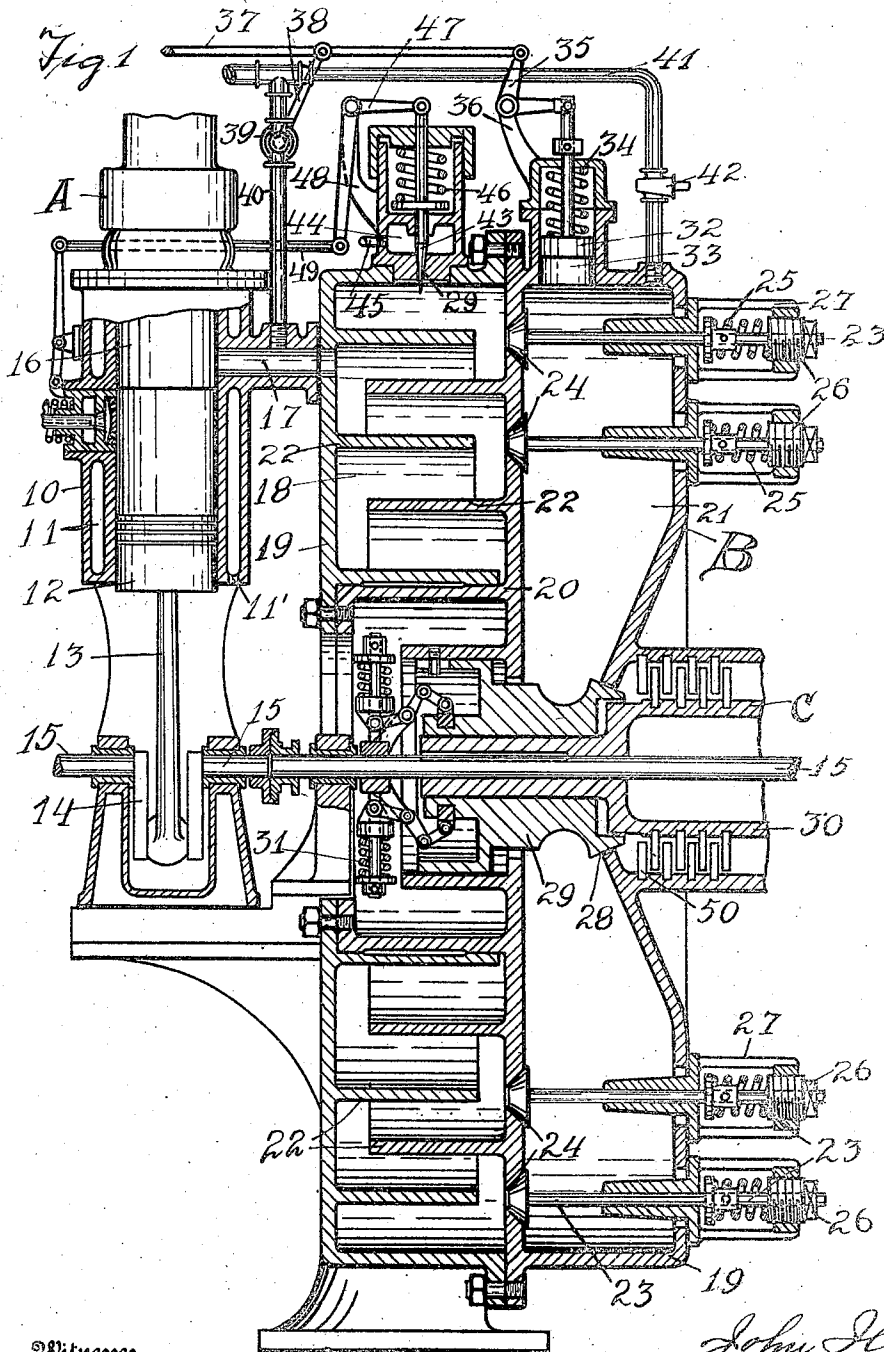


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MIXING ATTACHMENT FOR INTERNAL COMBUSTION ENGINES.
APPLICATION FILED NOV. 11, 1907.

933,709.

Patented Sept. 7, 1909.

4 SHEETS—SHEET 1.



Witnesses

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By

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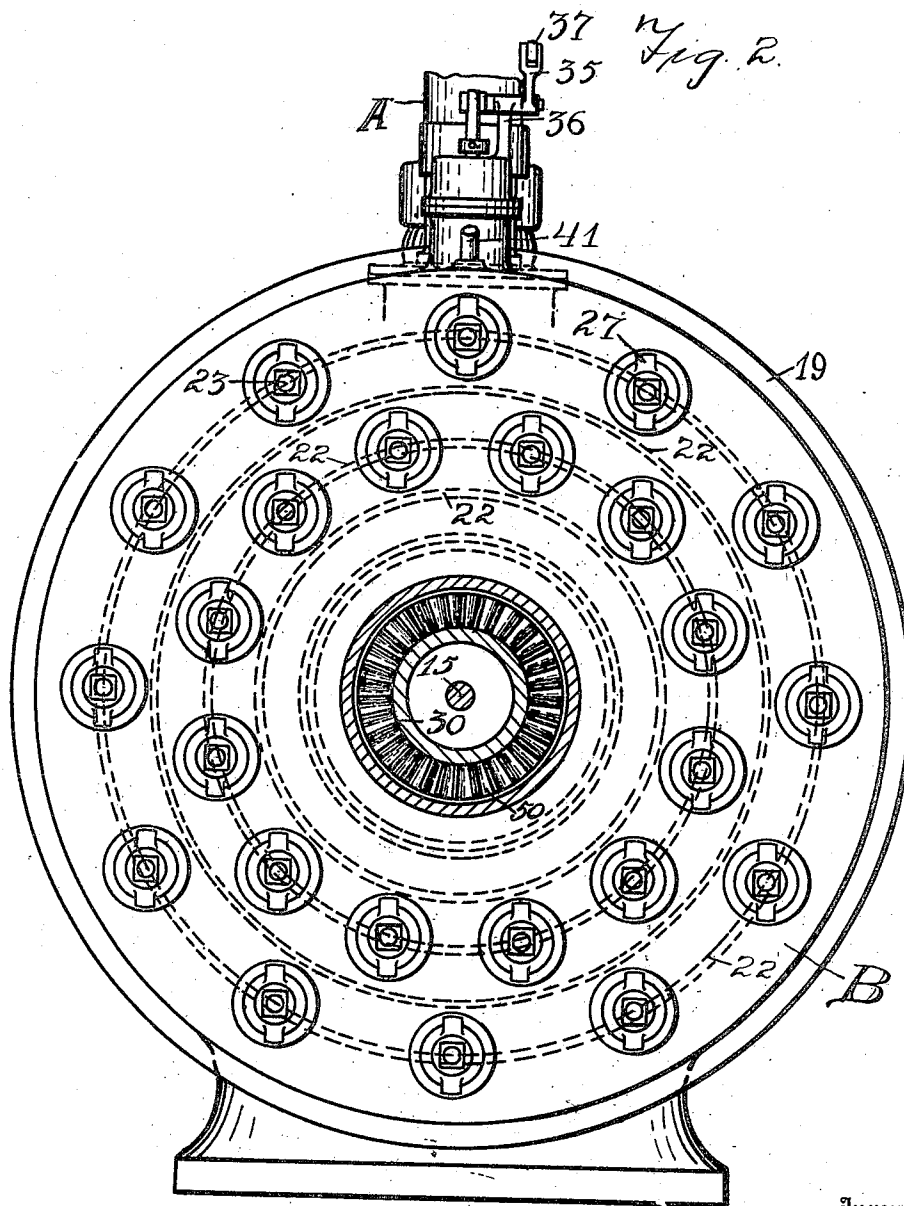
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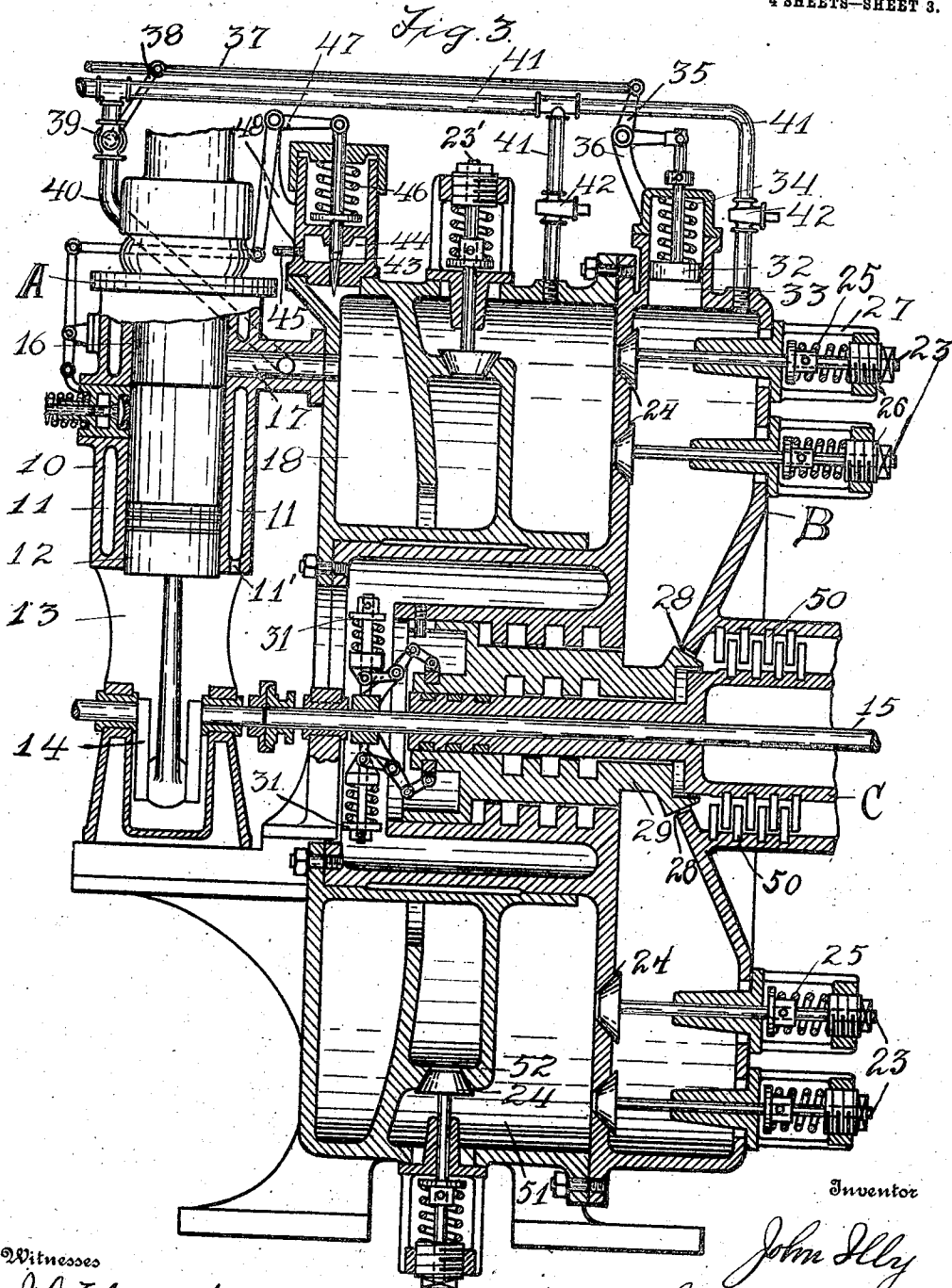
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Witnesses
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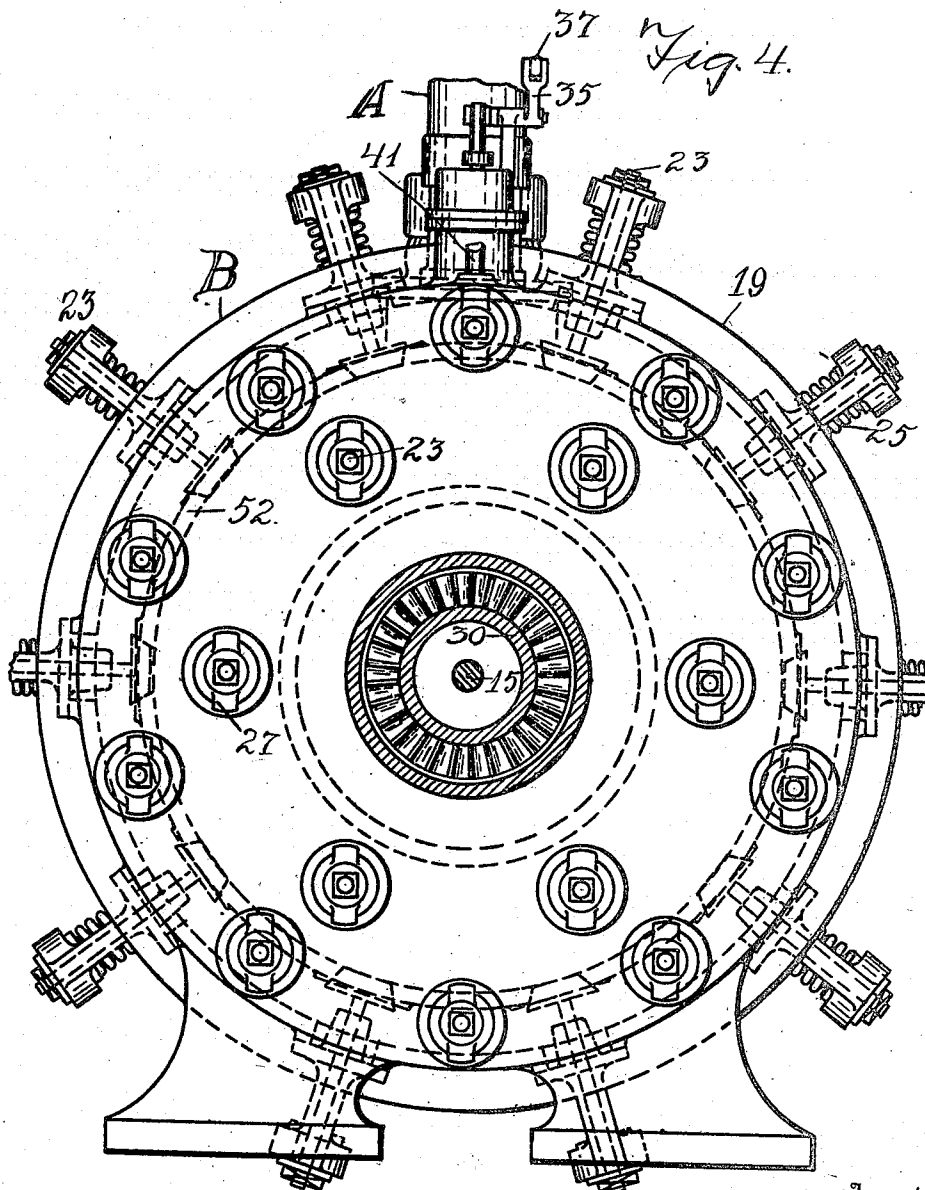
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

JOHN ILLY, OF JAMESTOWN, NEW YORK.

MIXING ATTACHMENT FOR INTERNAL-COMBUSTION ENGINES.

933,709.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Original application filed May 10, 1907, Serial No. 372,869. Divided and this application filed November 11, 1907. Serial No. 401,551.

To all whom it may concern:

Be it known that I, JOHN ILLY, a citizen of the Republic of Switzerland, and resident of the city of Jamestown, in the county of Chautauqua and State of New York, have invented a new and useful Mixing Attachment for Internal-Combustion Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

The invention relates to improvements in attachments for internal combustion engines, and is a part of my invention, as shown in my application for Letters Patent in the United States, Serial Number 372,869, filed May 10, 1907.

The object of the present construction is to provide means to conserve the largest possible amount of heat produced by internal combustion under pressure with the smallest amount of loss of heat by radiation; also to use the heat from either gaseous or liquid fuel to expand a second medium such as air, inert gas or water, by bringing them directly into contact, and thereby to decrease the initial temperature in any degree desired by mixing the heated gas or products of combustion with the expanding medium. I attain these objects by means of a special apparatus variously called a mixer, receiver, heater, or vaporizer, according to the different purposes for which it is used, that is, to receive the gaseous product of combustion and heat therein contained, as produced in a special heat generator and the added cooling medium to said gaseous product in said heat generator, and also to mix said gaseous product of combustion with a medium injected into the mixer to be heated or vaporized therein. Usually the heat of the gaseous products of combustion will expand the injected medium thereby reducing the temperature of the products of combustion and producing a controllable and workable motive fluid.

In the drawings, Figure 1 is a vertical sectional view of the heat generator and a mixer having two chambers; and Fig. 2 is an end elevation of said mixer. Fig. 3 is a vertical sectional view of a heat generator and a mixer arranged with three chambers; and Fig. 4 is an end elevation of the same.

Similar numerals refer to corresponding parts in the several views.

The letter A indicates the compressor or heat generator.

The letter B indicates the mixer, receiver, heater or vaporizer.

The letter C indicates the turbine which is shown with the outer end broken away.

The heat generator A consists of a double walled cylinder indicated by the numeral 10, which double walls provide a space 11 therebetween for air or water cooling said cylinder.

The numeral 12 indicates a piston working within cylinder 10 and having a piston rod 13 and crank 14 to connect it with the main drive shaft 15 from turbine C in order to drive said piston. Piston 12 works in one end of cylinder 10 and a valve piston 16 is slidably mounted in the opposite end of said cylinder. Piston 16 acts as an ingress valve for closing port or opening 17, which inlet is formed by a tubular connection between cylinder 10 and chamber 18 of mixer B. Generator A with its valves and pistons is preferably arranged as shown and described in my former specification, Serial Number 372,869, though other forms of heat generators might be used with my mixer or vaporizer B and not depart from my invention. The part B is variously called a mixer, receiver, heater, or vaporizer according as it is used for various purposes; these consist first of the receiving and mixing of the heated air, gaseous product of combustion and steam from the explosion chamber the heat generator A; second, the vaporizing of injected water, and third, the heating of non-combustible fluids such as air or inert gas by bringing them into direct contact with the heat from the explosion chamber in the heat generator and finally the mixing of all these elements to get a uniform mixture of the temperature desired. Accordingly the mixer B is constructed in its interior with a large heating surface by means of projecting and interlapping partitions and preferably with a plurality of chambers with spring valvular connection through which the heated air, gases and vapor force themselves, thereby thoroughly intermixing and at the same time coming under control from their superheated state so as to form a usable motive fluid. In order to accomplish this intermixing through a plurality of chambers, a mixer is shown in Figs. 1 and 2 with two chambers and in Figs. 3 and 4 with

three chambers, since adaptations in the form of the chambers and the placing of the valves are necessitated by added chambers. It will be recognized, however, that the principle and purpose are the same in the more complicated structure.

The various chambers of the mixer B are constructed by means of an outer casing 19, which is cylindrical on its outer side and the shaft 15 is concentric of the various chambers of the mixer. The outer casing 19 may be made in suitable parts and bolted together, and a dividing partition 20 for a two chamber mixer thereby forming the chambers 18 and 21. As above stated the heat and gaseous product of combustion from the explosion chamber enter chamber 18. Accordingly it is provided with a large heating surface, preferably by means of interlapping partitions 22. Partitions 22 are cylindrical, as shown in Figs. 1 and 2, and extend out alternately from the opposite walls. The number of partitions 22 is in accordance with the heating surface desired, and the space required to give the proper mixture of the products of combustion and the injected cooling medium, air or water, the necessary equality of temperature. The interlapping partitions 22 break up the hot products of combustion and mechanically mix them with the cooling medium.

Chambers or cavities 18 and 21 are connected by means of valves 23 which extend through chamber 21 to valve seats 24 in the dividing wall or partition 20. Valves 23 are pressed upon seats 24 partly by means of springs 25 and partly by the fluid pressure of the heated mixture within the chamber 21, which fluid pressure is usually less in chamber 21 than the fluid pressure in chamber 18 so that the valves 23 are usually open, though the fluid pressure in chamber 21 may at times equal the pressure in chamber 18 at which times the valve 23 will be closed by the predominance of the spring pressure over the fluid pressure. Springs 25 are placed in suitable yokes 27, which are distributed over the end of the mixer, as shown in Fig. 2. The pressure of springs 25 is adjusted by means of nuts 26.

Chamber 21 is preferably provided with a centrally placed outlet or egress 28 to the turbine C, which outlet is nozzle-shaped, that is, it contracts toward the turbine. Outlet 28 is controlled by means of the cylindrical egress valve 29 slidably mounted upon the turbine drum 30. The cylindrical valve 29 is controlled by a governor 31 which is mounted on the turbine shaft 15. According to the speed of the turbine shaft 15 the governor 31 by its centrifugal force, will by moving cylindrical valve 29 back and forth increase or decrease the area of opening 28 and according as a greater or less amount of the motive fluid is required by the turbine.

The outflow of the mixed motive fluid from chamber 21 reduces the pressure within said chamber and the heated mixture in chamber 18 presses through valves 23 whenever the force of the mixture in chamber 18 is able to overcome the resisting pressure on valves 23. As soon as the pressure rises in chamber 21 by this inflow from chamber 18, valves 23 will be closed. Hence there will be a constant opening and closing of valves 23 and leakage of the mixture through said valves.

In order further to control or equalize the variation of pressure in chamber 21 arising from the flow through the large outlet valve area 28 a piston 32 is provided in a suitable opening 33 in the casing of chamber 21, which piston will be raised in proportion to the increase of pressure in chamber 21, and lowered by a spring 34 in proportion to the decrease of pressure. A bell crank 35 is pivotally supported on a fixed arm 36 on the casing, and has one arm pivotally attached to the upper end of the stem of the piston 32; and its other arm is pivotally attached to a link 37 which is connected to the fuel admitting valve for the heat generator A, so that the oscillation of bell crank 35 due to the variation of pressure in chamber 21 will control the amount of fuel admitted to the heat generator. It is apparent that the desired degree of heat may thus be attained and continuously produced. Link 37 is also pivotally attached to lever 38 which turns valve 39 in air supply pipe 40 and the motion of link 37 will thus control the amount of cooling medium admitted to chamber 18. Air supply pipe 40 is continued by pipe 41 to chamber 21 and has valve 42 so that the air can be supplied as a cooling medium to chamber 21 should the temperature of the mixture become too high. It is desired, however, that the first chamber 18 shall be the main receiving chamber for the gaseous products of combustion and the cooling medium as the highest temperature exits in chamber 18 as it receives the products of combustion direct from the explosion chamber of heat generator and a rapid decrease of temperature is necessary to avoid injury to the material of which the mixer is composed. The air, as a cooling medium, will be admitted to chamber 21 by turning valve 42 by hand, since this is only needed in emergencies.

Should air not be sufficient as a cooling medium chamber 18 is provided with means for the injection of water as follows: a needle valve 43 is provided in the casing of chamber 18 and controls the opening between chamber 44 and chamber 18. Chamber 44 is filled with water by means of pipe 45, the water being under pressure greater than that existing in chamber 18. Needle valve 43 is pressed upon its seat by spring

46. The upper end of the stem of the needle valve 43 is attached to one arm of the bell crank 47. Crank 47 is pivotally supported on a fixed arm 48 on the casing. The other arm of crank 47 is pivotally attached to link 49, which link is connected to the injector of the cooling medium, preferably air or water, in the heat generator A, which injector is fully described in my former application, Serial Number 372,869. As therein described, the injector of the cooling medium in the heat generator A is actuated by the explosion pressure in the explosion chamber and this pressure is transferred by link 49 and bell crank 47 to needle valve 43. It is apparent that the intensity of the explosion pressure in the heat generator will control the size of the opening in the seat of valve 43 by controlling the distance which the needle valve is raised from the valve seat; and in consequence a lesser or greater quantity of the cooling medium, such as water, will pass into chamber 18 where it will be vaporized by the absorption of heat from the gaseous products of combustion. Thus a uniform mixture of the gaseous products, air and steam at a certain temperature and pressure may be maintained in the mixing chambers.

30 Instead of air or water as a cooling medium, an inert gas may be injected into the gaseous products of combustion in chamber 18; or a mixture of water and air, or of water and inert gas, and the amount of any of these fluids injected as an energy carrier will be so regulated as to be in proportion to the excess of the heat produced by each explosion, which, if continued, would bring the products of combustion to an overheated state, thereby resulting in a temperature injurious to the structural material of the mixer chambers.

It is apparent that outlet 28 could be arranged from chamber 18 direct into the turbine C and not depart from my invention. It is found, however, that where one chamber contains the direct inlet from the heat generator and outlet to the turbine, the pressure of the mixture of gases from the heat generator will be transmitted to the outflowing mixture to the turbine blades 50 and will cause speed variation in the turbine. It is also found that the more chambers provided in the mixer the better the equalization of the pressure and heat before outflow, and a consequent uniformity of movement is obtained in the turbine. Accordingly the type shown in Fig. 3, a central chamber 51 is provided between the two chambers 18 and 21; and it is apparent that any number of central chambers may thus be arranged for. This arrangement avoids passing the valve stem through adjacent chambers and diminishes the cost of construction. Additional supply pipes for the cooling medium may

also be provided for each chamber. The mixer may also be inclosed or covered by any good non-conducting material so that all the heat will be conserved.

Broadly stated, therefore, the object of the heat generator A and mixer B is to provide means for raising large quantities of air, gas or vapor to a high temperature without radiation of the heat produced by internal combustion under pressure greater than atmospheric and in the shortest possible time. The introduction of water would act as a reinforcement for the air, when the air would not be sufficient to cool the heated gases caused by the low rate of absorbing the heat. The cooling medium injected into the mixer expands by absorbing heat, until the differences in temperature of the different elements are perfectly equalized. The mixer therefore becomes a means to modify the gaseous product of combustion and heat to a usable fluid before entrance and use in the turbine.

When the mixer is filled with a motive fluid produced by an internal combustion engine, it is apparent that the series of explosions would raise the pressure of the motive fluid within the mixer to such an extent that the valves 23 would be constantly pressed off their seats 24 so that the openings through the valve seats would form constant passages in the motive fluid under such high pressure, the degree of fluid pressure controlling the size of the openings by the distance which it presses the valves 23 from the valve seats 24. Thus while the openings or passageways are automatically controlled by the pressure of the motive fluid, it is apparent that there will be an uninterrupted flow of the fluid in greater or less degree through the openings. While the degree of fluid pressure within the mixer is augmented or decreased by the number of explosions in the generator, the action of the valves 23 is independent of said explosion and the restraining force of the pressure of the plurality of valves acts as a constant means of control for the flow of the fluid through the passages or openings in the valve seats and thereby maintains a constant velocity for said motive fluid.

I claim as new:—

1. The combination of a generator for the hot products of combustion, a mixer for said hot products of combustion comprising a casing arranged to form a series of chambers to receive said hot products of combustion, partitions between said chambers having openings therein, spring valves to control said openings and operable by the pressure of said hot products of combustion, and an ingress valve from said generator and an egress valve from the last of said mixer chambers.

2. In combination with a heat generator, 130

a mixer having a plurality of chambers to receive the heated products of combustion and other fluids from said generator, the walls between said chambers having a plurality of passages connecting said chambers, a corresponding plurality of automatic pressure controlling devices in said passages to maintain a constant velocity for said fluid.

3. The combination with a generator for the hot products of combustion by explosion, of a mixer having a plurality of chambers to receive said hot products from said generator, the walls between said chambers having a plurality of connective passages in one plane, and a corresponding plurality of controlling devices in said passages operable by said hot products of combustion.

4. In combination with means for generating the hot products of combustion, a receiver for said products of combustion, said receiver having a series of mixing chambers, automatic valvular connection between said chambers, and a centrally placed nozzle-shaped outlet from the last chamber of said series to collect the mixed fluids.

5. In combination with a heat generator, a mixer having a plurality of chambers to receive the products of combustion and other fluids from said generator, a plurality of spring valves connecting said chambers, and a central valve controlled outlet from the last chamber of said mixer.

6. A mixer consisting of a casing containing a plurality of chambers side by side to receive fluid under pressure and arranged concentrically around a shaft, connecting passages between said chambers, and ingress to and egress from said mixer for said fluid.

7. A mixer consisting of a casing arranged concentrically around a shaft and having alternating partitions therein concentric of said shaft, an ingress port near the outer portion of said mixer, and an egress port near the center of said mixer.

8. In combination with a generator for the heated products of combustion by explosion, a receiver for said products of combustion and other fluids having a series of valve-controlled mixing cavities therein, a

suitable outlet from said receiver, and means actuated by said explosion for automatically introducing an expandible and cooling medium to equalize the pressure in said receiver.

9. In combination with a generator for the hot products of combustion by explosion, a receiver for said products of combustion and other fluids from said generator, a chamber on said receiver for an expandible fluid medium, and valvular connection between said fluid chamber and said receiver automatically actuated by said explosion to introduce said medium directly into said receiver.

10. In combination with a generator A having an explosion chamber to produce the heated products of combustion, a receiver B for said products of combustion having the mixing chambers 18 and 21 therein, said receiver having a chamber 44 thereon and connected thereto by a suitable valve seat opening, a valve 43 resiliently mounted in said opening, a bell crank 47 and connecting rods to said explosion chamber to actuate said valve by the explosion in said chamber, substantially as and for the purpose specified.

11. In combination with a generator A having an explosion chamber to give the hot products of combustion, a receiver B for said products of combustion having chambers 18 and 21 therein, an ingress opening 17 having a valve 16 automatically controlled by said explosion, a partition between said chambers having connective openings 24 and spring valves 23 in said openings, a shaft 15 through the center of said receiver, the casing of said mixer having a valve seat opening 28 around said shaft, and a valve 29 on said shaft to fit said valve seat, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN ILLY.

Witnesses:

A. W. KETTLE,
J. A. ELSWORTH.