

CROSS REFERENCE

Draftsman

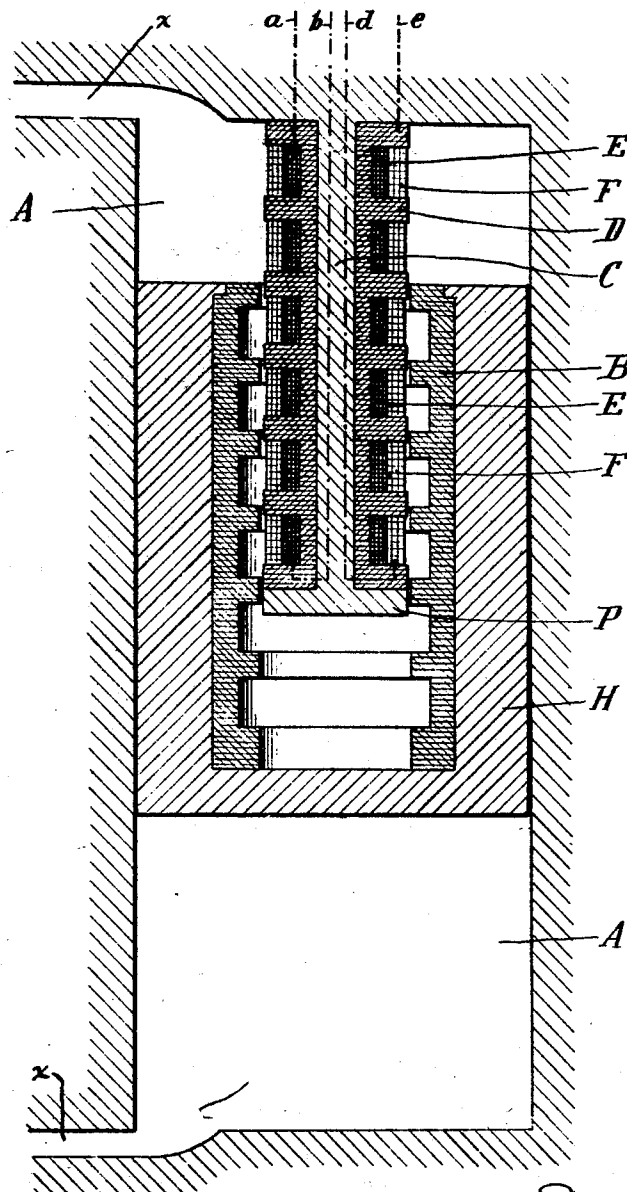
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E. JORDAN

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GENERATOR OF ELECTRIC CURRENT

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INVENTOR

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UNITED STATES PATENT OFFICE.

EUGENE JORDAN, OF PARIS, FRANCE, ASSIGNOR TO SOCIETE L'AIR LIQUIDE (SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE), OF PARIS, FRANCE.

GENERATOR OF ELECTRIC CURRENT.

Application filed April 24, 1923. Serial No. 634,205.

To all whom it may concern:

Be it known that I, EUGENE JORDAN, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Generators of Electric Current; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to generators of electric current and particularly to a reciprocating engine in which current is generated directly by the reciprocation of a moving piston actuated by the expansion of a fluid.

The invention is particularly useful in the expansion of gases with external work as in liquefaction systems, although it is not limited to such use. In liquefaction systems wherein refrigeration is developed by expansion of gases in engines, it has been usual to employ reciprocating engines connected to rotary current generators which supply the load and cause the expanding gas to do work. This arrangement involves a complication of apparatus and losses incidental to the multiplicity of moving parts.

It is the object of the present invention to avoid the disadvantages of apparatus heretofore used and to provide a simple and self-contained generator in which the load is applied directly to the moving piston.

Further objects and advantages of the invention will be apparent as it is better understood by reference to the following specification and accompanying drawing which illustrates diagrammatically a form of expansion engine which is adapted to accomplish the desired result.

In the application of the invention an expansion cylinder is employed with suitable inlets and outlets for the gas which may be controlled by valves which permit adjustment of the cut-off. The cylinder and valve mechanism may be such as are employed on ordinary expansion engines. The details of the valve mechanism form no part of the present invention and can be supplied readily by anyone who is familiar with the structure and operation of expansion engines. The engine hereinafter described differs from others in that the piston is not connected externally of the engine and

merely floats in the cylinder, being moved to and fro by the expansion of the gas as it is admitted and exhausted under control of the valve mechanism. The inner wall of the piston, which is hollow, consists of soft iron in which a flux is set up under the excitation of an electric current. The piston is therefore an armature. A stationary plunger is supported at one end on the cylinder head and projects into the hollow piston. This plunger has a non-magnetic core and a surface layer of soft iron. It also carries the field windings whereby the flux is set up in the armature and the windings in which current is generated as the piston or armature moves relatively to the plunger. Suitable current leads are provided to supply the exciting current and to deliver the current generated by the engine.

The exciting current may be obtained from any suitable source such as line, storage batteries, etc., or even through a current rectifier shunted across the circuit in which current is induced by the operation of the engine. The current induced is alternating with a period which is a function of the number of poles and the velocity of piston displacement. This current may be utilized, or it may be caused to pass through a suitable resistance where the only purpose is to provide a load for the engine.

Referring to the drawing, A indicates the expansion engine which may be of usual construction, having passages X through which the gas is admitted and exhausted under control of the valves (not shown). A piston H is adapted to move to and fro in the cylinder. The piston has a coaxial recess extending substantially throughout its length, and in the recess lamellæ B of soft iron are supported, the inner surface of the piston being thus provided with notches and annular poles. These poles project radially into the central space of the piston.

A plunger P is securely mounted on the head of the cylinder and substantially fills the central space in the piston when the latter is at one end of its stroke. The plunger consists of a non-magnetic core C upon which soft iron lamellæ D are mounted, the lamellæ forming notches and poles corresponding to those on the interior surface of the piston.

An insulated conductor E, of copper, for

example, is wound in the grooves; the direction of winding alternates in the adjacent grooves so as to produce consecutive poles of opposite sign when the conductor is energized by direct or rectified current from any source through the conductors *a* and *b*. A second insulated conductor *F* forming a circuit independent of the first winding is wound over the latter so as to fill the slots completely. The direction of winding changes from groove to groove so that the electromotive forces induced in the coils supplement each other. The generated current is delivered through the conductors *d* and *e*.

As will be readily understood from the foregoing description, reciprocation of the piston or armature will result in induced alternating current in the conductor *F* forming the outer coils of the plunger, and this current may be utilized as desired. By the application of the invention the difficulties met in maintaining the operating parts of engines and rotary generators, particularly when these are relatively small, is avoided by the elimination of the major portion of the apparatus heretofore considered to be necessary in such installations. The efficiency of the apparatus is greatly increased because losses from friction are reduced to a minimum.

Various changes may be made in the form and details of arrangement of the parts without departing from the invention or sacrificing the advantages.

I claim:—

1. A reciprocating fluid pressure generator of electric current, which comprises a cylinder, a piston adapted to reciprocate therein, and fixed means within the piston for generating induced currents by the displacement of the piston.

2. A reciprocating fluid pressure generator of electric current, which comprises a cylinder, a piston adapted to reciprocate therein, and a plunger supported by the cylinder and adapted to be enclosed by the piston, said plunger being provided with means for generating induced currents by the displacement of the piston.

3. A reciprocating fluid pressure generator of electric current, which comprises a cylinder, a piston adapted to reciprocate therein and provided with an axial recess having soft iron segments on its periphery and a plunger secured to the cylinder head and protruding into the recess, said plunger carrying soft iron segments and inductor and induced current coils on its periphery.

In testimony whereof I affix my signature.

EUGÈNE JORDAN.