METHOD OF GENERATING POWER BY INTERNAL COMBUSTION
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INVENTOR

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BY

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HIS ATTORNEY
To all whom it may concern:

Be it known that I, PONTUS OSTENBERG, a citizen of the United States, and resident of Los Gatos, in the county of Santa Clara and State of California, have invented certain new and useful Improvements in Methods of Generating Power by Internal Combustion, of which the following is a specific description.

My invention relates to the method of generating power by internal combustion wherein a revolving liquid is utilized to compress explosive mixtures, and the expansion of the said explosive mixtures when ignited is utilized to continue the liquid in revolution, as will be more fully described herein.

By compressing and expanding explosive mixtures in the manner indicated, one or more revolving fields of liquid may be utilized to compress an explosive cushion by stages of the revolving liquid, also the power may be absorbed by direct action, or by reaction as will be described herein.

Another advantage possessed by the present invention is that the compression in the combustion chambers will be equal to the pressure created by the circumferential velocity of the liquid, and may therefore be predetermined at will, and by compounding or staging of the revolving liquid high compression pressures may be secured.

In generating power in the manner described, liquid may be revolved in a horizontal or a vertical plane, and may be revolved within a circular chamber, or the generator and liquid may both be revolved in the same direction. In generating power in the manner described any type of liquid element may be used, such as water, mercury, acids, or molten metals.

The energy of the explosions may be absorbed by directing the liquid at a tangent to the revolving liquid, or by directing the liquid within the center of the revolving liquid. Also the energy may be absorbed by reaction when the generator and liquid are both revolved.

Various methods of introducing the explosive mixtures into the combustion chamber may be used, such as utilizing the outstroke from the combustion chamber to compress an air cushion within the center of the revolving liquid, or by utilizing a jet of liquid to compress and introduce the explosive mixture.

The accompanying drawings illustrate merely by way of example, means suitable for effecting the method herein described, and claimed. In the accompanying drawings—

Figure 1 shows a means for effecting the method by revolving liquid in a vertical plane.

Fig. 2 is a vertical section on line A—A of Fig. 1.

Fig. 3 is a means for effecting the method by revolving the liquid in a horizontal plane.

Fig. 4 is a section on line B—B of Fig. 3, but showing a different form of rotor.

Fig. 5 is a means for effecting the method by compounding the stages of revolving liquid, and utilizing the multiplied pressures to compress a cushion.

Fig. 6 is a section on line C—C of Fig. 5.

Fig. 7 is a means for effecting the method by revolving the liquid and generator and utilizing the energy by reaction.

Fig. 8 is a reduced section on line D—D of Fig. 7.

Figs. 9, 10 and 11 are diagrammatical views illustrating different methods of positioning the cylinders on the rotor chamber.

Fig. 12 illustrates a means for effecting the method by introducing liquid into the center of liquid revolving in a vertical plane.

Fig. 13 is a section on line E—E of Fig. 12.

Figs. 14 and 15 show different methods of utilizing the energy by reaction.

Fig. 16 shows a means of effecting the method by means of a large and a small rotor secured to the same shaft.

Similarly characters of reference refer to similar parts throughout the several views.

As illustrations of my improved method of generating power, I will describe in detail various constructions whereby the method herein described may be effected, Figs. 1 and 2 being first described as a typical example in which the liquid is revolved in a vertical plane. In these figures 1 is the rotor chamber and 2 a cylinder attached thereto provided with combustion chamber 3. Chamber 3 is provided with any suitable ignition means as hot-ball 4 and is provided with a port 5 discharging into rotor chamber 1 at an angle as shown. An intake port 6 provided with valve 7 permits the passage of liquid from chamber 1 to chamber 3. A shaft as 8 is revolubly mounted in chamber 110 and has a hub 9 secured thereto said hub 9 carrying arms 10 to which are secured a
plurality of disks as 11, thus forming rotor 12. A conduit is shown at 13 connecting the central part of chamber 1 with the lower part of cylinder 2 and is provided with a fuel intake port 14, normally closed by valve 15 and connected in any suitable way to a source of fuel supply not shown. The discharge end of conduit 13 forms cylinder 16 in which is fitted valve 17 secured to stem 18, said stem 18 also having valve 19 secured thereto, the same fitting tightly against seat 20 in port 21 when valve 17 is in the position shown, valve 17 being of larger diameter than valve 19. At 22 is shown an arm mounted on cylinder 2 and engaging stem 18. At 23 is shown a spring operating between arm 22 and valve 19. Revolving liquid in a vertical plane in chamber 1 will cause liquid to rise in cylinder 2 through valve 6, compressing an elastic cushion in combustion chamber 3. An expansion of this cushion by an internal combustion of air and fuel will force liquid through port 5 around the periphery of chamber 1 rotating rotor 12. This will continue the liquid in revolution in chamber 1 creating pressure therein which will return the liquid to cylinder 2 as soon as the pressure in combustion chamber 3 has fallen below the pressure in chamber 1. The exhaust of the burnt gases and introduction of fresh gases may be effected in the following manner: Exhaust valve 19 is forced against seat 20 from the outside by spring 23. As valve 17 is of a larger diameter than valve 19 a pressure in chamber 3 will force valve 17 outwardly thereby holding valve 19 tight against seat 20. When chamber 1 has received all of the liquid it will occupy space as shown at F, F to the circumference of the chamber, and in the center there will be a small space containing air or gases. As the liquid is revolved in chamber 1 it will be forced into cylinder 2 through port 6, liquid receding in chamber 1 to G, G. As the liquid recedes from F to G, a vacuum will be produced in the center of the revolving liquid, thereby drawing in a fresh charge of air or gas through port 14 and valve 15. As soon as an expansion of the compressed cushion in chamber 3 takes place, liquid will be forced from cylinder 2 into chamber 1. As liquid is forced into chamber 1 the space in chamber 1 contracts from G to F, compressing the gases within the center of the revolving liquid, the cushion entering conduit 13 and forcing valve 17 into combustion chamber 3 which will open exhaust valve 19 by means of stem 18. As soon as valve 17 opens into combustion chamber 3 the gases in conduit 13 will be discharged into combustion chamber 6, forcing out the exhaust gases through port 21. As the pressure in conduit 13 will now fall, spring 25 will close valves 19 and 17 and a return of liquid from chamber 1 to cylinder 2 will compress the new charge in combustion chamber 3, which will be ignited by hot ball 4 and the operating cycle repeated.

It should here be pointed out that the new charge will enter cylinder 2 in advance of the liquid from chamber 1 because of its elasticity and because it is a more perfect fluid and passes through valve 17 and into chamber 3 in cylinder 2 in the instant during which the liquid changes its direction of motion. When the generator is in full operation the discharge of the burnt gases and the induction of a fresh combustible charge is practically instantaneous, and as stated above takes place in the brief moment when the outward movement of the liquid through port 5 is overcome by the pressure of the liquid at the periphery of rotor 12. Although the pressure of the liquid at the periphery of rotor 12 may be greater than the pressure of the compressed charges at the center of said rotor 12 and in chamber 16, the greater elasticity and fluidity of said compressed charges more than counterbalances the greater pressure of the liquid.

Figs. 3 and 4 may now be described as a typical means for effecting the method when a liquid revolving in a horizontal plane is used.

In this type the liquid is discharged from chamber 3 through port 24 and valve 25 into chamber 26 in the center of chamber 1. Valve 25 is normally held in place by spring 27. Connecting chamber 26 with chamber 100 are ports 28 positioned at an angle so as to discharge obliquely against rotor 12. Conduit 23 connects the outer portion of chamber 1 with the lower end of cylinder 2 and is normally closed by valve 30. I have here shown a chamber 31 connected to cylinder 16 by neck 32, chamber 31 being connected to any suitable source of fuel supply not shown, by port 33 normally closed by valve 34. An injector 35 is shown passing from the periphery of chamber 1 to passage 32. Revolving liquid in chamber 1 will cause liquid to pass through conduit 19 and valve 20 into chamber 3 and compress a charge therein. The expanding charge will force liquid through port 24 into chamber 26 and from there through ports 28 against rotor 12 thereby continuing the same in motion, spring 27 closing valve 25 when the force of the expanding charge has been sufficiently expended. A fresh charge is introduced as follows: Exhaust valve 19 is forced against seat 20 from the outside by spring 23. As valve 17 is larger in diameter than valve 19 a pressure in chamber 3 will force valve 17 outwardly thereby holding the valve 19 tight against seat 20. As soon as the expansion of the cushion in chamber 3 has taken place, driving liquid from chamber 3 into chamber 1 and revolving rotor 12, the
revolving liquid will create sufficient pressure in cylinder 16 to force valve 17 inwardly and inject a fresh charge drawn through port 33 into said chamber 3, the incoming fresh charge and the rising liquid from conduit 13 driving out the burnt gases through port 21. The increasing pressure in chamber 3 aided by spring 23 now closes valves 17 and 19 and another expansion is effected.

Injector 35, neck 32, and chambers 16 and 31 are so proportioned that a relatively fine stream of liquid is injected through a small nozzle 32 into a relatively large chamber 16, chamber 31 being merely large enough to admit a fresh charge in the rear of neck 32. By this method of construction a charge of combustible mixture is held compressed in chamber 16 until valve 17 is forced open, whereupon chamber 16 is emptied of the charge and the small amount of liquid collected therein. When valve 17 is again closed the fine injector 33 continues to force fresh combustible mixture into chamber 16 and compress the same until valve 17 is again opened.

In Figs. 5 and 6 is shown the compounding or staging method. A shaft 36 is shown in a seat 37 and passing through three chambers 38, 39 and 40, each chamber having a rotor as 38, 39 and 40 positioned therein and secured to shaft 36. Chambers 38 and 39 are connected by conduits 41. Chambers 38 and 39, and 39 and 40 are connected by passages 39 and 40 respectively. A port to chamber 3 is shown at 42. If the rotors are revolved by a discharge of liquid through port 42 and a pressure of 30 pounds is generated in chamber 38 the pressure in chamber 39 will be 60 pounds and the pressure in chamber 40 will be 90 pounds, which will be the pressure available for compressing a combustible mixture in chamber 3.

These figures are of course approximate. If the liquid in chamber 38 is driven outwardly by the revolving of rotor 38 it will escape through conduits 41 and 39 to rotor 39. Assuming that the pressure imparted to said liquid by rotor 38 is 30 pounds the said pressure will now be increased to, say, 60 pounds through the action of rotor 39. The liquid now being forced outwardly and upwardly through the combined action of rotors 38 and 39 and exerting a pressure of 60 pounds will pass through the only available outlet, conduit 40, into chamber 40. In chamber 40 the liquid is subjected to the action of rotor 40 and therefore the liquid, which is already exerting a pressure of 60 pounds, will be driven outwardly in chamber 40 with a force sufficient to raise the pressure thereof to, say, 90 pounds. In a generator of this type it will, of course, be necessary to keep the same filled with liquid so that all of the rotors will be submerged and only sufficient room left in cylinder 2 for the compression and expansion of the combustible charges, and all of the parts so proportioned that when the charge in chamber 3 is compressed ready for ignition there will be some liquid in chamber 38 being acted upon by rotor 38. Chamber 38 will be filled with liquid when the charge in chamber 3 is expanded to its greatest extent. The liquid travels to compression in the direction indicated by the arrows. The advantage of this type of generator is that a high compression may be secured with low peripheral velocity of the liquid within the chambers 38, 39 and 40, and as a result there will be less friction loss in the revolving liquid. The same valve mechanism and means of introducing the combustible mixtures as shown in Fig. 1 may be used but has been omitted for the sake of clearness.

In Figs. 7 and 8 is shown a type of generator in which the liquid and generator are both revolved in the same direction and a reaction turbine is secured. In these figures 43 is a base carrying arm 44 and bearing 45. Bearing 45 carries journal 46 which is secured rigidly to generator body 47. Generator 47 comprises rotor 48 connected to cylinders 49 and 50 and combustion chambers 51 and 52 by ports 53 and 54. Rotor 48 is also connected to cylinders 49 and 50 by ports 53, 56 and 57, said ports 57 being controlled by valves 58. Shaft 59 is rigidly secured to arm 44 and has rotor 60 rigidly secured to its lower end, generator body 47 being provided with a bearing 61 so that it may be revolved freely about shaft 59. The rotor 60 is here shown built up of a number of vanes 62 secured to disk 63 which in turn is secured to spokes 64, spokes 64 being secured to shaft 59 through the medium of hub 65.

When liquid is driven against stationary vanes 62 through ports 53 and 54 by the expansion of charges in chambers 51 and 52, a rotary motion is imparted to generator body 47. This liquid passes through ports 55 into chamber 56, the revolving of said generator 47 driving said liquid outwardly in said chamber 56 and upwardly through ports 57 to again compress combustible charges in chambers 51 and 52. In a reaction turbine of this nature it is necessary to provide vanes 62 in order to prevent the liquid driven into chamber 48 from continuing in motion in the wrong direction and enabling it to drop into chamber 56 where the proper motion and force is imparted to it by the revolving generator body 47. The arrows indicate the direction of motion of said generator in the present instance. The same valve mechanism and method of introducing the fresh charges, and the same ignition
may be used as shown in Fig. 1, the corresponding parts in Fig. 7 being indicated by a similar numeral followed by the letter "a". In this instance the central part of the chamber 48 itself forms a part of the conduit 13 in which the valve 16 is positioned, and the mixture is delivered to port 14 by a passage through shaft 59 as indicated at 59a.

Figs. 12 and 13 illustrate a type of generator similar to that shown in Fig. 3 except that the liquid revolves in a vertical plane, the same type of injector mechanism for the introduction of fresh charges and the exhaust of burnt gases being used. In this form, however, valve 30 is provided with a pin 66 operating in socket 67 and is held normally closed by spring 68. The liquid discharged from cylinder 3 forces valve 30 open and passes through conduit 12 to chamber 26 and through ports 28 against vanes 29 causing the same to rotate. The revolving liquid in chamber 1 will be continued in revolution by rotor 12 and forced upwardly through valve 25 into chamber 3 where it compresses another combustible charge.

Fig. 16 shows another embodiment of this invention in which a large rotor 69 in chamber 1 and a relatively smaller rotor 70 in chamber 70a are secured to shaft 71, there being open communication between said chambers 1 and 70a. Combustion chamber 3 is so positioned with relation to chambers 1 and 70a as to permit the placing of an inlet check valve 72 between said chamber 3 and chamber 1 and 70a. The relation between chamber 3, port 73 and rotor 70 is the same as that between chamber 3, port 5 and rotor 12 in Figs. 1 and 2. If, then, the device is in operation and a combustible charge is expanded against a liquid in chamber 3, said liquid is driven through ports 73 against rotor 70 and said charge is caused to rotate in the same manner as rotor 12 is caused to rotate in Figs. 1 and 2. The revolving of rotor 70 operates rotor 69 through the medium of said chamber 3. As the rotation of rotor 70 continues the liquid in revolution around the perimeter of chamber 70a said liquid seeks to escape from said chamber and passes into the larger adjoining chamber 1 where it is continued in revolution by rotor 69. The force of the expanding charge in chamber 3 now having been expended and a fresh combustible charge introduced, the liquid in charge chamber 1 is caused to pass through check valve 72 and the exhaust gases are expelled and the fresh charge compressed. The exhaust and intake valves and ignition have been omitted from this and the other embodiments for the sake of clearness, being already described and shown in connection with Fig. 3.

Fig. 15 illustrates a type of reaction turbine in which the vanes are dispensed with. In this embodiment the cylinders 2 and generator body 47 are rigidly positioned with relation to each other, each of the cylinders having an inwardly projecting portion directed around the periphery of generator body 47 as indicated at 74 and 75 respectively, and the whole generator revolving mounted in any suitable manner as, for instance, described in connection with Fig. 7. When this device is in operation, if a compressed combustible mixture is expanded in chambers 3 the liquid is driven out of conduits 74 and 75 and directed around the inner perimeter of generator body 47. Generator body 47 being freely revolvable as hereinbefore described in connection with Fig. 7, the force of the liquid discharged as above set forth will impart a rotary motion to said generator because up to the time of said expansion of a combustible charge all of the liquid in said generator is traveling in the same direction as the generator. Since most of the energy developed by the expansion of said combustible mixture is expended in imparting a rotary motion to generator 47, said generator will quickly impart a rotary motion to the liquid contained therein and force the same to reenter conduits 74 and 75 and discharge the exhaust gases and compress a fresh charge.

At 76 are shown pistons positioned in cylinders 2 so that when liquid moves outwardly to compression an even compression of the combustible mixture will be obtained. This would not be the case if no solid piston were used as the liquid would tend to advance unevenly.

In Fig. 14 is shown a type of reaction turbine similar to that shown in Fig. 15 but in which the combustion chambers are turned back upon themselves, thereby obviating the necessity of using solid pistons as shown in Fig. 15. Figs. 9, 10 and 11 show that one or more 110 cylinders may be attached to the generator in various positions and still the desired result will be obtained.

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

1. The method of utilizing heat energy which consists in compressing and igniting an expansible charge against liquid in a revolving generator and moving both liquid and generator by the expansion of said charge.

2. The method of utilizing heat energy which consists in compressing and igniting an expansible charge against liquid in a revolving generator, moving liquid by the action of said expanding charge, and moving the generator by the reaction of said expanding charge.

3. The method of utilizing heat energy
which consists in compressing and igniting an expansible charge against liquid in a revoluble generator, moving liquid by the action of said expanding charge, moving the generator by the reaction of said expanding charge, and utilizing the inertia of the moving generator to force liquid to compress an expansible charge.

4. The method that consists in revolving both liquid and generator in the same direction, compressing an elastic cushion in the generator by liquid in the generator, expanding the cushion by heat, and utilizing the expansion to force liquid and to continue the generator in revolution.

5. The method that consists in revolving both liquid and generator in the same direction, compressing elastic cushions in the generator by liquid in the generator, expanding the cushions by heat, and utilizing the expansions to continue the generator in revolution.

In testimony whereof I have hereunto affixed my signature this 12th day of June, 1916.

PONTUS OSTENBERG.