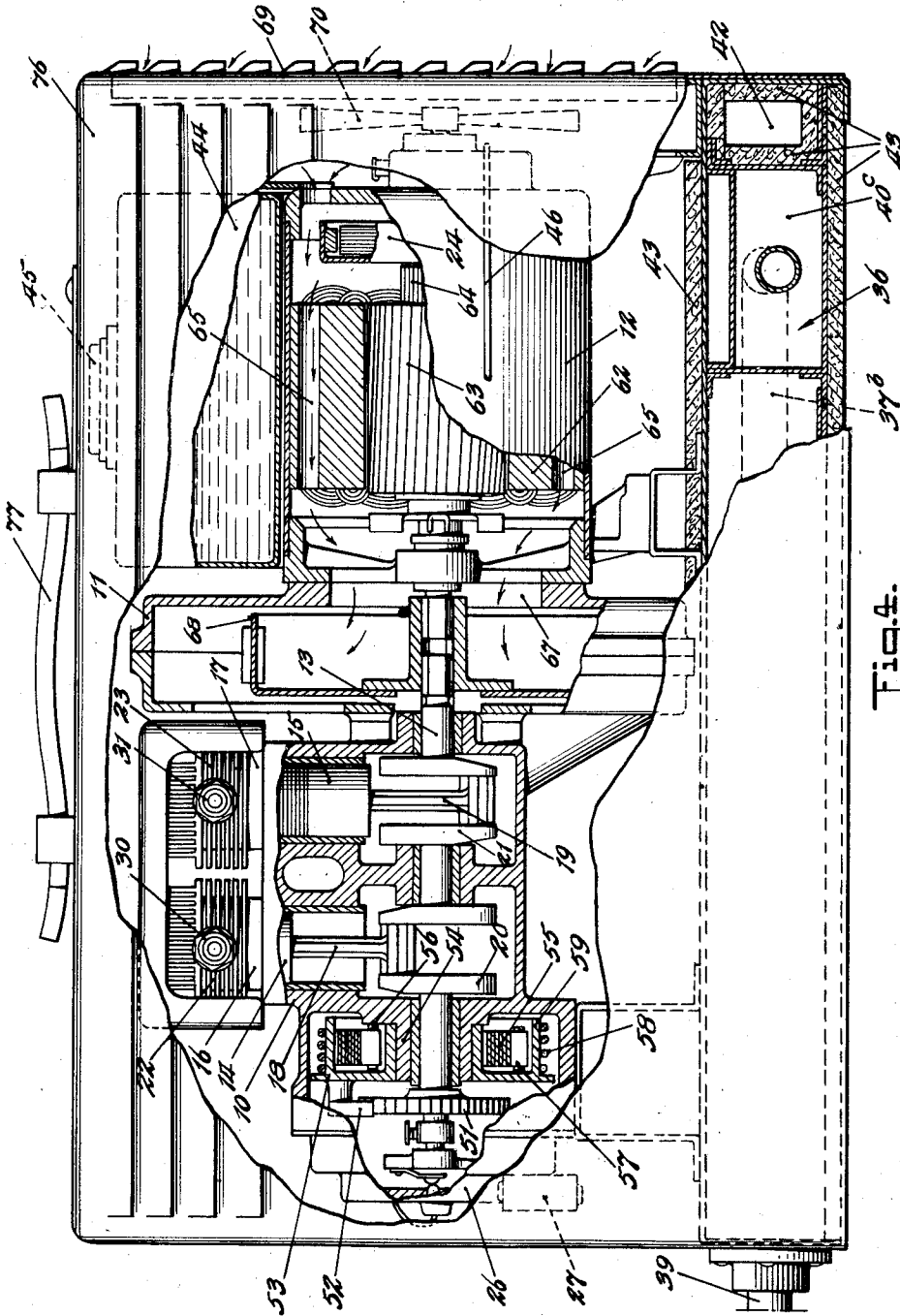


FIG. 4.

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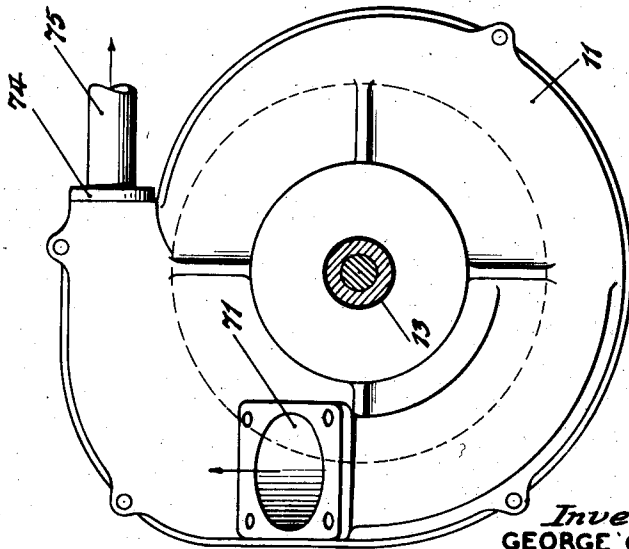
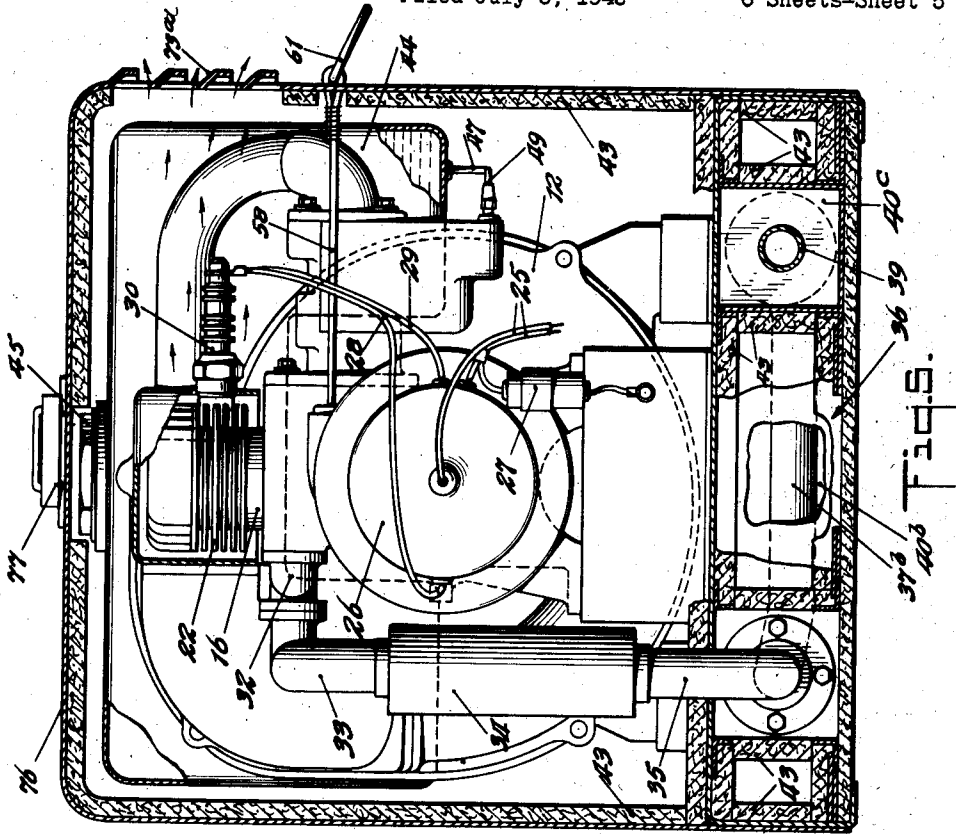
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6 Sheets-Sheet 5



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6 Sheets-Sheet 6

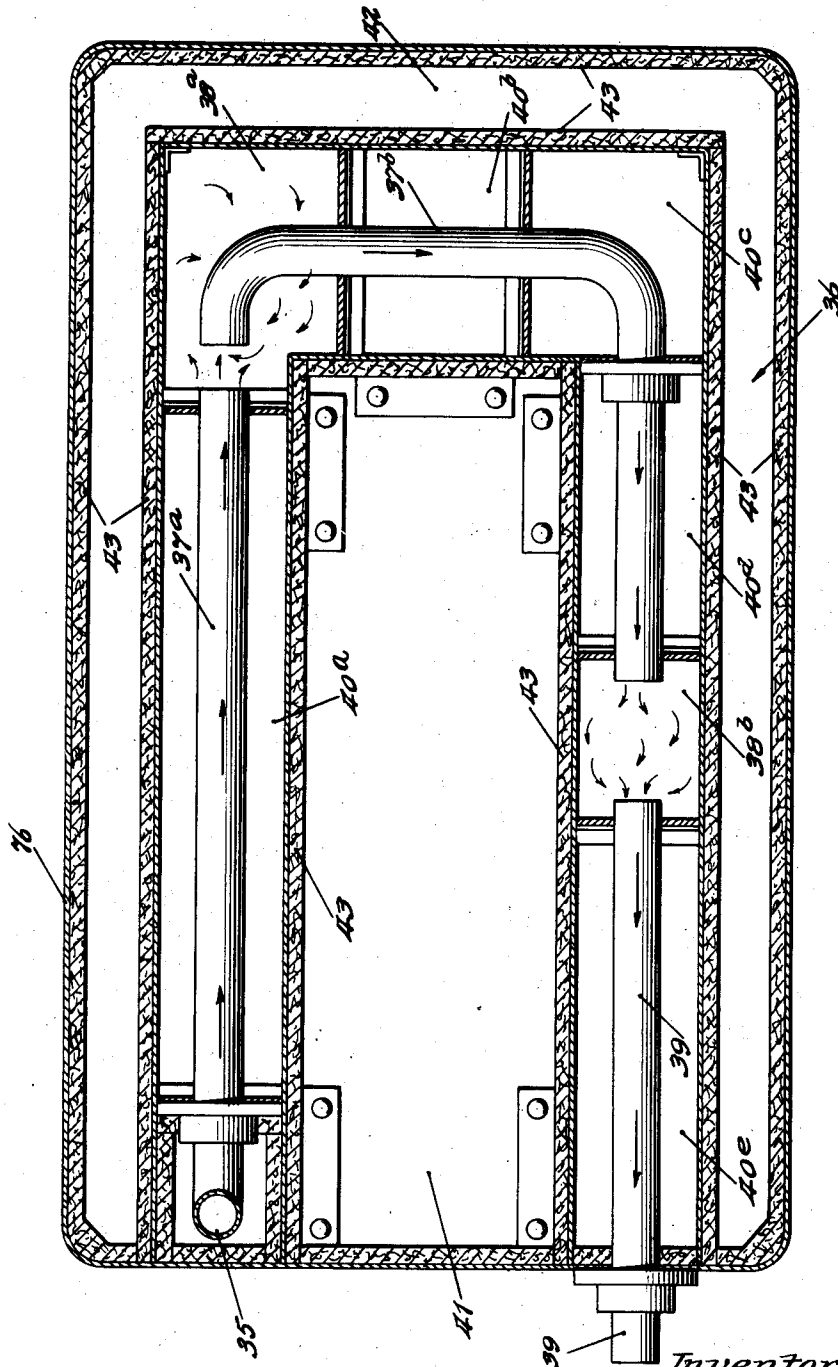


Fig. 2.

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UNITED STATES PATENT OFFICE

2,355,208

MOTOR-GENERATOR

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Application July 5, 1943, Serial No. 493,496

4 Claims. (Cl. 290—1)

Our invention relates to a motor-generator, and more particularly a portable motor-generator of high capacity. The invention is especially useful in connection with a portable power unit to be carried into the field, to which use, however, it is not limited.

One object of the invention is to provide a small power unit which may be easily carried into distant, difficultly-accessible locations. Another object is the provision of such a unit which will generate a maximum of electrical energy for its weight and size. A further object is the construction of such a light powerful unit in compact, easily handled form. Other objects and advantages of this invention will be obvious from the present specification considered in connection with the accompanying drawings, wherein—

Figure 1 is a side elevation of a motor-generator constructed in accordance with the invention, certain parts being cut away to show the interior of the unit;

Fig. 2 is a similar elevation showing the opposite side of the apparatus illustrated in Figure 1;

Fig. 3 is a top plan view of the same apparatus, with certain parts cut away to show details of the interior construction and arrangement;

Fig. 4 is a side elevation similar to Figure 1, with certain additional parts cut away or in section to show the internal construction of certain parts which Figure 1 illustrates in elevation;

Fig. 5 is a view of the same apparatus as seen from the left in Figure 1, certain parts being cut away or in section to show the internal construction of the apparatus;

Fig. 6 is an elevation of the supercharger unit, viewed from the left as seen in Figure 1; and

Fig. 7 is a horizontal sectional view of the muffler unit as seen from above.

In many situations it is desirable to carry a generator of electrical energy to points to which wires cannot or may not reach and which are inaccessible to power propelled vehicles or beasts of burden. If a man is to carry such a generator, it is highly desirable to conserve his energy and promote his mobility by making the generator as light and as easily handled as possible. It is also desirable to produce the maximum of electrical energy for a given weight of portable apparatus. We have accordingly departed from the usual battery-operated apparatus and have invented a new and useful combination of internal combustion motor, supercharger or blower and generator for producing electrical energy.

In the embodiment of the invention which is illustrated in the drawings, there is shown a mo-

tor or internal combustion engine 10, a supercharger 11, and a generator of electrical energy 12, all carried by the same frame and all mounted upon the same shaft 13. Thus the generator and blower act as a flywheel for the motor. Obviously these three elements do not necessarily operate upon the same shaft, but their relative speeds may be varied by providing separate shafts and by using gears or belts or the like for connecting the elements. Furthermore, these machines need not be positioned in the sequence shown in the drawings.

The motor 10 is here shown as a two cycle, two cylinder internal combustion engine, having pistons 14 and 15 reciprocating in cylinders 16 and 17 respectively, and connected by piston rods 18 and 19 respectively to cranks 20 and 21 on the shaft 13. The cylinder 16 is air-cooled by a plurality of cooling elements or fins 22, and the cylinder 17 is air cooled by a plurality of cooling elements or fins 23, in well-known manner.

Ignition is provided for the engine 10 by a magneto 24, which is connected by leads 25, 25 to a distributor 26; and a condenser 27 is included in the combination in the usual manner. Leads 28, 29 connect the distributor 26 to spark plugs 30 and 31, in the cylinders 16 and 17 respectively.

The cylinders 16 and 17 exhaust into a manifold 32, whence an exhaust pipe 33 carries the exhaust to a silencer, here shown as a Maxim silencer 34. A second pipe 35 carries the exhaust gases from the silencer to a muffler 36 which underlies the entire mechanism. The muffler comprises a series of open-ended tubes 37a, 37b which exhaust into chambers 38a, 38b. These chambers are designed to cushion the pulses of exhausted gas from the entering end of the preceding tube. Pressure built up in the chambers 38a and 38b is relieved by open-ended tubes leading away from the chambers. In the construction illustrated, the tube 37b leads the exhaust gases away from the chamber 38a and into the chamber 38b; and a final exhaust tube 39 leads the gases away from the chamber 38b and out of the apparatus.

Thus, the pulses of exhaust gases, which already have passed through the silencer 34, are cushioned a plurality of times in the muffler 36, and finally leave the apparatus in a comparatively steady stream without noise. This is exceedingly important in cases where it is necessary not to disclose the position or presence of the man using the apparatus.

As an additional precaution, the tubes 37a, 37b

and 39 are supported in dead air spaces 40a, 40b, 40c, 40d and 40e. Additional dead air spaces 41 and 42 are provided about the supporting frames. Finally sound-deadening material 43 surrounds the supporting frames and the dead air spaces.

Fuel is supplied to the motor 10 from a saddle-shaped fuel tank 44 overlying the generator 12. An internally threaded opening in the top of the tank 44, closed by a threaded plug 45 provides means for filling and closing the fuel tank. Fuel is withdrawn from the tank 44 by means of a pipe 46 connected to the bottom of the saddle-shaped tank on one side thereof, and a nipple 47 connected to the bottom of the tank at the other side thereof. The pipe 46 and the nipple 47 are connected by a T 48 to a feed pipe 49. The feed pipe 49 is connected to the carbureter 50 of the motor 10, which it supplies with fuel.

The motor 10 may be started very simply somewhat as an outboard motor is started, although any other convenient means may be employed. As here shown, a ratchet wheel 51 is fixed to the shaft 13, and a coacting pawl 52 is carried by a bushing 53 rotatable concentrically with the shaft 13 about a part 54 of the bearing which carries the shaft. (See Fig. 4.) A spiral spring 55 is wound about the bushing 53 and has one end attached to the part 54 as at 56, and the other end attached to the bushing 53 as at 57. A lanyard 58 is wound about a cylindrical flange 59 formed on the bushing 53 concentrically therewith and outside of the spring 55. The lanyard 58 has one end fastened to the bushing 53 in a manner not shown, and extends through an opening 60 in the apparatus to a terminal ring 61 to which its other end is attached. The opening 60 is of such size that the ring 61 may not pass therethrough. The spring 55 acts to wind the lanyard 58 about the cylindrical flange 59 and to keep the lanyard in tension between the bushing 53 and the part of the apparatus in which the opening 60 is formed.

Thus a pull upon the ring 61 turns the bushing 53 about the part 54 against action of the spring 55. At the same time the pawl 52 engages a tooth on the periphery of the ratchet wheel 51 and turns the ratchet wheel together with the shaft 13 and the parts attached thereto. The motor is thus started. Upon releasing the ring 61, the spring 55 immediately turns the bushing 53 back to its original position thereby drawing the ring 61 against the casing of the apparatus adjacent the opening 60. At the same time, in well known manner, the pawl 52 is disengaged from the ratchet wheel 51.

The generator 12 comprises an electromagnet 62 within which rotates an armature 63, fixed to the shaft 13. In the embodiment illustrated, the armature rotates at the same speed as the motor 10, being coupled directly to the shaft of the motor. Commutator bars 64 are indicated at the end of the armature farthest from the motor, the complete apparatus being too well known to those skilled in the art to require full illustration of the energy collecting means in the drawings.

Longitudinal passages 65 are provided in the electromagnet 62 to permit passage of cooling air therethrough. Similar passages 65a may be provided in the armature. All such passages extend completely through the parts in which they are formed in the direction of the armature axis. Leads 66, 66 are indicated whereby energy pro-

duced by the generator 12 may be carried to the point of use.

The supercharger 11 comprises a centrifugal blower which draws air through a passage or intake opening 67 into its interior where a fan 68 throws the air outwardly of the blower in the manner of such fans, circulating the same clockwise when the blower is viewed as in Fig. 6. Obviously other types of supercharger may be substituted for the particular type here illustrated and described.

The air drawn through the passage 67 enters the apparatus through louvers 69 formed in the casing of the apparatus beyond the generator 12. Air filter material 69a may be provided inside the louvers 69 for excluding foreign matter in the air. This air is drawn by the supercharger 11 through the generator, which it cools. Thus, connection of the passage 67 in the supercharger to the passages 65 and 65a, provides a cooling connection between the generator and the supercharger. Most of the air passes through the passages 65 and 65a but some of it may pass through the clearance between the pole pieces 62 and the armature 63. A booster fan 70 mounted on the outer end of the shaft 13 beyond the generator 12 assists in moving the air through the louvers 69, the filter material 69a and the generator.

The supercharger discharges air through two outlet openings as best seen in Fig. 6. Most of the air is discharged through a flanged opening 71 into a large conduit or pipe 72 which is connected with a hood 73 surrounding the cooling flanges 22 and 23 of the motor cylinders 16 and 17. A column of air thus passes over these flanges and carries heat away from the cylinders in an air stream which passes through the casing of the apparatus and out of louvers 73a formed in the side of the casing. Thus the large pipe 72 constitutes a cooling connection between the supercharger and the motor.

The second opening 74 of the supercharger 11 has fitted therein one end of a small conduit or pipe 75 which is connected at its other end to the carbureter 50 of the motor to which it supplies air under pressure in the usual way. The pipe 75 thus provides a supercharging connection between the supercharger and the motor. The motor 10 is thus supercharged, or more properly "scavenged" (since a two cycle motor is shown) by the supercharger 11.

The apparatus is compact and easily handled. The entire apparatus is here shown as inclosed in a portable casing 76, with a carrying handle 77 attached thereto. The motor is preferably a high speed motor which operates the generator at high speed, and the supercharger facilitates operation of the whole, not only by cooling the generator and the motor, but by supercharging or scavenging the motor, whereby the latter may be operated at very high speeds.

Because such apparatus is designed for military or emergency use, economy and durability are not required of it. The apparatus is expected to wear out after a short time and be replaced by another such unit. Accordingly, speeds and loads which would normally be prohibitive are permissible with this apparatus.

Finally, as indicated above, the apparatus is noiseless and can be operated secretly. Being a portable, independent power unit, it is adapted for use in isolated localities. Accordingly, the motor-generator can be carried by individual men, or in non-powered units as gliders, sail

boats, tow boats, bicycles, dog sleds and the like.

The form of the invention here described and illustrated in the accompanying drawings is presented merely by way of illustration. Other forms and applications of the invention will readily suggest themselves to those dealing with such problems, which do not depart from the invention or the proper scope of the appended claims.

We claim:

1. Portable apparatus for generating electric impulses comprising a casing having air intake and air outlet openings therein; a generator having air passages therethrough mounted in said casing; and an air-cooled motor for operating said generator mounted in said casing; in combination with a supercharger for drawing air through the passages in said generator and supplying cooling air and supercharging air to said motor operatively associated with said generator and said motor in said casing; and a silencer and muffler connected in series in said casing into which said motor exhausts.

2. Portable apparatus for generating electric impulses comprising a casing having air intake and air outlet openings therein; a generator of electric impulses, having air passages through its pole-pieces, mounted in said casing; and an air-cooled motor mounted in said casing for operating said generator; in combination with a supercharger for drawing air through the pole-pieces of said generator and supplying cooling air and supercharging air to said motor, operatively associated with said motor and said generator in said casing; and a silencer and muffler in series in said casing into which said motor exhausts.

3. Portable apparatus for generating electric impulses comprising a casing having air intake and air outlet openings therein; a generator of electric impulses, having air passages through its

pole-pieces and through its armature, mounted in said casing; and an air-cooled motor mounted in said casing for operating said generator; in combination with a supercharger for drawing air through the passages in said generator and supplying cooling air and supercharging air to said motor, operatively associated with said motor and said generator in said casing; and a silencer and muffler in series in said casing into which said motor exhausts.

4. A self-contained, portable, silent apparatus for generating electric impulses, said apparatus comprising a casing, an air-cooled motor in said casing, a shaft for said motor, a generator mounted on said shaft in said casing and acting as a flywheel for said motor, said generator having air passages through its poles and its armature extending in the direction of the armature axis, louvers in said casing adjacent said generator for admitting air to said casing, an air filter associated with louvers for excluding foreign matter in the air, and exit louvers in said casing adjacent said motor for permitting egress of air from said casing, in combination with a supercharger mounted on said shaft between said generator and said motor having its intake connected to the passages in said generator, said supercharger having a large outlet and a small outlet, a conduit connecting the large outlet of said supercharger to a point adjacent the cooling elements of said motor, a second conduit connecting the small outlet of said supercharger to the carbureter of said motor, a silencer in said casing into which said motor exhausts, a multi-chamber muffler in said casing into which said silencer exhausts, and a covering of sound-deadening material surrounding said muffler, substantially as described.

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