Aug. 27, 1963 V. P. COMBS 3,102,205

ENGINE DRIVEN ELECTRICAL GENERATOR

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Fig. 1

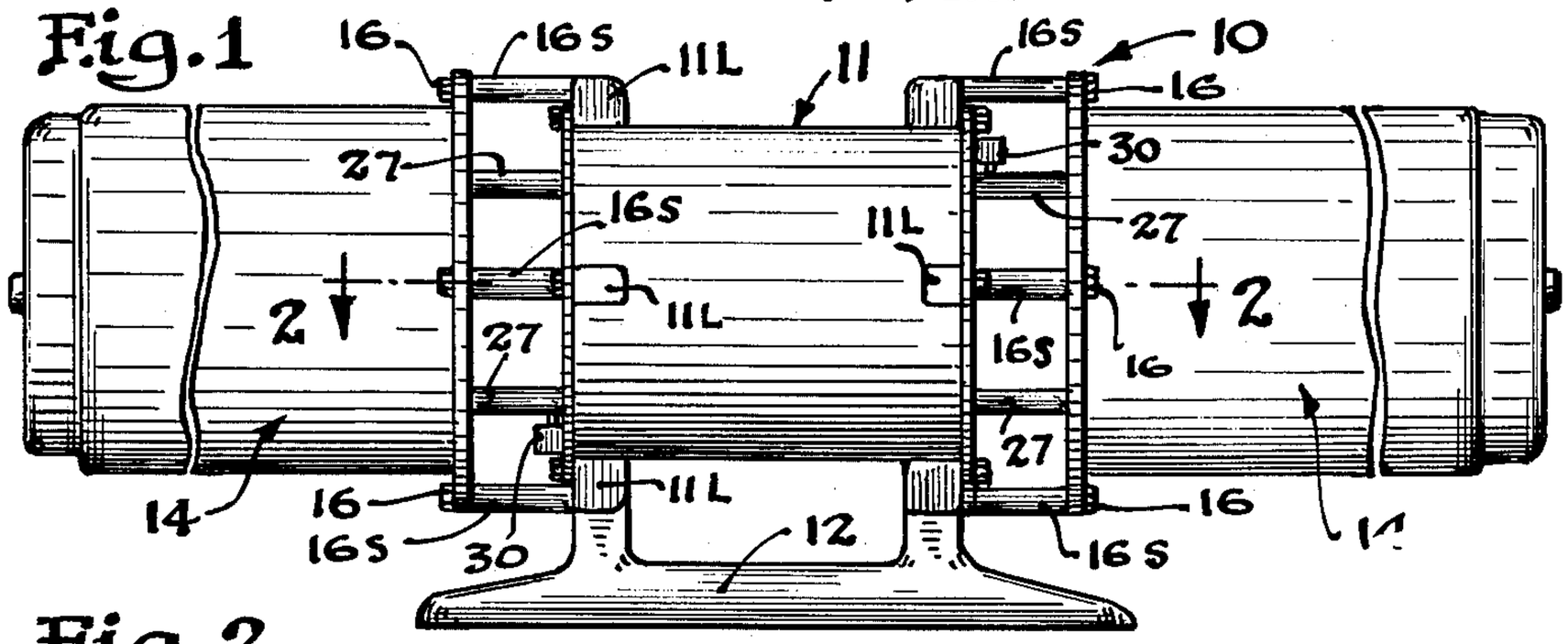
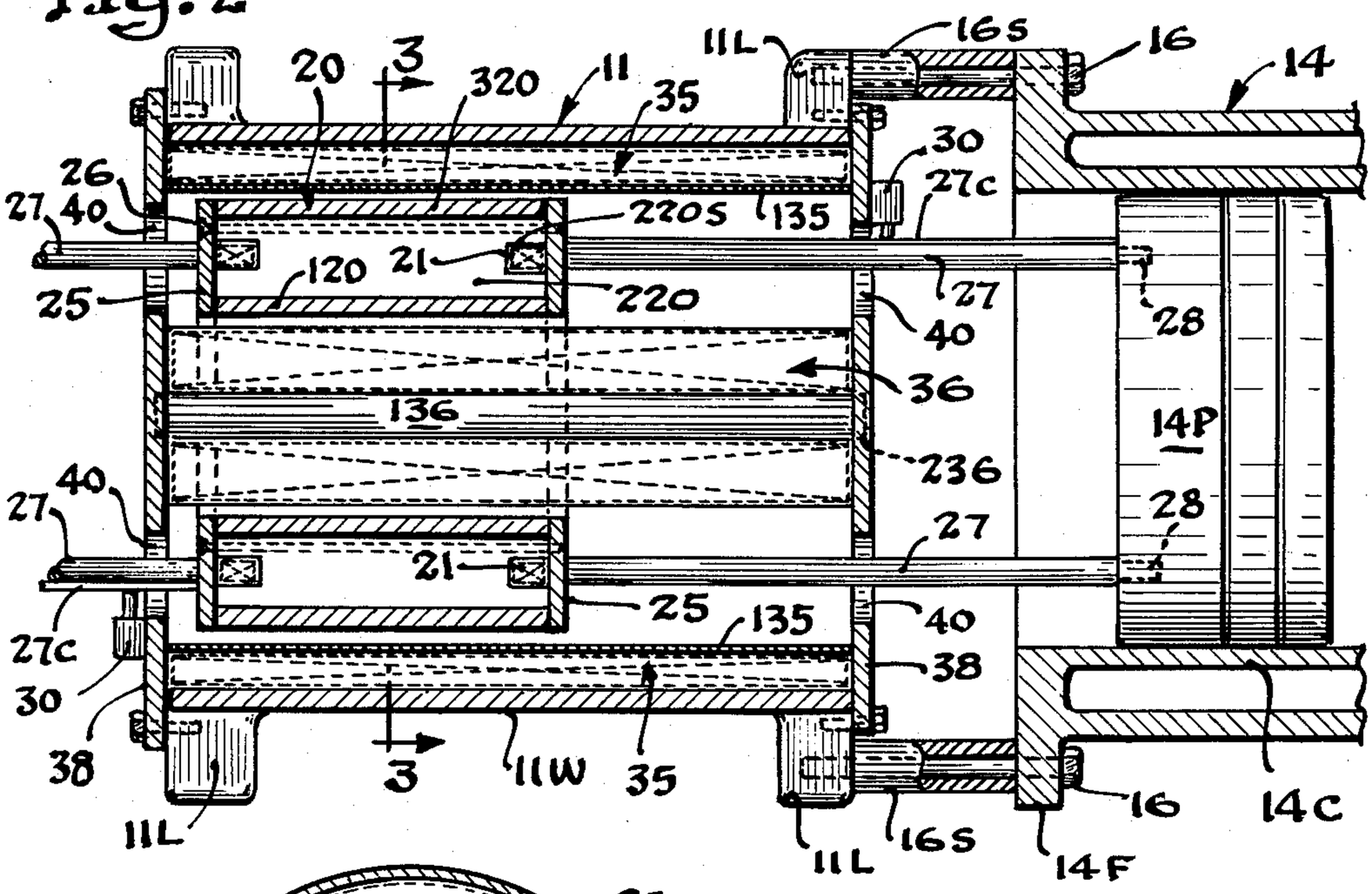


Fig. 2



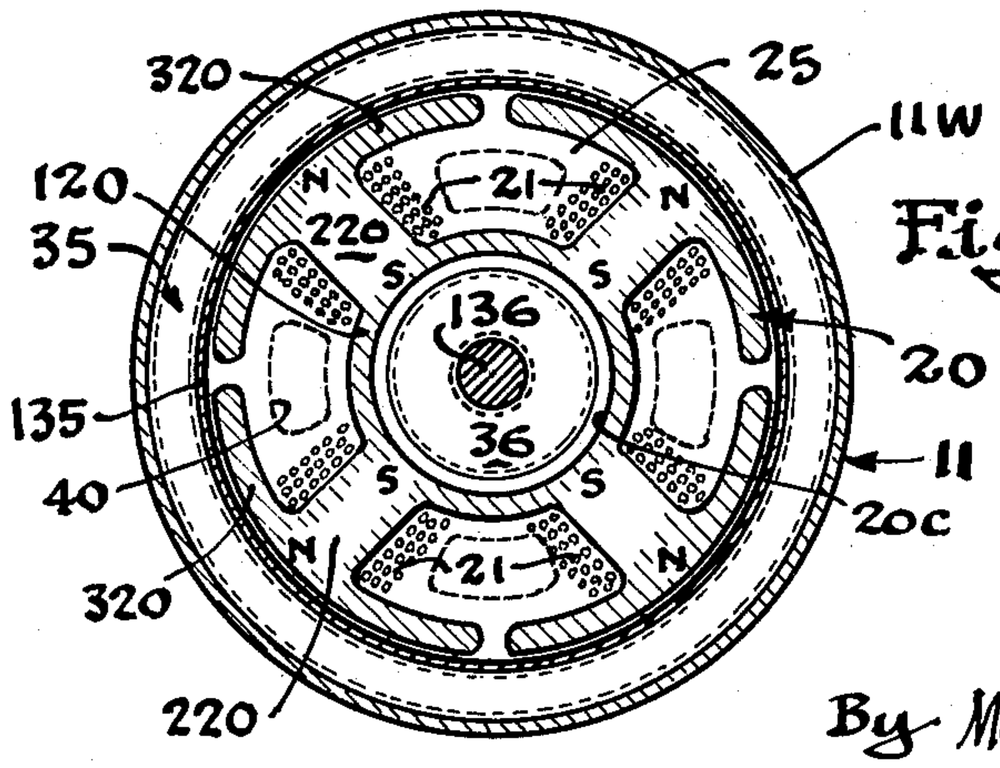


Fig. 3

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ENGINE DRIVEN ELECTRICAL GENERATOR

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This invention relates to electrical generators, and particularly to an internal engine driven electrical generator unit.

Where the usual types of rotary electric generators are driven by internal combustion engines the reciprocating piston motion must of course be converted into rotary motion and this involves considerable loss in power or efficiency. It is, therefore, the primary object of the present invention to enable such inefficiency and energy loss to be avoided in internal combustion engine driven electric generators. A related and more specific object of the invention is to combine a free piston internal combustion engine with a reciprocating electric generator so that the movable element of the generator has the movement of the free piston transmitted directly thereto and the piston and the movable generator element reciprocate in unison.

Other and further objects of the present invention will be apparent from the following description and claims, and are illustrated in the accompanying drawings, which, by way of illustration show preferred embodiments of the present invention and the principles thereof, and what is now considered to be the best mode in which to apply these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the invention.

In the drawings:

FIG. 1 is an elevational view of an engine driven electrical generator embodying the invention;

FIG. 2 is a fragmental horizontal view taken substantially along the line 2—2 of FIG. 1; and

FIG. 3 is a vertical cross sectional view taken substantially along the line 3—3 of FIG. 2.

For purposes of disclosure the invention is herein illustrated as embodied in an engine driven electrical generating unit 10 having a main frame 11 supported on a base 12 and having piston and cylinder units 14 supported on the frame 11 in aligned and at opposite ends of such frame.

The frame serves as a housing for a reciprocable electrical generator means, and the piston and cylinder units 14 are mounted on opposite ends of the frame 11 in alignment with each other and with the path of reciprocation of the movable element of electrical generating means. The piston and cylinder units 14 constitute a free piston internal combustion engine and may be provided with the usual fuel feed, speed control and other appurtenances in accordance with known practice. Moreover, one of the piston and cylinder untis may be used as a bounce chamber, if desired, in accordance with known practice in free piston engines, or in other instances, according to the conventional practice, the two units 14 may serve as alternately fired power elements.

The frame 11 is generally in the form of a hollow cylinder having a wall 11W with a plurality of radially extending mounting lugs 11L arranged about and adjacent to the opposite ends of the wall 11W to serve in the association or mounting of other parts of the mechanism including the piston and cylinder devices 14. Thus, as shown particularly in FIGS. 1 and 2, each piston and cylinder device 14 comprises a cylinder 14C which is, in the present instance, shown as a water-jacketed or water cooled cylinder, with a piston 14P reciprocable therein. The cylinder 14C is flanged at 14F at the end that is to

be adjacent to the frame 11, and the cylinder is supported in axially spaced relation on and with respect to the frame 11 by a plurality of cap screws 16 and spacer sleeves 16S, the cap screws 16 being extended through the spacer sleeve 16S and being threaded into the respective mounting lugs 11L of the frame.

As above pointed out, the piston and cylinder devices 14 are aligned with the electrical generator means that are disposed within the wall 11W of the frame, and the pistons 14P of the two piston and cylinder units are interconnected with each other through the movable portion of the electrical generating means so that the two pistons and such movable portion operate in unison in their reciprocating movements.

In the present instance the electrical generating means is arranged so that the field thereof constitutes the movable element of the apparatus, and the field is illustrated in detail in FIGS. 2 and 3 of the drawings. Thus the electrical generating means has a field unit 20 that is generally cylindrical in form and is somewhat smaller in diameter and considerably shorter in length than the wall 11W of the frame, and the field unit 20 has a relatively large central opening 20C formed therein axially thereof for purposes that will appear hereinafter.

In FIG. 3 of the drawings, the field is shown for illustrative purposes as being formed as an iron casting with a central sleeve 120 having four equally spaced radial arms 220 projecting outwardly therefrom, and at the outer ends of the radial arms 220, arcuate face plates 320 are formed which at their edges are spaced circumferentially from each other and which provide an interrupted cylindrical outer surface for the field unit 20. The radial arms 220 are elongated longitudinally of the unit 20 as will be evident in FIG. 2 and have slots 220S formed in their ends to receive magnetizing coils 21 that may be energized to constitute the arms 220 as electro-magnets.

The coils 21 of the electro-magnets are wound in series and in such relative directions about the radial arms 220 that when the several coils 21 are energized by a common circuit, each of the arms 220 will provide a north pole N at its outer radial end and a south pie S at its inner radial end. The coils 21 are provided with an outside energy source as will be described.

The opposite ends of the field unit are, in the present instance, closed by ring-like end plates 25 that are attached by means of screws 26, FIG. 2, that extend into the body of the unit 20, and the end plates 25 are of brass so that they cannot serve as return circuits for the magnetic flux in the field unit 20, and a return circuit for the magnets or poles is provided as will be described.

The end plates 25 function in connecting and supporting the field unit 20 between the two pistons 14P. Thus, each end plate 25 has a pair of connecting rods or shafts 27 secured thereto on opposite sides of the central axis of the end plate, and these connecting shafts are extended to the adjacent piston 14P and are secured thereto as by cap screws and end fittings 28. Two of the connecting shafts 27 are provided with conductor plates 27C extending throughout their length and connected to the opposite ends of the series circuit provided through the several magnetizing coils 21, and the energizing current for the circuit is extended to the contact strips 27 by brush assemblies 30 that are stationary and which are mounted as will be described.

The present generator provides two stationary mounting armature coils for cooperation with the reciprocating field unit 20, a first armature coil 35 being disposed within and directly adjacent to the wall 11W and outside of the field unit 20 for cooperation with the north poles N of the field, while a second or inner armature coil 36 is disposed in a stationary position within the central opening

20C of the field unit. The outer armature coil is wound about a perforated metal shell 135 which may be perforated aluminum and the winding of the coil is such that the several turns of the coil will be centered on the axis of the field unit 20. The inner coil 36 is wound on a central rod 136 of magnetic material so that the coils thereof are concentric with the axis of the rod 136, and this rod, if desired, may be of a laminated metal or soft iron material.

The outer armature coil 35 is put in position within the wall 11W of the frame and is held in position by removably mounted end plates 38 that are fastened by cap screws to the lugs 11L. The armature coil 35 has a snug fit within the wall 11W so that it is properly centered. The other or inner armature coil 36 is supported in the desired centered position by extending the ends of the central shaft 136 into aligned axial sockets 236 that are formed in the end plates 38.

The coils 35 and 36 may have independent output terminals, or may be connected to series but with a reverse winding relationship with respect to the axis of the field unit so that the current generated will be cumulative, and in such an instance, a single set of output terminals will be required.

In the operation of the internal combustion engine that is provided by the piston and cylinders 14P, the generating unit will produce alternating current at a frequency that will be determined by the operating speed of the internal combustion engine, and through control of this speed in a conventional manner, the desired frequency may be attained.

The end plates 38 serve as a mounting for the brush units 30, as shown in FIG. 2, and such end plates also form part of the return path for the magnetic circuit. Thus the housing 11, the end plates 38 and the central support rod 136 are formed from a magnetic material such as iron so that the magnetic circuit may extend from the north poles N radially across the magnetic gap and through the outer armature coil 35, and any laminations that may be associated with such coil, to the wall 11W, and this circuit then extends through the wall 11W to the end plates 38 and radially inwardly through the end plates to the central support rod 136 from which the magnetic path or circuit extends longitudinally of the rod 136 and then radially outwardly through the inner armature coil 36 and across the annular magnetic gap to the south poles S of the field unit 20.

In the operation of the apparatus the reciprocation of the field unit 20 has a piston-like action whereby air flow through the generating unit is induced, and suitable ventilating openings 40 may be provided in the end plates 38 of the housing and in the end plates 25 of the field unit 20 to control and distribute the flow of cooling air therethrough.

From the foregoing description it will be apparent that the present invention provides new and improved engine-operated electrical generator wherein the number of moving parts is reduced to the minimum and wherein energy loss due to conversion of motion from reciprocating to rotary is eliminated so as to improve the overall efficiency of the apparatus.

Thus while a preferred embodiment of the invention has been illustrated herein, it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appending claims.

1. In an engine driven electrical generator, an elongated housing, an internal combustion engine including aligned cylinders mounted in opposite ends of the housing, pistons reciprocable in the respective cylinders, an outer unit stationarily mounted adjacent the walls of the housing, a central structure extending longitudinally of the housing, end walls for the housing supporting said central structure, a sleeve-like reciprocable unit within said housing and about said central structure and supported between said pistons for reciprocation therewith, one of said units comprising an armature coil and the other comprising a field unit having a plurality of field magnets radially related with respect to said inner structure and having corresponding magnetic poles correspondingly related to the axis of said housing, and means including said inner structure, said end walls and said housing providing a return path for the flux of said field magnets.

2. In an engine driven electrical generator, an elongated cylindrical housing, an internal combustion engine including aligned cylinders mounted on opposite ends of the housing concentric with the axis of the housing, pistons reciprocable in the respective cylinders, a generally cylindrical field unit supported between said pistons within said housing and having an axial opening therethrough, said field unit having a plurality of field magnets arranged radially with corresponding poles facing radially outwardly, an outer field coil stationarily disposed in the housing concentric with and outside of the field unit, an inner field coil supported on a central rod and disposed in said housing stationarily with respect to the housing and within the axial opening, end plates on said housing supporting the ends of the rod, said end plates, said rod and said housing being of magnetic material providing a return flux path for said field magnets.

References Cited in the file of this patent

UNITED STATES PATENTS

2,362,151	Ostenberg	Nov. 7, 1944
2,900,592	Baruch	Aug. 18, 1959