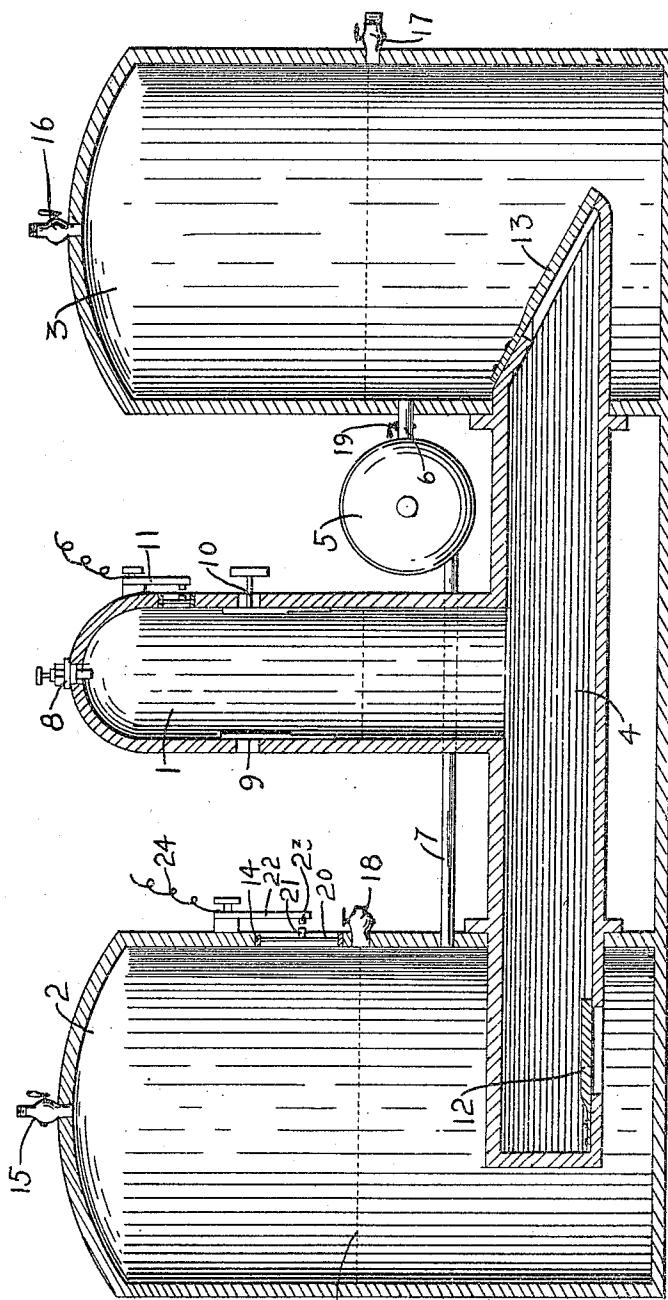


P. OSTENBERG,
EXPLOSIVE METHOD OF GENERATING POWER,
APPLICATION FILED JAN. 28, 1915.

1,237,688.

Patented Aug. 21, 1917.

3 SHEETS—SHEET 1.



INVENTOR

INVENTOR

Pontus Ostenberg

BY G. B. Bates
HIS ATTORNEY

WITNESSES:

John A. Macmillan
J. B. Chambers

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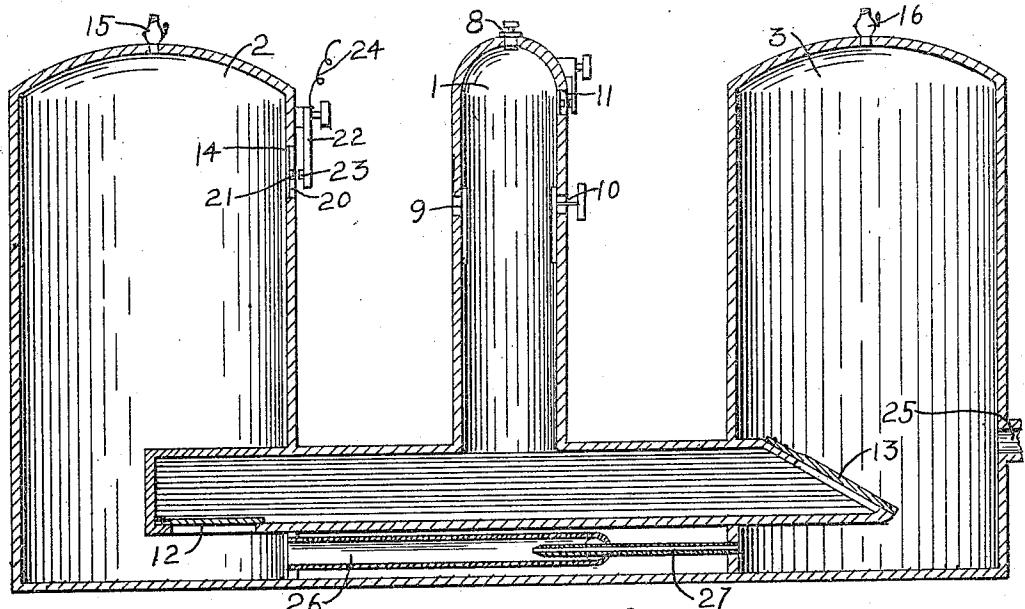


FIGURE 2

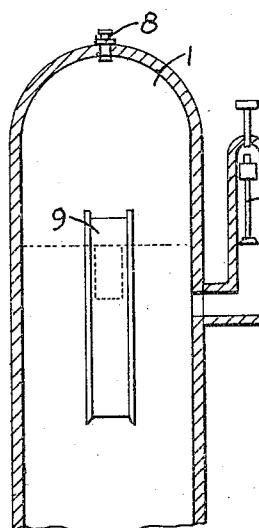


FIGURE 3

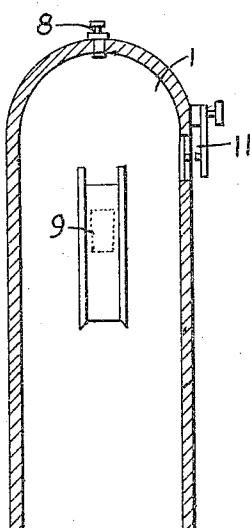


FIGURE 4

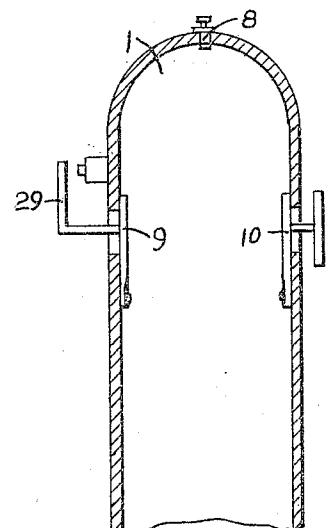


FIGURE 5

WITNESSES:

John A. Raismith
J. B. Chambers

INVENTOR

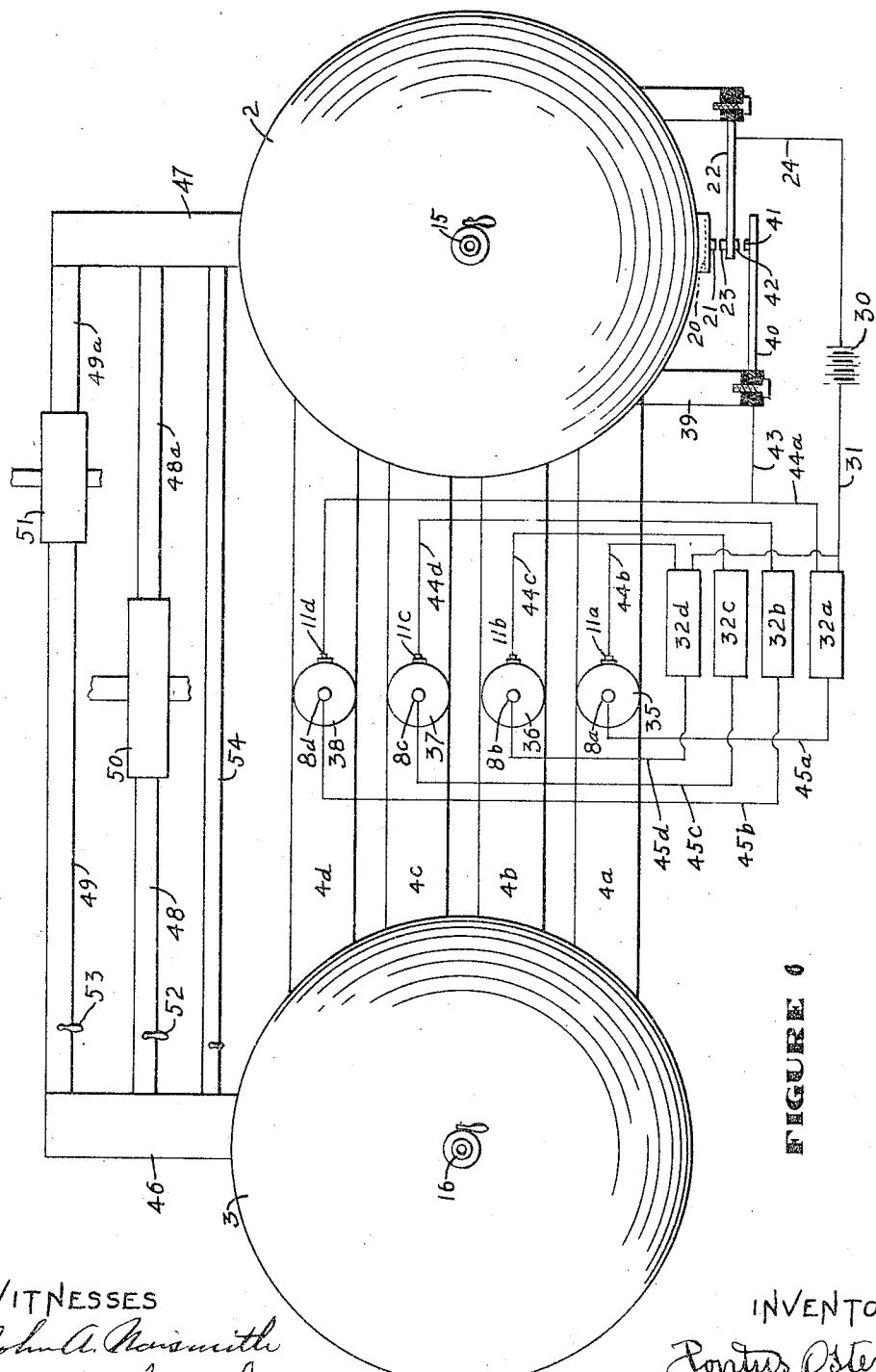
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3 SHEETS—SHEET 3.



WITNESSES

John A. Knauth
J. B. Chambers

INVENTOR

Rontus Ostenberg
BY P. G. Bates
HIS ATTORNEY

UNITED STATES PATENT OFFICE.

PONTUS OSTENBERG, OF LOS GATOS, CALIFORNIA.

EXPLOSIVE METHOD OF GENERATING POWER.

1,237,688.

Specification of Letters Patent. Patented Aug. 21, 1917.

Application filed January 28, 1915. Serial No. 4,880.

To all whom it may concern:

Be it known that I, PONTUS OSTENBERG, a citizen of the United States, and a resident of Los Gatos, in the county of Santa Clara 5 and State of California, have invented a certain new and useful Improvement in Explosive Methods of Generating Power, of which the following is a specification.

My invention relates to improvements in 10 explosive method of generating power in which the expansion of a compressed and ignited combustible mixture of air and fuel is used in combination with a non-com- 15 pressible liquid under a high elastic fluid pressure.

The object of my invention is to produce a power generator of great simplicity, light in weight per given horsepower, and the utilization of a high elastic fluid pressure 20 within the generator to produce a high compression and rapid induction of liquid into the explosion chambers of the generator, and to provide means for controlling such a 25 generator automatically.

The present invention differs from other power generating methods which employ liquids as a propelling agent in combination with explosions of combustible mixtures from the fact that such use a rapid recipro- 30 cation or high velocity of the liquid to produce a compression in the explosion chambers of the generator. It also differs from other generators which compress an air cushion during the power stroke and which 35 induces compression upon the return stroke from the fact that the elastic pressure in the present invention not only contracts and expands somewhat with the explosions, but falls and rises when liquid is allowed to flow 40 in the circuit. In my invention a high compression is produced by a high elastic fluid pressure, such as air or gas, forcing liquid into the explosion chambers of the generator. I also control the explosions in an 45 automatic manner by the pressures from within the generator as will be more fully described herein.

In generating power in the manner herein described, I utilize a liquid operating in a 50 closed circuit under a high fluid pressure, said circuit comprising a low pressure tank and a high pressure tank, an internal com-

bustion pump, and a power transmitting medium. I further contemplate using the pressures of the explosions and the system for 55 closing electric circuits and timing the explosions in the explosion chambers of the generator, and also to utilize the pressures in either of the above mentioned tanks for automatically closing the timing circuit 60 when the pressure therein rises above a specified point, and to break said circuit when said pressure falls below said point. I further contemplate adapting my generator for 65 use with a broken circuit as hereinafter described.

Referring to the drawings, which illustrate suitable means for effecting my invention, and in which similar reference characters refer to similar parts throughout the 70 several views,—

Figure 1 is a vertical cross section of my generator.

Fig. 2 is a vertical cross section of another embodiment of my invention.

Figs. 3, 4 and 5, are vertical cross sections through an explosion chamber showing various methods of utilizing my timing device.

Fig. 6 is a diagrammatical plan view showing a plurality of pumps and power units 80 connected to the high and low pressure tanks of my generator and the ignition system used therewith.

In the drawings 1 indicates the internal combustion pump, 2 the low pressure tank, 3 the high pressure tank, 4 a passage connecting said tanks 2 and 3 and pump 1, and 5 a power unit connected to said high pressure tank 3 by pipe 6 and to low pressure tank 2 by pipe 7. Internal combustion pump 1 is fitted with any known ignition device as spark plug 8, and with any suitable fuel inlet valve 9 and exhaust 10, and an automatic timing device 11 hereinafter described in detail. Passage 4 is provided with an inlet valve 12 opening from low pressure tank 2, and an outlet valve 15 opening into high pressure tank 3. An automatic electric circuit closer is shown at 14 positioned in the wall of low pressure tank 2, although the same results as hereinafter described would be obtained if said circuit closer 14 were positioned in the wall of high pressure tank 3. A valve 15 is shown in the top of tank 2 and

a valve 16 in the top of tank 3. These valves may be of any design that will permit the pumping of a fluid, such as air, into their respective tanks. An inlet valve of ordinary 5 type is indicated at 17, and a discharge valve is located at 18. An ordinary cut-off valve is shown at 19 in pipe 6.

In operating my generator the same is filled with a liquid through valve 17 to a 10 level with a discharge valve as 18, said level being indicated by line A, and an explosive mixture is admitted into pump 1 through intake valve 9. Intake valve 9 is supplied with a combustible mixture through any desirable 15 mechanism not shown and is preferably of the reed type of valve. The vacuum following the explosion in pump 1 therefore sucks in a fresh charge of combustible mixture through the upper part of valve 9, the nature 20 of the valve serving to direct said charge into the upper portion of combustion chamber of said pump. The momentum imparted to the liquid by the explosion of the charge in pump 1 is sufficient to cause said liquid 25 to create a partial vacuum in pump 1 thereby drawing in a fresh combustible charge as described. The exhaust valve 10 being double headed is closed as shown when acted upon by a pressure within the pump and is 30 closed from the outside when drawn shut by the creation of a partial vacuum within said pump. When, however, a fresh charge has been drawn into pump 1 and the liquid starts to return into said pump due to the 35 pressure from tank 2, then the spring-like action of the inner member of valve 10 serves to hold said valve open for the exhaust of burnt gases until the rising liquid shuts the same, valve 9 having closed when the pressure 40 within the pump approximated atmospheric pressure. The compressible fluid as air, in tank 2 is now pumped to a pressure of one hundred pounds or more through valve 15, and the compressible fluid in tank 3 is 45 pumped to a pressure of two-hundred pounds or more through valve 16, the figures of course only indicating the approximate relative pressures in said two tanks. The liquid in low pressure tank 2 will be driven there- 50 from through valve 12 and into internal combustion pump 1 under a pressure of one hundred pounds, and the kinetic energy developed being upward of two hundred pounds will be sufficient to compress the explosive 55 charge in said pump which, when exploded, will force said liquid out through passage 4 and valve 13 into high pressure tank 3 with a pressure of upward of six hundred pounds, and of course still further 60 compressing the compressible fluid contained therein. Valve 19 in pipe 6 being opened the liquid will now flow from high pressure tank 3 to low pressure tank 2 through said pipes 6 and 7, and any power unit that may 65 be connected therebetween, thereby again

raising the pressure in low pressure tank 2 until the liquid is again driven therefrom into pump 1, whereupon another explosion occurs and the cycle of operations repeated.

Referring now more particularly to the 70 spark timing device, the circuit closer 14 above referred to forms a make-and-break device in the circuit, the ignition circuit comprising a battery 30 and coil 32 connected to the contact devices in the following manner. 20 is a diaphragm positioned in the wall of tank 2 and having a projecting pin 21 secured to the outer surface thereof. Secured to the outer surface of tank 2 and insulated therefrom is an electrode 22 having a pin 23 secured thereto in such a position as to engage pin 21 when diaphragm 20 is pressed outward, said electrode 22 being connected with the battery 30 by wire 24. Battery 30 is connected to 80 coil 32 by low tension wire 31, and coil 32 is connected to contact device 11 in pump 1 by low tension wire 44. At 45 is indicated a high tension wire connecting coil 32 to spark plug 8. In operation this device 90 works as follows: Electrode 22 is adjusted so that pin 21 cannot make contact with pin 23 when the pressure in tank 2 does not exceed one hundred pounds. A combustible mixture is now admitted into pump 95 1 through inlet valve 9 and the pressure in tanks 2 and 3 raised the necessary degree and said combustible mixture compressed as hereinbefore described, thereby closing contact device 11. The pressure 100 being raised in tank 2 to one hundred pounds or more diaphragm 20 will be forced outward and pin 21 caused to contact with pin 23, whereupon a current is caused to flow in the circuit above described and a spark 105 produced in pump 1 and the initial charge fired. It is now clear that as long as the pressure in tank 2 remains at or above a certain point the ignition circuit is closed at contact 21-23 but remains open at contact device 11 until the pressure in pump 110 1 is sufficiently raised to close the same whereupon the entire ignition circuit is closed and a spark ensues that fires the charge in pump 1, the resulting discharge of liquid from the pump lowering the pressure therein and breaking the ignition circuit at contact device 11 until the incoming liquid again raises the pressure sufficiently to close the same. If no method of 115 breaking the main circuit is provided the motor would soon blow itself to pieces as it would be working under higher and higher compression. With a make and break device as shown at 21-22 an explosion cannot occur in pump 1 until the pressure exceeds a certain amount in chamber 2. For instance, if it is desired to drive power unit 5 at a low speed the supply through pipe 6 is reduced by valve 19. Then explosions will oc- 120 125 130

cur in pump 1 until the liquid in chamber 3 is under great pressure and the liquid in chamber 2 under low pressure so that main circuit is broken at 21—22 and the explosions 5 stopped. The liquid is now driving power unit 5 at low speed and passing into chamber 2. When the pressure in chamber 2 exceeds a certain degree the main circuit is closed at 21—22 and an initial spark produced in pump 1 causing the first explosion. The main circuit being closed ignition device 11 will cause explosions at the proper intervals until said main circuit is again broken at 21—22 and the pressure in tank 15 3 allowed to decrease and the pressure in tank 2 to increase as hereinbefore described. The ignition means, when a plurality of pumps are used, is connected and operated as follows. Assuming that four pumps 35, 20 36, 37 and 38 respectively are connected by their respective passages 4^a, 4^b, 4^c and 4^d to low pressure tank 2 and high pressure tank 3 as hereinbefore described, power units 50 and 51 being connected to high pressure tank 25 3 by pipes 48 and 49 respectively, and to low pressure tank 2 by pipes 48^a and 49^a. Each of said pumps is provided with a spark plug as indicated at 8^a, 8^b, 8^c and 8^d respectively and with a make-and-break device, preferably a diaphragm as hereinbefore described, and indicated at 11^a, 11^b, 11^c and 11^d respectively. The coils for the respective pumps are indicated at 32^a, 32^b, 32^c 30 and 32^d. At 39 is indicated an insulated support carrying an electrode 40 provided with a contact pin 41 adapted to contact with pin 42 in arm 22 when diaphragm 20 is forced outward by the pressure in tank 2. Arm 40 is connected by wire 43 to wire 44^a which is 35 connected to coil 32^a and contact device 11^d in pump 38. Coil 32^a is connected by high tension wire 45^a to spark plug 8^a in pump 35, and coils 32^b, 32^c and 32^d being connected to spark plugs 8^b, 8^c and 8^d in 40 pumps 36, 37 and 38 by high tension wires 45^b, 45^c and 45^d respectively. Contact devices 11^a, 11^b and 11^c are connected to their respective coils 32^d, 32^c and 32^b by low tension wires 44^d, 44^c and 44^b. The contacts 45 at 11^a, 11^b, 11^c and 11^d are designed to close only under explosion pressure when a plurality of pumps are used, therefore it is necessary to provide some means of firing the initial charge in pump 35. This is accomplished by means of electrode 40 and the parts connected thereto as above described, for when the pressure in tank 2 reaches the required point diaphragm 20 is pressed outward until pin 21 comes in contact with pin 23 and pin 42 comes in contact with pin 41. The electric current is now closed through coil 32^a and a spark caused to pass in pump 35 igniting and exploding the charge therein. The forcing of liquid out of tank 60 2 and into tank 3 now causes the circuit to be broken at 41—42 (electrode 22 being a strong spring) but contact is maintained at 21—23 as long as the pressure in tank 2 is above a certain point, say one hundred pounds. The explosion in pump 35 closes contact 11^a which thereupon closes the circuit in which coil 32^d is an element and thereby causes a spark to pass in pump 36 thus producing an explosion therein. The explosion in pump 36 causes an explosion in 70 pump 37, which is followed by an explosion in pump 38 in the same manner. Contact 11^d in pump 38 being connected by low tension wire 44^a to coil 32^a which in turn is connected by high tension wire 45^a to spark 80 plug 8^a of pump 35, the explosion in pump 38 must cause an explosion in pump 35 and so on, so that the pumps must operate in rapid succession as long as the pressure in tank 2 is sufficient to keep the ignition circuit closed at 21—23. When the circuit is broken at 21—23 the pumps will cease to operate but will automatically start again the moment said circuit is again closed at 21—23 and 41—42. Any number of power 85 units may be operatively connected between high and low pressure tanks 3 and 2 by connecting them with conduits connecting one tank with the other or connecting main conduits leading from said tanks. In Fig. 95 6, 46 and 47 represent main conduits leading from tanks 3 and 2 respectively, and 48 and 49 are conduits connecting with main conduits 46 and 47 and having power units 50 and 51 respectively connected therein, 100 the supply of power being regulated by valves 52 and 53 respectively. Each power unit may thus be operated entirely independently of the other power units. Instead of using the timing device shown at 11, a 105 float operating contact device as shown at 28 may be used or an intake valve operated arm may be used as shown at 29 for firing the charges in the adjoining pump. It will be seen from the foregoing that the 110 generator operates in an automatic manner, pump 1 continuing to keep the pressure in tank 3 at a predetermined point automatically.

While the explosion controlling device is 115 shown mounted on tank 2 it may be mounted on tank 3, or it may be a float actuated by the rise and fall of the liquid in the tanks without departing from the spirit of the invention. Also the explosions instead of 120 being interrupted as herein described, may be reduced in volume as in a throttling engine, and a bypass conduit as 54 may be used between tanks 2 and 3 to allow enough liquid to pass from tank 3 to tank 2 to 125 allow the generator to continue in operation under reduced fuel charges, but it is preferable that it should operate in the manner herein described for high economy.

When my power generator is used as 130

shown in Fig. 2 there is no power unit positioned between high pressure tank 3 and low pressure tank 2 but the liquid used as a driving means for a power unit or mechanism of any kind is discharged from high pressure tank 3 through an outlet pipe as 25. To compensate for the liquid discharged at 25, an amount of liquid equal to that discharged is introduced through pipe 26 into 10 low pressure tank 2. This liquid is introduced by means of an injector 27 connected to high pressure tank 3, so that the amount of liquid in the generator will be a predetermined quantity whether the generator 15 is operating or not. A generator of this type may be used for driving ships by hydraulic force or for raising water by the injector method.

While I have described my invention in 20 the form which I consider best adapted to generate power in the method described, I do not restrict myself to details of construction as these may be modified or varied in many ways without departing from the 25 principles of the invention. I also contemplate using pressures from a few pounds to pressures sufficient to ignite heavy fuels by self ignition as in the Diesel engine, in which case the sparking devices may be removed.

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

1. The method of generating power which consists in subjecting a body of liquid to an 35 elastic fluid pressure of 50 lbs. or more, utilizing the elastic pressure to force liquid into explosion chambers thereby compressing combustible mixtures therein, utilizing the energy of the expanding charge when exploded to induce fresh combustible mixtures and to force liquid into a second body of liquid under an elastic fluid pressure of 100 lbs. or more and utilizing the elastic pressure of said second body of liquid to force 45 liquid through power transmitting devices and to replenish said first body of liquid.

2. The method of generating power which consists in subjecting a body of liquid to an elastic fluid pressure, utilizing the elastic 50 pressure to force liquid into an explosion chamber thereby compressing a combustible mixture therein, utilizing the energy of the expanding charge when exploded to induce a fresh combustible mixture and to force a second body of liquid to a higher elastic pressure, and utilizing said higher elastic pressure of said second body of liquid to force liquid through power transmitting devices into said first body of liquid and to 55 force liquid directly into said first body of liquid.

3. The method of generating power which consists in subjecting a body of liquid to an elastic fluid pressure, utilizing the elastic 60 pressure to force liquid into explosion cham-

bers thereby causing self ignition of the combustible charge contained therein, utilizing the energy of the expanding charge when exploded to induce fresh combustible mixtures and to force a second body of 70 liquid to a higher elastic fluid pressure, and utilizing said higher elastic fluid pressure of said second body of liquid to force liquid through power transmitting devices and to replenish said first body of liquid.

4. The herein described method of generating power which consists in subjecting a body of liquid to an elastic fluid pressure, utilizing the elastic pressure to force liquid into explosion chambers, thereby compressing combustible mixtures therein, utilizing the energy of the expanding charge when exploded to induce a fresh combustible mixture and to force a second body of liquid to a higher elastic pressure, and utilizing said 80 high elastic pressure of said second body of liquid to force liquid through power transmitting devices and to replenish said first body of liquid.

5. The herein described method of generating power which consists in subjecting a body of liquid to an elastic fluid pressure, utilizing said elastic fluid pressure to force liquid into explosion chambers thereby compressing the explosive mixture contained 90 therein, and to close an electric circuit thereby exploding the explosive mixture in one of said explosion chambers, utilizing the energy of the expanding charge through the liquid medium on power transmitting devices before the return of said liquid to the explosion chamber and to close an electric circuit thereby exploding an explosive mixture in another explosion chamber.

6. The herein described method of generating power which consists in connecting a plurality of explosion chambers to a high and a low pressure tank, subjecting the liquid in the low pressure tank to an elastic fluid pressure sufficient to force it into said 100 explosion chambers thereby compressing explosive mixtures contained therein and to close an ignition circuit thereby exploding the explosive mixture in one explosion chamber, and thereafter utilizing the energy 110 of the expanding charge in each explosion chamber to close an ignition circuit and thereby explode the explosive mixture in another explosion chamber and to force liquid through power transmitting devices before the return of said liquid to said explosion chambers.

7. The method of generating power which consists in subjecting a body of liquid to an elastic fluid pressure of 50 lbs. or more, utilizing the elastic pressure to force liquid into explosion chambers thereby compressing combustible mixtures therein, utilizing the energy of the expanding charge when exploded to force liquid into a second body 120

of liquid under an elastic fluid pressure of 100 lbs. or more and utilizing the elastic pressure of said second body of liquid to force liquid through power transmitting devices and to replenish said first body of liquid.

In testimony whereof I have hereunto

affixed my signature in presence of two subscribing witnesses.

PONTUS OSTENBERG.

Witnesses:

JOHN A. NAISMITH,
CLARENCE A. NAISMITH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."