

Nov. 22, 1960

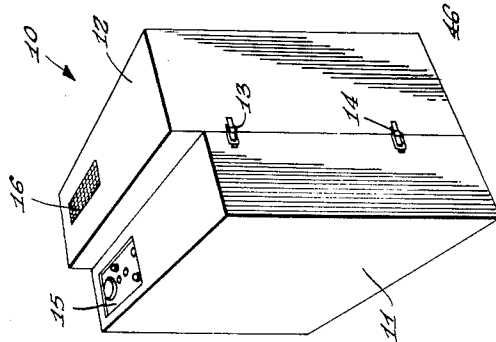
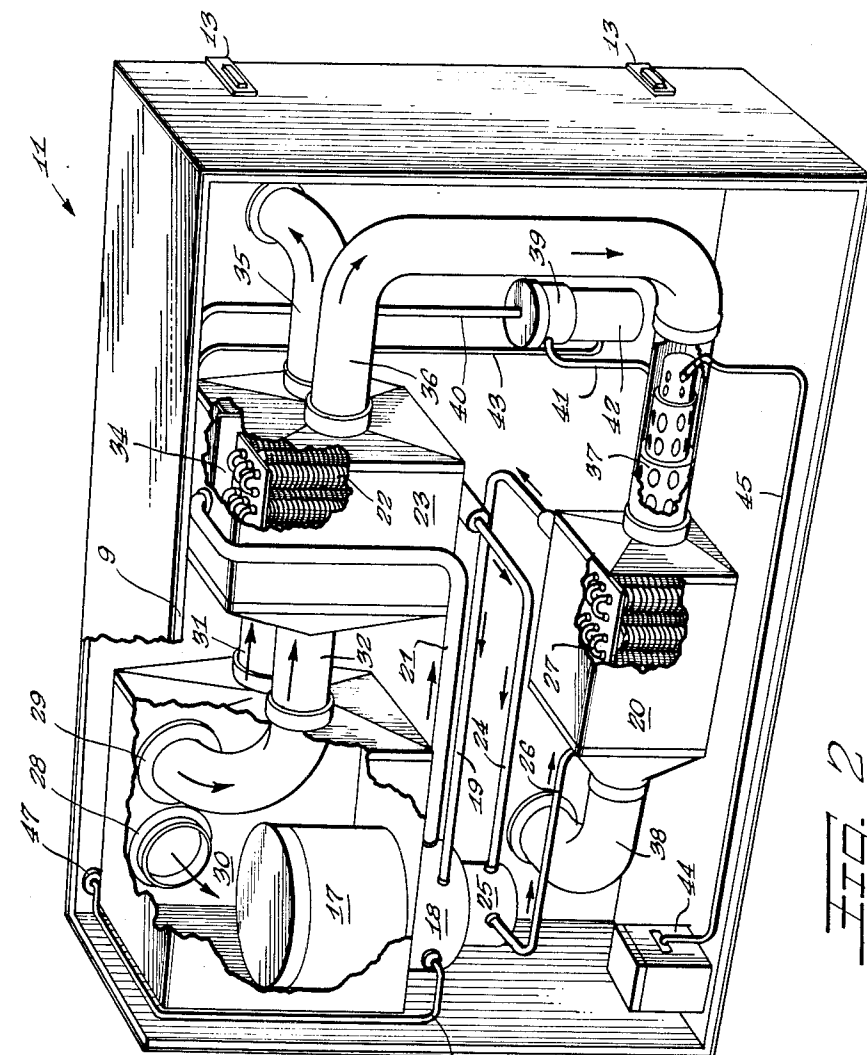
W. M. SHIPITALO

2,961,549

PORTABLE POWER PLANT

Filed Aug. 29, 1958

2 Sheets-Sheet 1



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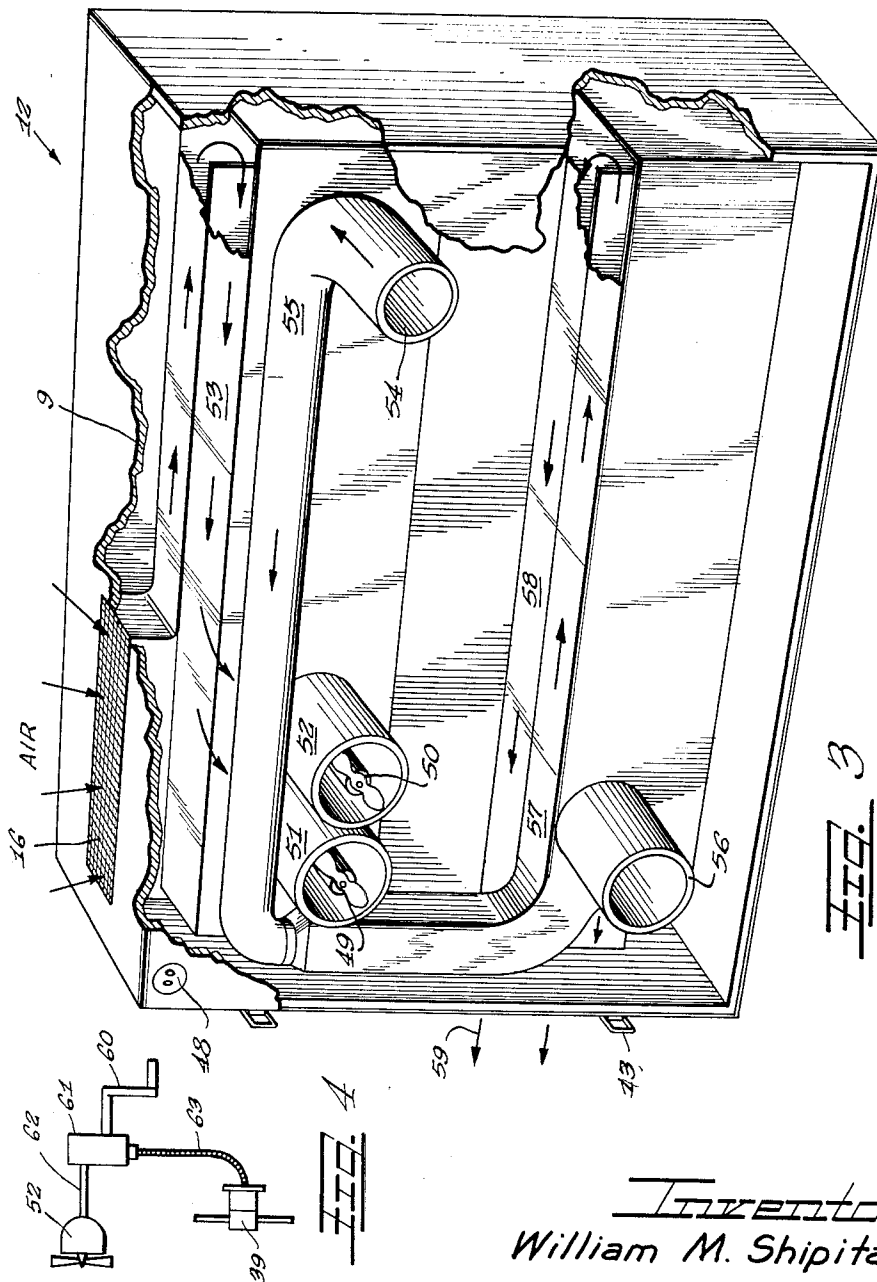
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PORTABLE POWER PLANT

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This invention relates generally to manually portable but complete or self contained electric supply units or electric generator power plants including a prime mover.

More particularly this invention relates to such a unit which can be readily taken apart into a plurality of parts for the separate manual carrying thereof and for the ready assembly thereof for operation.

It is a feature of this invention to provide a two-piece light weight silent packaged alternator set operating on the Rankine mercury cycle to efficiently produce about 2½ kilowatts of electric power from a package weighing slightly over 100 pounds and having its components housed in a package about the size of a conventional suitcase. It is another feature of the invention to provide a two-section package the sections of which are connected together by quick disconnect or slip fit connections, one section containing the power package itself and the other section containing a muffler or silencing device and associated controls. The separability of the two sections considerably facilitates the ready portability of the apparatus.

It is therefore an object of this invention to provide a small portable silent alternator set.

It is a further object of this invention to provide such an alternator set which is housed in a two-piece package, the two portions of which are readily separable for the manual carrying of each separately.

It is a further object of this invention to provide an alternator set driven by a turbine operating on a mercury vapor Rankine cycle.

While the novel and distinctive features of the invention are particularly pointed out in the appended claims, a more expository treatment of the invention, in principle and in detail, together with additional objects and advantages thereof, is afforded by the following description and accompanying drawings in which like reference characters are used to refer to like parts throughout and wherein:

Figure 1 is a perspective view showing the two-piece package or housing of the present invention in assembled relation.

Figure 2 is a perspective view partly broken away showing the interior of the power package portion of the unit of Figure 1.

Figure 3 is a perspective view partly broken away showing the interior of the silencing or muffler unit of the package of Figure 1.

Figure 4 is a schematic view showing one type of apparatus which may be used to start the alternator set.

Turning now to the drawings, there is shown in Figure 1, a housing or package 10 for the alternator set. The housing 10 comprises two separable sections or individual housings 11 and 12 respectively, the section 11 housing the power plant itself and the section 12 housing an associated silencing unit and if desired, associated controls. Each of the packages 11 and 12 consist of a light weight box preferably lined with a sound absorbing material 9 of honey comb construction. Each box shell may con-

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sist of metal, wood, plastic, or any other suitable material. The units 11 and 12 are fastened together by trunk type clamps 13 and 14 or by any other suitable quick disconnect or slip fit fastening means. A control panel 15 may, if desired, be disposed in a recess in the top of the power package unit 11 whereas a grilled air inlet opening 16 may be positioned in the top of the silencing unit 12.

The power package 11 is shown in greater detail in Figure 2. The power package includes an alternator 17 which is directly driven by a turbine 18 using mercury vapor as the operating fluid. Mercury vapor enters the turbine 18 through a pipe or conduit 19 which connects the outlet of a boiler 20 to the inlet of turbine 18. The outlet of turbine 18 is connected by a pipe 21 to the inlet end of the coils 22 of a condenser 23.

During its passage through the coils 22 of condenser 23, the mercury vapor is changed to a fluid which flows through a pipe or conduit 24 to the inlet of a mercury pump 25. Alternator 17, turbine 18, and pump 25 are integrally mounted on a common shaft so that the energy supplied to the turbine 18 by the incoming mercury vapor drives the alternator, the turbine, and the pump. The mercury fluid leaves the pump 25 at an increased pressure and flows through conduit or pipe 26 to the inlet of coils 27 of boiler 20. The fluid mercury is vaporized in the coils of the boiler by the heat energy supplied thereto. The resulting mercury vapor then flows through pipe 19 to the inlet of turbine 18 to complete the Rankine cycle.

As noted above, turbine 18, alternator 17, and pump 25 are mounted on a common shaft and preferably operate in hydrostatic mercury bearings to enable the complete mercury system to be positively sealed from the atmosphere. The entire mercury system is contained in the power package 11. However, the air which is used to condense the mercury vapor and to vaporize the fluid mercury in the boiler enters and leaves the power package through the detachable silencing package 12. The air enters the power package 11 through dual ducting comprising the inlets 28 and 29. Inlet 28 discharges into an enclosed housing 30 which surrounds the alternator. This portion of the air flow serves as a cooling medium for the alternator and leaves the housing 30 at relatively low pressure through a duct 31. Duct 32 is directly attached to inlet 29. Both ducts 31 and 32 are connected to supply the cooling air to the condenser 23 which is divided by a partition 34 into two sections, duct 31 feeding air to one section and duct 32 feeding air to the other section. From the divided condenser part of the air is ducted back to the atmosphere through a conduit 35 which leads the air to the silencing package and thence back to the atmosphere. The air from conduit 32 is ducted at relatively high pressure through conduit 36 into a combustion chamber 37 connected to boiler 20. The divided condenser is used so that the warm condenser exit air in duct 36 may be utilized in the combustor and boiler, this air being derived from that portion of the condenser forming the inlet end for hot mercury vapor. From the combustion chamber 37 the heated air flows through the boiler 20 and is then ducted through a conduit 38 back through the silencing package 12 and thence to the atmosphere.

A fuel pump 39 has fuel supplied to it through a conduit 40 from any convenient supply and in turn pumps this fuel through a conduit 41 to the combustor 37 through which air is fed from duct 36 to the boiler 20. Pump 39 is preferably driven by an integrally mounted motor 42 electrical energy for which is supplied through cable 43 from the alternator 17. A storage battery 44 is connected by cable 45 to the spark plugs or other ignition system of the combustor 37. Cable 46 connects turbine

18 and alternator 17 to a connector 47 from which connections may in turn be made to the control panel 15 and, if desired, to silencing package 12. Output from the alternator 17 may be derived through any convenient cable connection to the exterior of either of the packages, this cable connection not being shown.

The power package 11, which as noted above is structurally a light weight box preferably lined with material of honey comb construction, is connected in use to the similarly constructed silencing package 12 by the trunk type clamps 13 or any other suitable fastening means. Either of these packages may contain the control panel, the fuel pump, the boiler fan, the condenser fan, and/or the starting system. In any event, all connections between the power package and the silencing package are either quick disconnect or slip fit and are automatically engaged when the packages are fitted together.

This automatic engagement may more readily be seen by comparing Figure 3, which is a cut away perspective view of the silencing package, with the structure discussed above in connection with Figure 2. The silencing package 12 is a detachable self-contained muffler designed to silence the combustor and component noise of the power package. It consists primarily of muffling ducts and material although, as noted above, it may contain any or all of the following items: boiler fan, condenser fan, fuel pump, control panel, or starting system (to be described below).

The connector 47 on the power package 11 is adapted to mate with a receptacle 48 on the silencing package 12 to supply power for driving fans 49 and 50 positioned respectively in conduits 51 and 52. Conduits 51 and 52 are outlets from a re-entrant or tortuous air conduit 53 the other end of which is connected to the air inlet 16. The fans 49 and 50 are positioned in the outlets of conduits 51 and 52 which mate respectively with the air inlets 28 and 29 in the power package unit. Thus, air from air inlet 16 is circulated through conduit 53, a portion of this air being driven by fan 49 through conduit 51, inlet 28, alternator chamber 30, conduit 31, condenser 34, conduit 35, and thence back to the silencing unit through the inlet 54 of a conduit 55. The other portion of the air from conduit 53 is driven by fan 50 through air inlet 29, conduit 32, condenser 23, conduit 36, combustor 37, boiler 20, conduit 38, and thence back through an air inlet 56 which connects to an extension 57 of the conduit 55. The conduit 57 has a re-entrant or reversed section 58 which leads to an air discharge in the end wall of package 12 discharging air in the direction indicated by the arrow 59.

The re-entrant or reversing shape of conduits 53, 57, 58, and the generally tortuous nature of the entire air path also serves to provide baffles which further muffle or silence the noise generated by the operation of the power plant.

The duct work in the silencing package 12 thus serves in cooperation with sound absorbing material within the package to provide a muffling action for the noise of the combustor and components of the power package.

Any suitable apparatus is of course provided to initiate or start the operation of the system. Thus, referring to Figure 4, combustor fan 52 and condenser fan 51 (not shown in Figure 4) as well as the fuel pump 39 may for example be initially driven by hand by means of a crank 60, gear box 61, a direct detachable shaft connection 62 to the fan 52, and a flexible cable connection 63 to the pump 39. It will of course be understood that fan 51 may also be driven either by a direct shaft or flexible cable connection. The showing in Figure 4 is of course schematic only and the actual physical location of the cranking apparatus may readily be varied depending upon the design and features of the particular apparatus. It may for example be permanently or detachably included in the silencing unit 12, the crank handle projecting out of the remote or rear side thereof and the rest of the ap-

paratus making suitable connection to permanently installed parts. Alternatively, of course, a suitable vibrator power supply may be actuated from storage battery 44 and in turn actuate the fan and pump motors during the starting operation much in the manner of an automobile ignition system. In the latter event of course, the storage battery would be connected to be recharged by the alternator 17 during normal operation.

It will be understood that modifications and variations of the foregoing preferred exemplary embodiment of the invention may be effected without departing from the spirit and scope of the invention as defined by the following claims.

I claim as my invention:

1. A manually portable electric power generator set comprising, a carrying case enclosing said set and separable into first and second separable housings, readily disconnectable means to secure said housings together, said first housing containing a turbine driven alternator unit, a boiler having a fuel burning combustible unit, an air cooled condenser, and means to recirculate an operating fluid in a closed cycle through said condenser and said boiler to drive said turbine, means to supply and discharge condenser cooling and combustion air from outside said case to said condenser and said condenser unit and back out of said case, said means including said second separable housing containing duct work in said second housing forming an air inlet path for air to cool said condenser and an air outlet path for air from said combustion unit, said duct work being shaped to also provide baffles to absorb the noise of operation of said power generator, each housing having matching and readily separable connections for said air flow.

2. A manually portable electric power generator set comprising, a case therefor in the form of first and second separable housings, each of said housings being lined with a sound absorbing material, means to secure said housings together during the operation of said generator, said first housing containing an electrical generator and fuel and air burning and air cooled means to drive said generator, said second housing containing duct work forming combustion and cooling air inlet and outlet paths, each of said paths being in open communication at one end with said first housing and in open communication at the other end with the ambient atmosphere, means including matching and readily disconnectable connections to supply air through said paths to said power generator in said first housing, said paths formed by said duct work in said second housing being shaped to also provide baffles to absorb the noise of operation of said power generator.

3. A manually carriable, hand luggage size electric power generating set comprising, first and second separable housings, means to secure said housings together during the operation of said generator, said first housing containing electric power generating means including a fuel burning prime mover, said second housing containing duct work to supply combustion and cooling air to, and exhausted from, said generating means, said duct work also being shaped to provide baffles to absorb the noise of operation of said power generator, and each of said housings having matching come apart connections for said duct work.

4. A two piece portable electric power supplying unit comprising an enclosing case formed by two outer case forming portions each having an open face and connected open face to open face to readily come apart to permit the easier manual carrying of the separated portions, one case portion enclosing an electric generator and a connected fuel and air burning prime mover therefor, and means to supply air to, and discharge the combustion gases from, said prime mover including the other casing portion, said other casing portion enclosing air supplying and combustion gas discharging passages including noise muffling baffle means and opening out through the outer

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wall of said casing portion, and readily disconnectable connection means for said passage on each of said two case portions at their open faces.

5. A two piece portable electric power supplying unit comprising an enclosing case formed by two case forming portions each having an open face and readily detachable connections thereon to join said portions to permit the manual carrying of the separated portions, one case portion enclosing an electric generator and a connected fuel and air burning prime mover therefor, and means to supply air to, and discharge the combustion gases from, said prime mover including the other case portion, said other case portion enclosing air supplying and combustion gas discharging passages opening out through the outer walls of said case portion, said connections being actuated only by the engagement or disengagement motions of said case portions.

6. A power supply unit manually carriable in two pieces comprising an enclosing case formed by two case portions each having an open face to be connected open face to open face by slip connections to permit separation for the manual carrying of the separated portions, one case portion enclosing an upper and upright axis electric generator and a lower connected prime mover therefor having a lower fuel and air burning means, and means to supply air to, and discharge the combustion gases from, said fuel and air burning means including the other case portion, said other case portion enclosing air supplying and combustion gas discharging blower means and separate upper and lower passages extending in reversed horizontal directions to form noise muffling baffles and opening out at vertically spaced apart points through the outer walls of said case portion.

7. A complete, electric generating unit readily separable into two parts to permit the separate manual carrying thereof comprising two box-like casing forming portions each having at least one side which is at least partly open, said portions being detachably connected at their said open sides for operation, an electric generator and a connected air and fuel burning prime mover therefor enclosed in one of said casing portions, and air supplying and discharging means for said prime mover comprising matching and detachable passage connections on the open sides of each of said casing portions and passages including noise silencing muffler means in said other casing portions and opening through its outer walls at spaced points.

8. A self contained electric power plant manually carriable in two parts comprising two casing portions each having only one upright side which is substantially open, said portions being detachably connected at their said open sides for operation and to be moved apart transverse to their open sides for separation thereof, combustion air burning electric power supplying means in one of

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said casing portions, and air supplying and discharging means for said combustion air burning means comprising male and female type slip fit conduit connections on the open sides of each of said casing portions and conduits including muffler means for both the entering and the discharged air formed in said other casing portion and opening out through its outer walls.

9. A self contained electric power plant manually carriable in two parts comprising two box-like casing forming portions, each having at least one upright side which is at least partly opened, said portions being detachably connected at their said open sides for operation, a fuel and air burning and air cooled means to supply electric power enclosed in one of said casing portions, and combustion and cooling air supplying and discharging means therefor comprising detachable connections on the open sides of each of said casing portion and passages in said other casing portion opening through its outer walls at only two vertically spaced apart points, the inner walls of at least said other casing portion having an inner lining of sound deadening material.

10. A complete but readily portable electric generator plant comprising a casing separable into a plurality of box-like parts of substantially hand luggage size and weight for the easy manual carrying thereof, means to rapidly and operably connect said parts for operation, one of said parts enclosing a unitary electric generator-prime mover having means to burn fuel and air, and another of said parts enclosing air supply and exhaust blower and passage means including noise silencing muffling means, said means to connect said parts being engaged or disengaged only by relative motions between said parts.

11. A self contained but manually portable electric generating plant comprising a substantially closed, upright box-like case, an electric generator and an air cooled and fuel and air burning prime mover drivingly connected thereto in said case, said case also enclosing two separate and vertically spaced upper and lower, horizontally extending passages each being reversed to have double the length of the case and to provide muffling baffles, said upper and lower passages opening through the case to the outside air for intake and for discharge and being interconnected only through said prime mover to supply and withdraw combustion air and cooling air therefor.

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