W. L. DEMPSEY.

PROCESS OF AND APPARATUS FOR PRODUCING POWER.

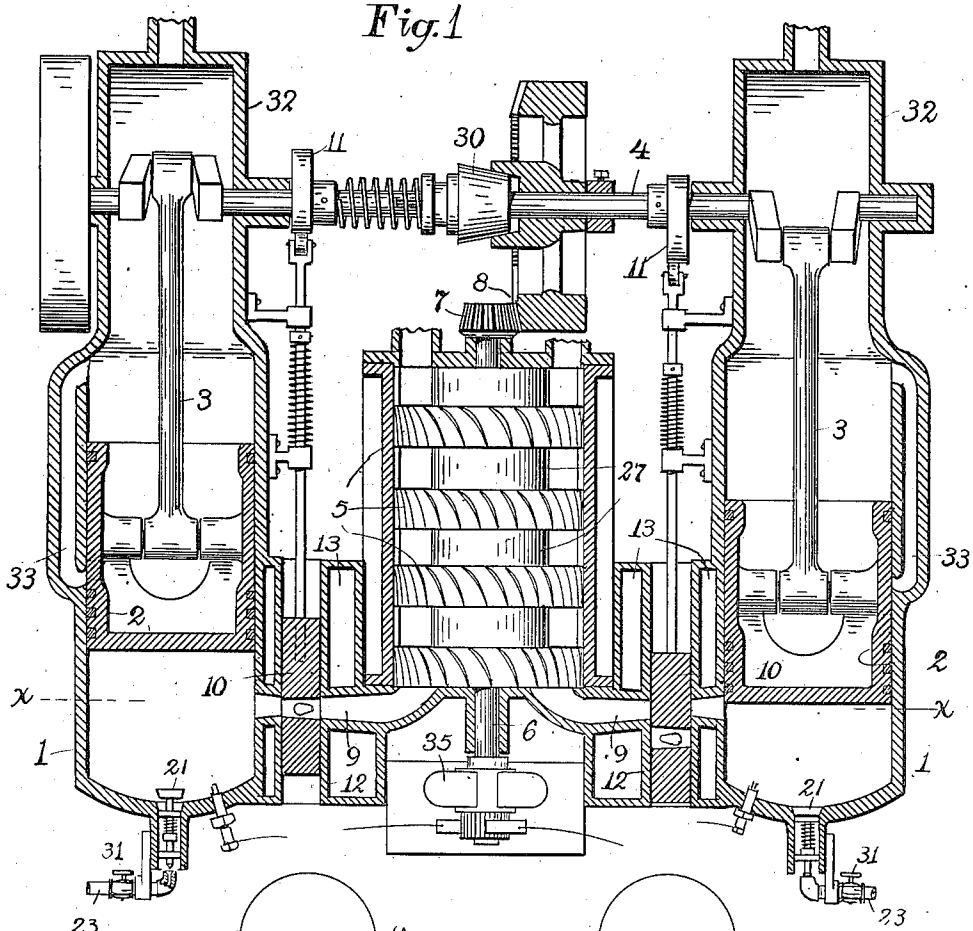
APPLICATION FILED JULY 11, 1913.

1,176,207.

Patented Mar. 21, 1916.

2 SHEETS—SHEET 1.

Fig. 1



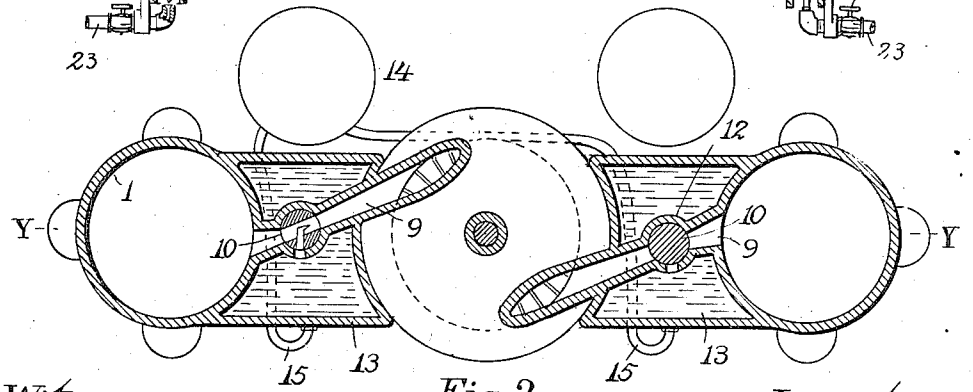


Fig. 2

Witnesses,

A. J. McIntosh.

C. C. Munster

Inventor,

William L. Dempsey;

By

Attorney.

W. L. DEMPSEY.

PROCESS OF AND APPARATUS FOR PRODUCING POWER.

APPLICATION FILED JULY 11, 1913.

1,176,207.

Patented Mar. 21, 1916.

2 SHEETS—SHEET 2.

Fig. 3

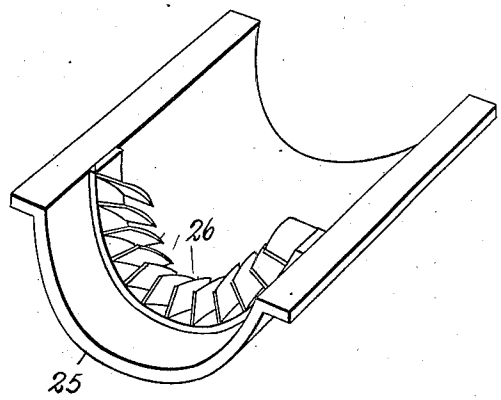
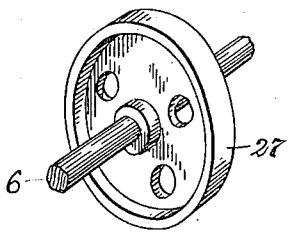


Fig. 4



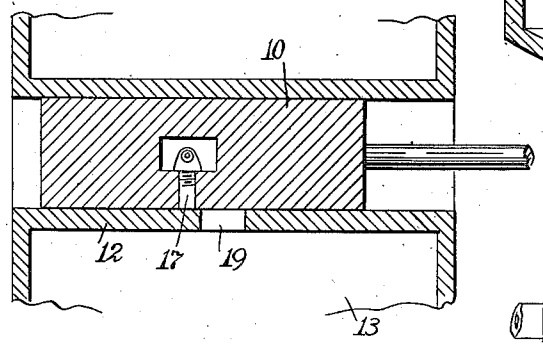


Fig. 6

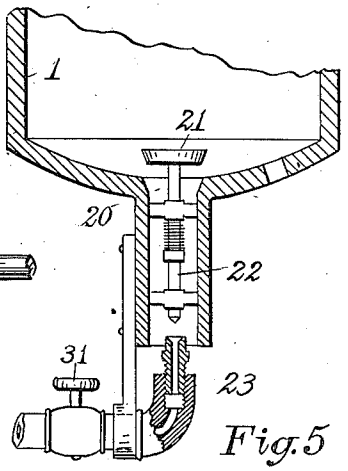


Fig. 5

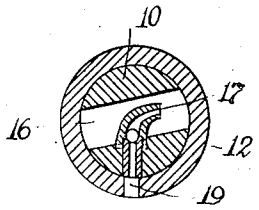


Fig. 7

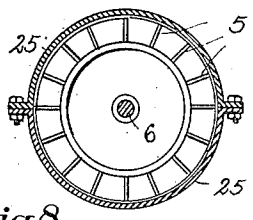


Fig. 8

Witnesses;

H. J. McCulloch.

E. C. Munsler

Inventor,

William L. Dempsey;

By A. B. Graham

Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM L. DEMPSEY, OF SOMERVILLE, MASSACHUSETTS.

PROCESS OF AND APPARATUS FOR PRODUCING POWER.

1,176,207. Specification of Letters Patent. Patented Mar. 21, 1916.

Application filed July 11, 1913. Serial No. 778,532.

To all whom it may concern:

Be it known that I, WILLIAM L. DEMPSEY, a citizen of the United States, and a resident of Somerville, in the county of Middlesex and Commonwealth of Massachusetts, have made certain new and useful Improvements in Processes of and Apparatus for Producing Power, of which the following is a full and exact description.

As is well known, the usual types of internal combustion engines, while much more economical than steam engines for the production of power, are nevertheless quite wasteful of thermal units, and hence of power, in several ways. In the first place, the high degree of heat produced by the explosion, or instantaneous combustion, of the charge, is ordinarily gotten rid of—that is, thrown away,—either by direct radiation, or by a water jacket, or both, and no power is derived from such wasted thermal units. In the second place, the thermal units contained in the exhaust, and the residual power contained therein, are also usually wasted, particularly in engines for motive power purposes. Moreover, the usual types of internal combustion engines do not furnish a constant torque, or turning effect, upon the crank shaft, but apply the power derived from the explosive charge in an intermittent or spasmodic way. It is also less effective than it would be if a heavier charge could be drawn into the cylinder at each charging stroke of the piston.

The purpose of my invention is the devising of a process, and the construction of mechanism for carrying the same into effect, whereby to conserve a large proportion of the thermal units ordinarily lost as above recited, and to convert the same into power.

My purpose is further the effecting of means whereby an almost constant torque or turning action will be exerted upon the crank shaft, and for charging the cylinder with a heavier charge than has heretofore been done.

Further purposes are the provision of means for cooling the combustion chamber from within and the utilization of the cooling substance for the immediate production of power; the construction of a turbine engine driven by an explosive charge, and the effecting of means for lowering the temperature of the exploding charge before it enters the turbine cylinder; and, finally, the construction of an engine which is simpler, more compact, more economical, lighter and more efficient than any with which I am familiar.

To such ends I have devised a process wherein the initial energy of an exploding charge is utilized for the production of power, and then such partly expanded charge is delivered to a separate but connected power-producing means for securing the balance of power contained in such charge.

My process further consists in cooling by means of a fluid the inner surface of the first power-producing means, and in utilizing the energy of such vaporized fluid for the propulsion of the second power-producing means; and also in cooling by a suitable fluid the partly exploded charge on its way to the second power-producing means, and utilizing the energy of such vaporized fluid for added propulsive effort.

The mechanism I have devised for carrying my process into effect consists essentially of a reciprocating engine geared to a turbine engine so that the latter will rotate at a far higher speed, and adapted to discharge its exploded charge to the vanes of the turbine at an early point of the reciprocating engine's stroke; the reciprocating engine's cylinder being preferably constructed to take in air, or water, or both, before the termination of its working stroke, and where water is taken in, to deliver the steam therefrom to the vanes of the turbine for the development of further power; and the diverging nozzle, through which the exhaust from the reciprocating engine to the turbine is conducted, being further adapted to be cooled by water and to deliver steam generated by such cooling as added propulsive means for the turbine.

Referring to the drawings forming part of this specification, Figure 1 is a sectional plan view on the line Y—Y in Fig. 2 of an engine embodying my improvements and adapted for carrying my process into effect. Fig. 2 is a cross section of the same on the line X—X in Fig. 1. Fig. 3 is a perspective view of a portion of the turbine cylinder, showing a part of one of the stationary vane members. Fig. 4 is a perspective view of one of the drums or wheels composing a part of the rotor of the turbine. Fig. 5 is a sectional view on a somewhat larger scale than Fig. 1, of a portion of a reciprocating engine cylinder and its valve. Fig. 6 is a longitu-

dinal section of a piston valve, and Fig. 7 is a cross section of the same. Fig. 8 is a cross section of the turbine engine.

In carrying my process into effect, I prefer to employ two auxiliary power and charging cylinders of substantially a well known reciprocating two-cycle type, coacting with a single turbine cylinder or rotor. Figs. 1 and 2 illustrate such an arrangement, the reference numeral 1 designating the reciprocating cylinders; 2, the trunk pistons connected by pitmen 3 to a common crank shaft 4; 5, the movable vane-members of the turbine, and 6 the shaft thereof connected to said common shaft 4 by bevel gears 7, 8 adapted to permit the shaft 6 nearly ten times the speed of said crank shaft.

From a point of each cylinder 1 to be uncovered by its piston immediately after half working-stroke, extends a diverging nozzle 9 adapted to deliver the discharge from said cylinders to the vanes of the turbine; each nozzle being controlled by a piston valve 10 operated by a cam 11 on the crank shaft. The case 12 of each piston valve is provided with a chamber 13 kept full of water from a receptacle 14 communicating through a pipe 15 entering the floor of the chamber. As shown in Figs. 2, 6 and 7, water is admitted within the passage way 16 through each piston valve by means of a small vent 17 coacting with a port 19 through the case 12 at a certain point of the valve's travel.

Each cylinder 1 is formed with a port 20 normally closed by a puppet valve 21, the stem 22 of which is formed to act as a needle valve for closing simultaneously the water pipe 23. When said valve is opened, as by a vacuum within the cylinder, both air and water are admitted together.

Within the turbine case 25 are a series of movable vane-members 5 fixed upon the shaft 6 and rotative therewith, while fixed to the interior of said case are the stationary vane-members 26, shown in Fig. 3, positioned between the movable vanes but not in actual contact therewith. To inclose the open inner ends of the vanes 26, drums 27 (Fig. 4) are fixed on the shaft 6, as shown in Fig. 1. Hence when a blast of gas strikes the nearer movable vanes in a direction substantially parallel with the shaft 6, such blast will react between the movable vanes and the stationary vanes in the usual reactionary manner, until all the power residing in the blast has been consumed and the shaft is rotating with its maximum speer. As shown in Fig. 2, I prefer to have the nozzles 9 connect with the head of the turbine case at diametrically opposite points.

The steps of my process are as follows: In starting the engine, the clutch 30 is thrown to unclutch the turbine section, and the cocks 31 are closed to shut off the water from the pipes 23. Then the shaft 4 is cranked up in the usual manner, sucking in air through the ports 20, then forcing a charge from the crank cases 32 into the cylinders 1 to mix with such air, until proper ignition causes an explosion of one or both charges and the reciprocating cylinders begin to operate. The exhaust from the cylinders discharges into the turbine, but, the latter being unclutched and running idle, gives no resistance to the exhaust nor to the starting of the crank shaft and connected parts. The cocks 31 are left closed until after the turbine has been clutched to the shaft 4, and the cylinders begin to get quite hot, then the water is turned on and permitted to spray into the cylinders for cooling them. Now, immediately after a piston begins its working stroke, its valve 10 opens the associated diverging nozzle 9, but the latter remains closed by said piston until slightly past half stroke. The instant, therefore, that its crank reaches or passes 90°, the diverging nozzle is unclosed and the exhaust permitted to discharge to the vanes of the turbine. So great is the velocity and consequent momentum of the outrushing gas that it leaves behind it a partial vacuum or rarefaction sufficient to open the pop valve and admit both air and a strong jet of water. As this water strikes the surfaces within the cylinder, the great heat of the latter instantly flashes the water into steam, and such steam pressure acts both against the piston to aid it in the remainder of its travel, but mainly to discharge through the diverging nozzle against the vanes of the turbine and continue the rotation of the latter. The quantity of water thus admitted to the cylinder is adjusted for the proper cooling of the same, so that no exterior cooling is required, further than radiation. Just before each piston reaches the end of its working stroke and uncovers the mouths of the by-passes 33, its valve 10 is made to close the nozzle 9. Hence, when such mouths are unclosed, the charge rushes into the cylinder and mixes with the moistened air therein, in a proportion to give a most powerful mixture. The piston now returns, the mixture is compressed and ignited, and the cycle repeated. It should be noted that by exhausting at half stroke, and then filling the cylinder with air and steam, practically every portion of the products of combustion are forced therefrom; whereas in the usual two cycle engine, a considerable proportion of the exhaust remains to be mixed with the charge, and, moreover, a quantity of the charge itself escapes with the exhaust before the exhaust port is closed. Hence, since in my device none of the exhaust remains to weaken the mixture, but the cylinder is filled with pure hydrocarbon and oxygen; and, moreover, since none of the charge escapes from the cylinder, every explosion is of maximum

power and economy, as compared with the usual engine. Although the action of the reciprocating cylinders is thus made effective and economical, such cylinders are not the primary power-producing means of my engine, but merely preliminary to the operation of the turbine. They are in effect compression chambers for the turbine, although adapted to add their quota to the power communicated to the drive shaft 4.

In previous attempts at combining reciprocating and rotary hydrocarbon engines, the two were geared together to run at equal numbers of revolutions per unit of time. They have never, however, proved successful, and the reason therefor I have discovered to be the fact that, among other causes, the motion of the turbine is so slow as to be wholly without efficiency. I have, consequently, geared the turbine to run several times faster than the reciprocating cylinders,—preferably ten to one. Another cause for such inefficiency of former attempts was owing to the considerable distances the exhaust was required to travel to reach the turbine. In my construction I reduce such travel to a minimum by positioning the reciprocating cylinders parallel with the rotary cylinder and close beside the same, in practice having the distances less even than illustrated in Figs. 1 and 2.

Another difficulty in connection with a turbine explosion engine is found to consist in the rapid erosion and injury to the thin vanes thereof by the intensely hot gases. To remedy this, I have provided the water jet entering each nozzle 9 through the small vent 17, as already described. When the piston valve 10 is presented to its open position, as it is during the first half of the working stroke of each piston, said vent is directly above the opening 19 (Fig. 7) of the valve case 12, and a tiny stream of water is consequently being forced by gravity into the nozzle 9 and converted by the residual heat of the parts into steam, which travels toward the turbine vanes. The instant the piston uncovers its nozzle 9, the exhaust from the cylinder bursts past the vent 17 and impinges upon the turbine vanes, adding to their velocity. The vanes having already been cooled somewhat by the steam, and the exhaust itself being materially reduced in temperature by the steam, said vanes are kept from receiving an excessive and injurious heating. Moreover, as the exhaust shoots past the vent 17, a suction is produced which causes a still larger flow of water therefrom. This also flashes into steam, further cooling the exhaust and metal parts, and greatly increasing the volume of turbine-operating fluid, so that it is a fair question whether the turbine is not actuated by steam pressure more than by gas pressure. However that may be, it is certain that a very large proportion of the heat ordinarily lost in an internal combustion engine, is in my engine converted into propulsive energy, while at the same time the engine is saved from the injurious effects ordinarily associated with explosion engines, arising from the intense heat generated by the instantaneous combustion.

It should be noted further that the highest temperature and the maximum pressure are first received in the reciprocating cylinders which are far more able to withstand the same than are the vanes of the turbine; that each reciprocating piston receives but half the expansive effect of the exploded charge, while the turbine receives not only the final half, but, in addition, the large volume of superheated steam generated both in the cylinders and in the nozzles; and that the torque upon the drive shaft is continuous when but a single reciprocating cylinder is combined with the turbine, since the power communicated to said shaft by the turbine is continued from the instant of the uncovering of the nozzle until the piston completes its compression-stroke, this long continuance coming from the action of the steam on the vanes of the turbine and the prolonged generation of such steam. By combining two such cylinders with the turbine, not only is more power generated for the same turbine, but the torque on the crank shaft is thereby rendered not alone continuous, but practically uniform in intensity. By having the turbine run at a high velocity compared with the reciprocating engine, the former is given an efficiency wholly lacking in a slower rotor. Such speed seems also to aid in the production of the vacuum needed in the feeding in of the air and water to the reciprocating cylinder. Further, the high speed of the turbine's shaft renders it practicable to mount thereon a magneto or generator 35 for ignition and lighting purposes.

What I claim is:

1. The process of producing power by internal combustion consisting in compressing a combustible mixture in a combustion chamber having a piston, igniting the same, utilizing a portion of the expansive energy to actuate the piston, releasing the partially expanded gases from the combustion chamber into an expanding nozzle, interposing a body of water in the path of said gases to cool said gases and by its vaporization to increase the volume thereof and utilizing the velocity of the product to actuate a rotatable power transmitting member.

2. The process of producing power by internal combustion consisting in compressing a combustible mixture in a combustion chamber having a piston, igniting the same, utilizing a portion of the expansive energy

to actuate the piston, releasing the partially expanded gases from the combustion chamber into an expanding nozzle, introducing a body of water in the path of said gases to cool said gases and by its vaporization to increase the volume thereof, adding to the gases a further amount of water by inspiration and utilizing the velocity of the product to actuate a rotatable power transmitting member.

3. The process of producing power by internal combustion consisting in introducing by inspiration into a suitable combustion chamber having a piston definite amounts of air and water, adding thereto a charge of over-rich hydrocarbon, compressing the mixture thus obtained, igniting the same, utilizing a portion of the expansive energy thus obtained to actuate the piston, releasing the partially expanded gases and directing the same upon the blades of a rotary power transmitting member, simultaneously supplying to said exhausting gases a fluid adapted to be volatilized by the heat of said gases and thereby to supplement the volume and velocity of the same.

4. The process of producing power by an internal combustion engine having a cylinder and a piston, consisting in introducing by inspiration during the exhaust stroke of the piston a definite amount of air and water, adding thereto a charge of over-rich combustible gas, compressing the mixture thus obtained, igniting the same, utilizing a portion of the energy thus created to actuate said piston, exhausting the gases when partially expanded, treating the same with a body of liquid adapted upon contact with said gases to cool the same and by vaporization to increase the volume thereof and utilizing the volume and velocity of the product to impel a rotary power transmitting member.

5. A power producing means comprising a reciprocating internal combustion engine having a cylinder and a piston, means for supplying said cylinder with a hydro-carbon mixture, means for igniting said mixture after compression by said piston, a turbine having blades operatively connected with said engine, a conduit for receiving the exhaust gases from said cylinder and delivering them against the vanes of said turbine, a valve located at an intermediate point of said conduit and having an opening, said valve being adapted for closing said conduit and for presenting said opening thereto and means for delivering water into said opening.

6. A power producing means comprising a combustion cylinder and a piston, means for supplying a hydro-carbon mixture to said cylinder, means for igniting said mixture after compression by said piston, a turbine, an expanding nozzle leading from said cylinder at a point substantially at the midstroke of said piston to said turbine, a valve located in said conduit, means for supplying water to said valve and means for actuating said valve in synchronism with said piston whereby said gases being exhausted upon the midstroke of the piston will impinge upon the pool of water contained in said valve so that said gases will be cooled and their volume supplemented by the vaporization of said water, means for introducing additional water into said gases by inspiration whereby the resulting cooled product will be caused to impinge upon the blades of said turbine.

7. A power producing means comprising a reciprocating internal combustion engine having a cylinder and a piston, a conduit disposed to receive the discharge from said engine at half working stroke, a turbine having vanes and operatively connected with said engine, a conduit adapted to deliver and discharge against said vanes, a valve having an opening, said cylinder having an exhaust port at half stroke connecting with said conduit, means for moving said valve to present said opening to said conduit before the engine piston reaches half stroke and means for delivering water into said opening.

8. The combination of a reciprocating internal combustion engine, a turbine engine operatively connected therewith, a nozzle for directing the exhaust from the reciprocating engine to the turbine engine for the actuating of the latter, means for surrounding the exterior of said nozzle with water, a piston valve controlling said nozzle and having a transverse hole through it composing a section of said nozzle, said valve having an opening connecting with the surrounding water and a piston valve having a vent adapted periodically to coöperate with the last named opening for the admission of water to the nozzle.

In testimony that I claim the foregoing invention, I have hereunto set my hand this 9th day of July, 1913.

WILLIAM L. DEMPSEY.

Witnesses:
A. B. UPHAM,
HARRY SILVERMAN.