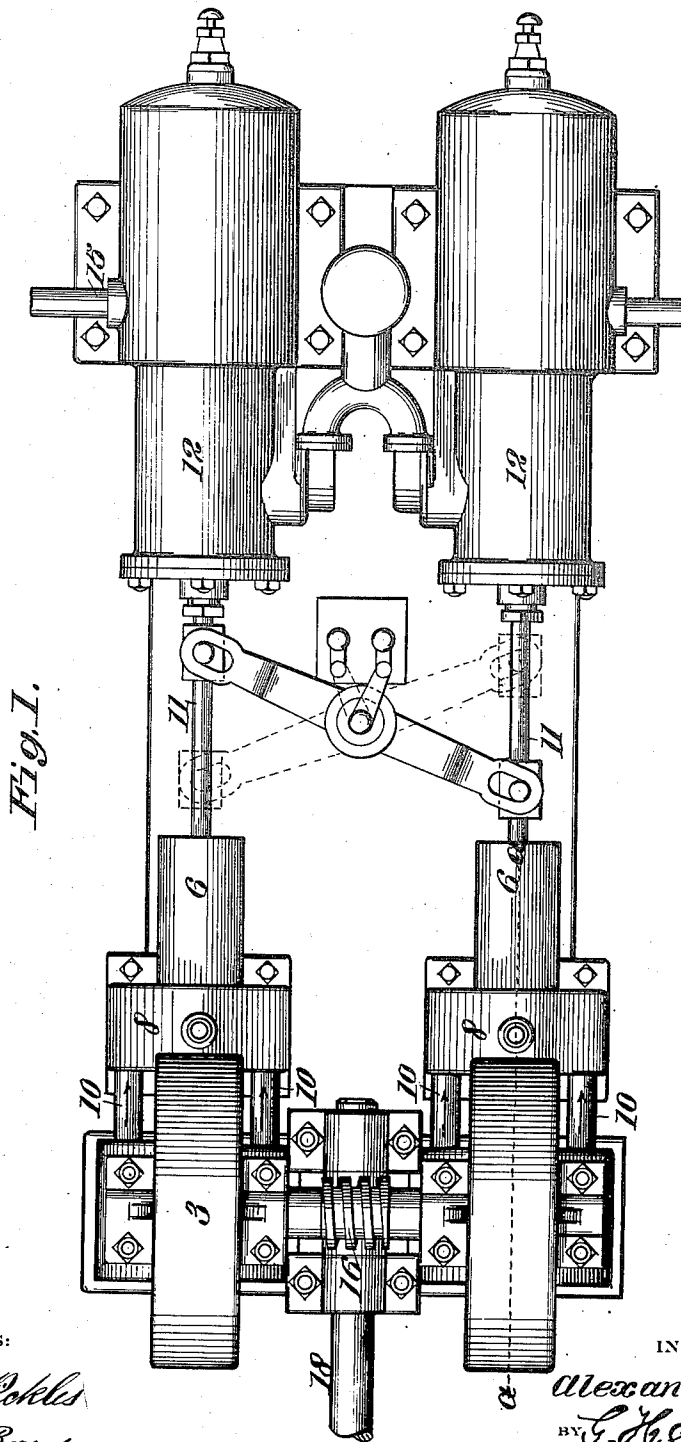


A. LUDWIG.
POWER GENERATOR.
APPLICATION FILED JUNE 18, 1913.

1,093,280.

Patented Apr. 14, 1914.

2 SHEETS-SHEET 1.



WITNESSES:

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INVENTOR

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Fig. 2.

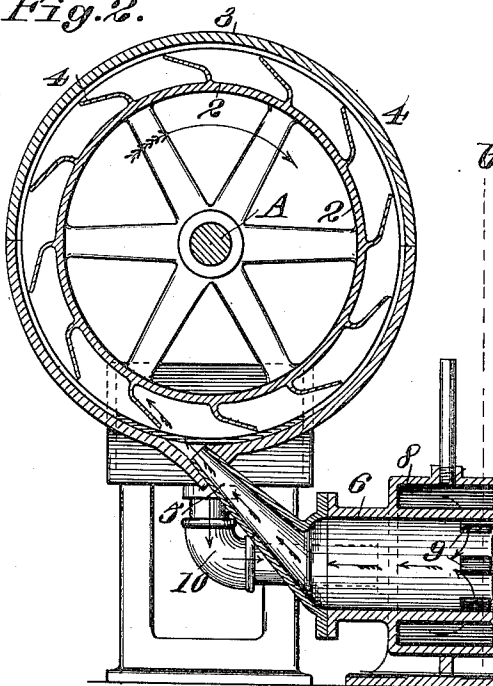


Fig. 3.

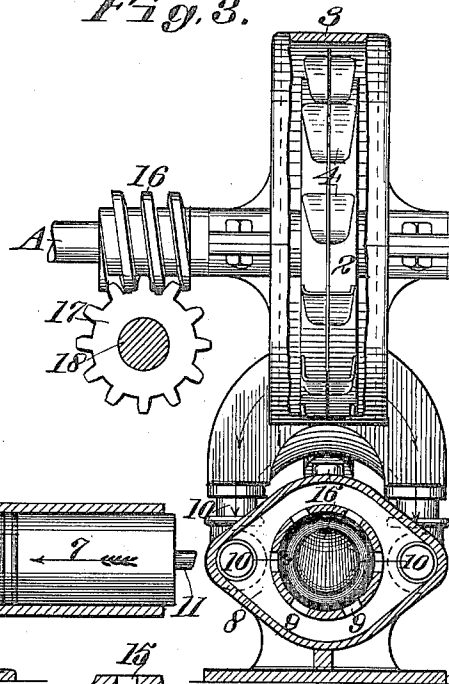
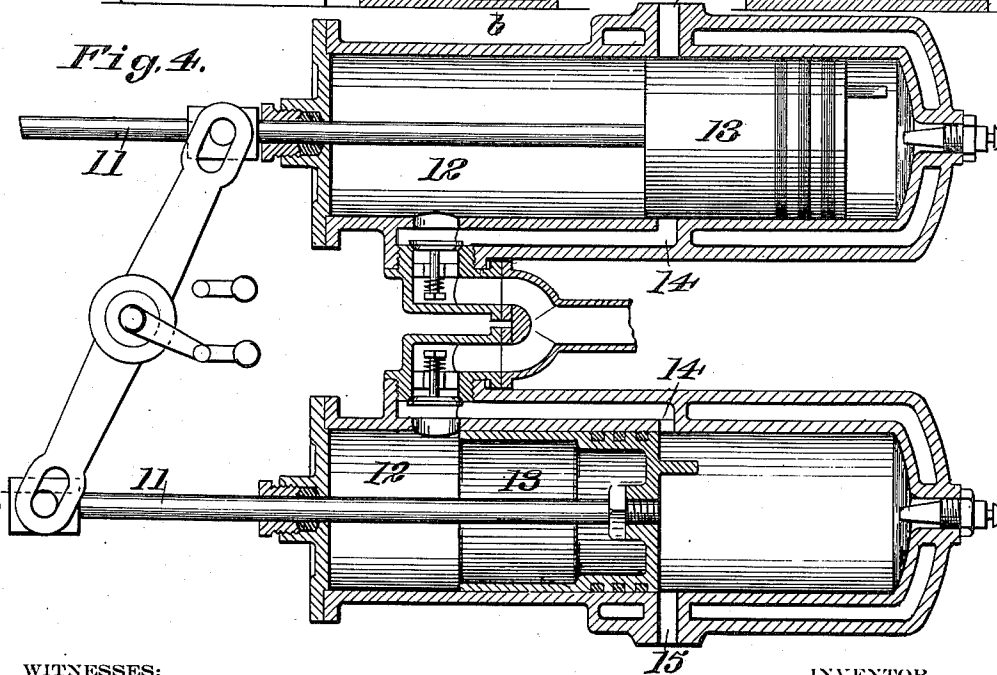


Fig. 4.



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UNITED STATES PATENT OFFICE.

ALEXANDER LUDWIG, OF REDDING, CALIFORNIA.

POWER-GENERATOR.

1,093,280.

Specification of Letters Patent.

Patented Apr. 14, 1914.

Application filed June 18, 1913. Serial No. 774,383.

To all whom it may concern:

Be it known that I, ALEXANDER LUDWIG, a citizen of the United States, residing at Redding, in the county of Shasta and State of California, have invented new and useful Improvements in Power-Generators, of which the following is a specification.

This invention relates to a power generator.

10 It is the object of this invention to provide means for converting the power generated by the expansion of steam or explosion of gases, in a reciprocating engine, into continuous rotary motion through the medium of a hydraulic ejector.

15 Another object is to provide a substitute for a crank as a means for converting reciprocating motion into continuous rotary motion, by means of which loss of energy due to dead centers and momentum will be obviated and a continuous, uniform application of power to a drive shaft may be obtained.

20 A further object is to provide a power generator of the above character which is simple in construction and efficient in operation.

25 The invention primarily resides in a turbine wheel, a hydraulic ejector for discharging a liquid in such manner as to rotate the turbine wheel and adapted to use the same liquid continuously, and means for operating the ejector by a reciprocating engine.

30 The invention further consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

35 Figure 1 is a plan view of the invention. Fig. 2 is an enlarged vertical section on the line *a—*a** of Fig. 1. Fig. 3 is a vertical section in elevation on the line *b—*b** of Fig. 2, with parts broken away. Fig. 4 is a horizontal section of the engine cylinder.

40 In the drawings A represents a drive shaft which is supported in suitable bearings and has a pair of spaced turbine wheels 2 rigidly mounted thereon. The turbine wheels 2 are incased in separate housings 3 and are provided with the usual turbine buckets or vanes 4 on their outer peripheries. Opening into the casings 3, on their undersides, are nozzles 5, which diverge outwardly from their connections with the housings 3 and are connected at their en-

larged outer ends to horizontal cylinders 6, in which pistons 7 are reciprocally mounted.

60 Formed on the cylinders 6 are annular chambers 8 which communicate with the interior of the cylinders through ports 9; the ports 9 being so disposed as to be open when the pistons 7 are in their rearmost or retracted position and closed when the pistons are in a slightly advanced position. 65 The chambers 8 communicate with the interior of the housings 3 by means of drain pipes or conduits 10, which lead from the housings 3 at their lowest points, adjacent to the nozzles 5. The chambers 8 are designed to serve as reservoirs for the liquid employed in operating the turbine wheels 2, which liquid drains from the housings 3 into the chambers 8, through the pipes 10, and enters the cylinders 6, through the ports 9, when the pistons 7 are in their rearmost position; such quantity of liquid being introduced into the housings 3 as will approximately fill the forward ends of the cylinders 6 and nozzles 5 when the pistons 7 are 80 in their rearmost positions.

The pistons 7 are connected to piston rods 11 which extend into engine cylinders 12, and are secured at their outer ends to pistons 13 reciprocally mounted in the engine cylinders 12. The engine cylinders 12 are 85 arranged parallel with each other and are provided with suitable inlet ports 14, and exhaust ports 15, being here shown as adapted to be operated by the explosion of gases, which may be delivered to the interior of the cylinders and exploded in any suitable manner to reciprocate the pistons 13 alternately. A form of engine in which the pistons 13 are retracted by cushion pressure is preferably employed, but it is manifest that any suitable means may be employed for reciprocating the pistons 13, as desired; the essential feature being to provide means for reciprocating the pistons 7 in the cylinders 6. 100

In the operation of the invention the pistons 13 are reciprocated by the explosion of gases in the cylinders 12 in a manner common in gas engine operations, or by the expansion of steam in the well-known manner. 105 The operation of the pistons 13 causes the pistons 7 to reciprocate in opposite directions in relation to each other in the cylinders 6, one of the pistons moving rearwardly as the other advances. A piston 7 moving to its rearmost position uncovers the ports 9 and thereby permits a quantity of liquid 110

entering the cylinder from the chamber 8. The piston 7 then moving forward closes the ports 9 and ejects the liquid in front of the piston with considerable force through the nozzle 5, and causes it to be impinged upon the turbine buckets or vanes 4 on the wheel 2 in such manner as to rotate the latter and thereby revolve the drive shaft A. During the time that one of the pistons 7 is traveling in a forward direction the other piston will be moving in a rearward direction, a portion of the liquid previously ejected into the housing 3 being drawn into the cylinder 6 on the initial backward movement of the piston 7.

When the piston 7 has reached its extreme rearmost position and thereby uncovered the ports 9, the liquid entering the chamber 8 through the drain pipe from the interior of the housing 3, will pass into the cylinder 6 in front of the retracted piston 7. The retracted piston 7 will then be advanced so as to close the ports 9 and eject the liquid against the blades 4 of the turbine wheel 2 and thereby impart a rotary motion to the latter.

By employing a pair of turbine wheels, pistons 7 and their connections, and arranging the pistons 7 to operate in ejecting alternate streams of liquid against the turbine wheels, a substantially continuous application of power to rotate the shaft A will be obtained; one piston 7 operating to eject a stream of liquid against a turbine wheel, while the other is moving backward to its retracted position.

It is manifest that while I have shown and described a pair of turbine wheels and ejectors as employed in rotating a single shaft A, the number of turbines and ejectors may be increased to any desired extent. It is also obvious that any suitable means for reciprocating the ejector pistons 7 may be employed. Power may be taken from the drive shaft

A in any suitable manner; a worm wheel 16 meshing with a pinion 17, on a shaft 18, being here shown as provided for that purpose.

Liquid of any desired character may be used in the ejector, a heavy liquid such as mercury being preferably employed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described, parallel cylinders with plungers, motors by which said plungers are reciprocated in opposite directions, hollow chambers surrounding the cylinders, ports opening into the cylinders and in communication with the chambers at each retraction of the plungers, impulse wheels and casings in which said wheels are journaled, jet nozzles connecting the cylinders with the wheel casings, and return conduits connecting the wheel casings with the cylinder inclosing chambers.

2. In an apparatus of the character described, cylinders having annular surrounding chambers with ports opening into the cylinders intermediate of their length, plungers and means to reciprocate them within the cylinders, said plungers being of such length as to expose the ports when fully retracted, means to supply liquid to the chambers, incased wheels mounted upon a power transmitting shaft, nozzles through which jets are impelled by the plungers to impinge against the wheel buckets, and return passages from the wheel casings to the cylinder inclosing casings.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALEXANDER LUDWIG.

Witnesses:

ALBERT F. ROSS,
CARL R. BRIGGS.