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G. J. & C. H. WEBER.

APPARATUS FOR THE PRODUCTION OF MECHANICAL ENERGY AND HEAT.

APPLICATION FILED FEB. 28, 1903.

2 SHEETS—SHEET 1.

Fig 1

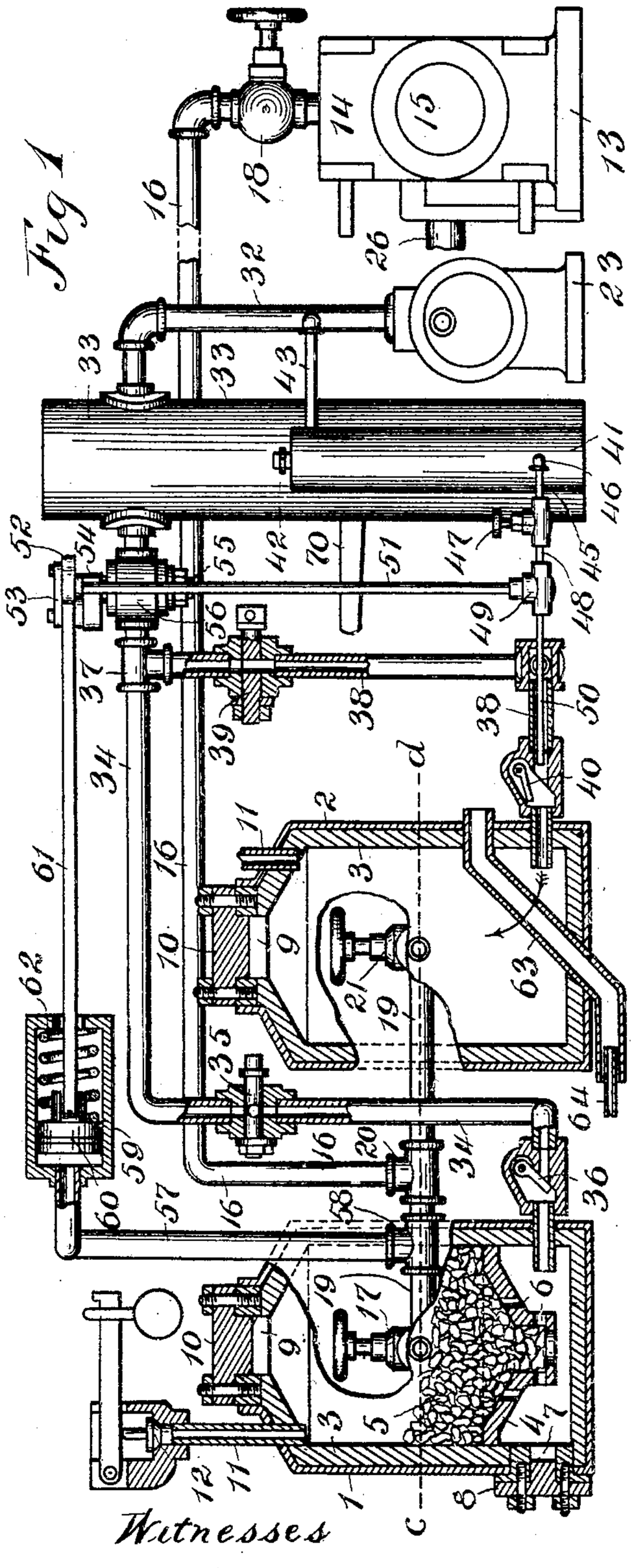


Fig 4

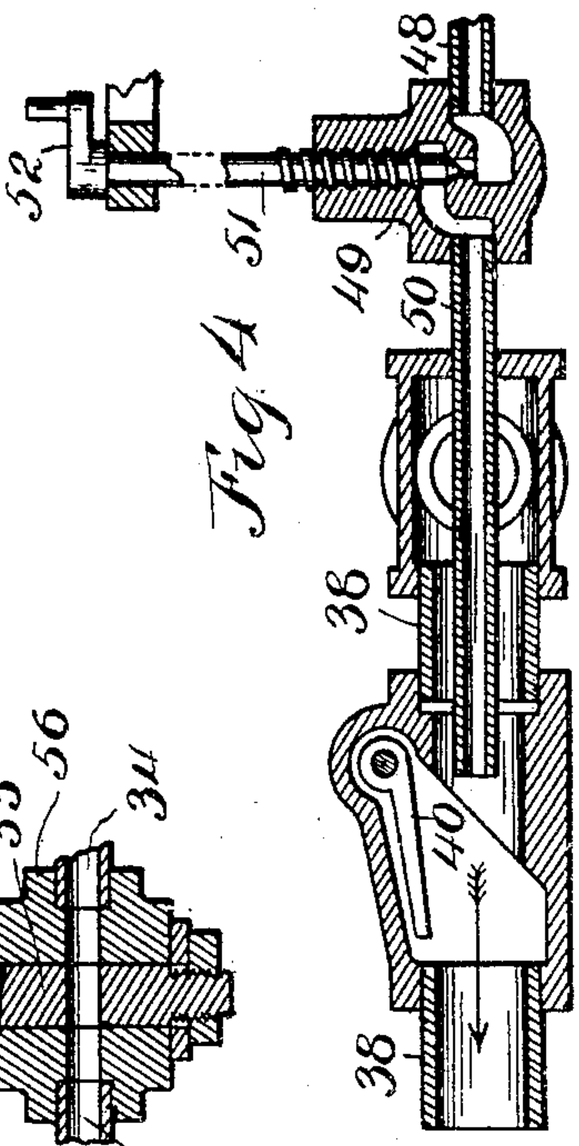
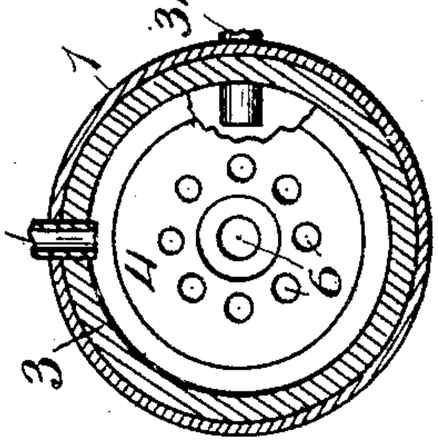


Fig 5

Fig 3

Fig 2



Witnesses

P. E. Hamilton
H. F. Rose

Inventors

George J. Weber
Charles H. Weber,
By Warren D. House,
Their Attorney.

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APPARATUS FOR THE PRODUCTION OF MECHANICAL ENERGY AND HEAT.

APPLICATION FILED FEB. 26, 1903.

2 SHEETS—SHEET 2.

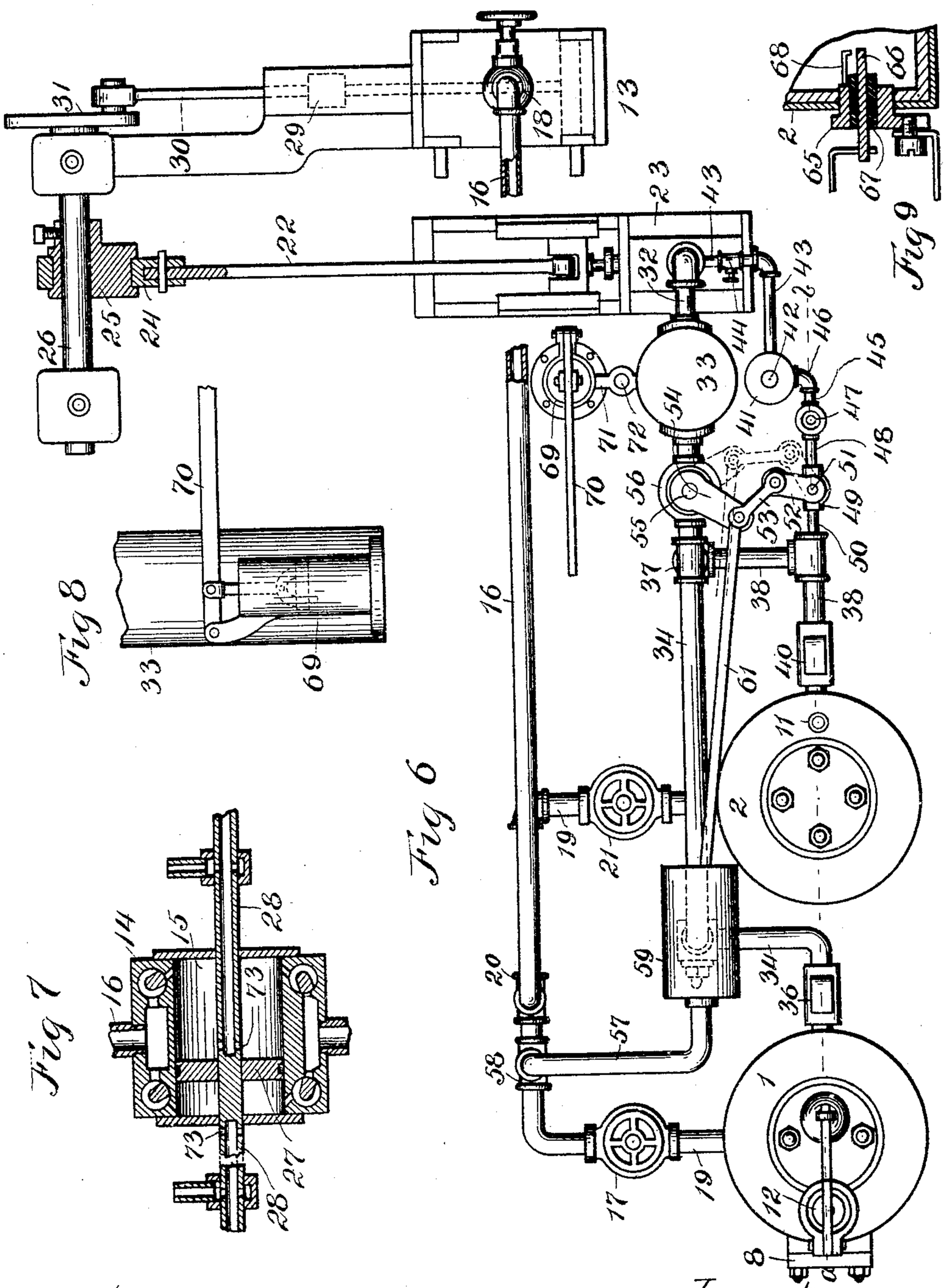

Fig 9

Fig 8

Fig 7

Fig 6

Witnesses
R. E. Hamilton.
H. F. Rose

Inventors
George J. Weber
Charles H. Weber,
By Warren D. House,
Their Attorney.

UNITED STATES PATENT OFFICE.

GEORGE J. WEBER AND CHARLES H. WEBER, OF KANSAS CITY, MISSOURI.

APPARATUS FOR THE PRODUCTION OF MECHANICAL ENERGY AND HEAT.

No. 803,735. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed February 28, 1903. Serial No. 145,540.

To all whom it may concern:

Be it known that we, GEORGE J. WEBER and CHARLES H. WEBER, citizens of the United States of America, residing in Kansas City, in the county of Jackson and State of Missouri, have invented a new and useful Improvement in Apparatuses for the Production of Mechanical Energy and Heat, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

Our invention relates to an improved apparatus for the production of mechanical energy and heat.

The object of our invention is to provide an apparatus in which fuel is burned and the products of combustion held under pressure.

Our invention provides means by which the products of combustion thus held under pressure are converted into mechanical energy—as, for instance, in running an engine.

Our invention provides means by which the mechanical energy thus produced is utilized in continuing combustion, thus replacing the products of combustion converted into mechanical energy and keeping up a continuous pressure for further use.

Our invention provides, further, means by which the pressure of the products of combustion may be retained within certain predetermined limits.

Our invention also provides means by which the mechanical energy produced by conversion from the products of combustion may be used to control the supply of air uniting with the fuel.

Our invention provides, further, a combustion-chamber in which the products of combustion are held under pressure, an engine, means by which portions of the products of combustion are withdrawn from the combustion-chamber and caused to operate the engine by expansive force, an air-injecting means connected with the combustion-chamber, and means by which the air-injecting means is caused to operate and force air into the combustion-chamber, thus replacing with fresh products of combustion those withdrawn from the combustion-chamber to run the engine.

Our invention provides, further, means by which the said engine is caused to actuate the air-injecting means.

Our invention provides also means by which the pressure of the products of combustion in the combustion-chamber is caused to control the introduction of air into the combustion-chamber, thus compensating for withdrawal of portions for conversion into different forms of energy.

Our invention provides, further, means by which a preliminary pressure may be obtained in the combustion-chamber prior to the withdrawal of portions of the products of combustion for conversion into mechanical energy.

Our invention provides, further, means by which the introduction of fuel and air into the combustion-chamber is automatically controlled by the pressure in said combustion chamber.

Other novel features are hereinafter fully described and claimed.

With the use of our invention coal may be burned and the products of combustion resulting therefrom may be utilized in driving an engine by their direct pressure without the intervention of a steam-boiler. Furthermore, an engine of the expansion and condensing type may be used and the products of combustion after use may be released at about atmospheric pressure, thus effecting great economy in the production of mechanical energy.

In an apparatus of the kind herein described the combustion taking place under high pressure affords a means of securing more complete combustion than is obtained under ordinary atmospheric pressure.

Our invention may be used with great economy in producing heat for blast-furnaces and other uses.

In the accompanying drawings, illustrative of our invention, Figure 1 is a vertical sectional view taken on the dotted line *a b* of Fig 6, portions of parts in the rear being shown also in vertical section and portions of each combustion-chamber being broken away to show parts in the rear thereof. Fig. 2 is a horizontal sectional view of one combustion-chamber, and Fig. 3 a similar view of the other combustion-chamber, both views being taken on the dotted line *c d* of Fig. 1. Fig. 4 is a longitudinal vertical sectional view taken on the dotted line *a b* of Fig. 6 of enlarged portions of the air and fuel feed mechanism connected with one combustion-chamber. Fig. 5 is a detailed vertical sectional view of the valve controlling the air-injecting mechanism. Fig. 6 is a plan view of what is

shown in Fig. 1, some parts being broken away and a portion of the mechanism connected with the air-compressor being shown in horizontal section. Fig. 7 is a vertical sectional view of an ordinary Corliss engine-cylinder and its valves, including a condensing mechanism connected with the piston and adapted to be used in conjunction with our power producer. Fig. 8 is an elevation view of the lower end of one side of the air-tank and the supplementary air-pump. Fig. 9 is a vertical sectional view of a portion of one of the combustion-chambers provided with an electric igniting device of the jump-spark type.

Similar characters of reference indicate similar parts.

1 and 2 indicate, respectively, the two combustion-chambers of any desirable form, preferably cylindrical and closed at all sides and ends. Each combustion-chamber may be provided on its inner walls with suitable lining 3, composed of some refractory non-heat-conducting material, such as fire-clay. The chamber 1 is provided with a transverse grate 4 near the lower end adapted to support thereon the fuel 5, which may be ordinary coal. Said grate 4 is provided with openings 6 therethrough to permit the upward passage of air and to permit the passage downward of non-gaseous products of combustion.

In one side of the combustion-chamber 1 below the grate 4 is provided an opening 7, through which the ashes may be removed. A closure of any desirable type, as indicated by 8, may be used to tightly close the opening 7.

In the upper end of each chamber 1 and 2 is provided an opening 9, through which fuel may be inserted or access to the interior of the chamber afforded. Each of said openings 9 is provided with a closure 10 of any desirable type having any suitable means for hermetically closing the said opening. In each chamber is secured a vertical pipe 11, to the upper end of which is mounted an ordinary safety-valve 12. The said valve is removed in Figs. 1 and 6 from the chamber 2.

13 indicates an engine of the Corliss type, the steam-chest and cylinder of which are indicated, respectively, by 14 and 15. Connecting the steam-chest 14 with combustion-chamber 1 is a conductor 16, comprising suitable piping and elbows. In the said conductor to the rear of the combustion-chamber 1 is inserted an ordinary valve 17. A valve 18 is inserted in the conductor 16 above the steam-chest 14. A conductor 19 extends rearwardly from the chamber 2 and connects with the conductor 16 by means of a T 20. A valve 21 is inserted in the conductor 19 to the rear of the chamber 2. The connecting-rod 22 of an ordinary air-compressor 23 is pivotally connected to the strap 24, which encircles the eccentric 25, mounted upon and revoluble with the driving-shaft 26 of the engine 13.

27 indicates the piston of the engine 13, connected, by means of piston-rod 28, slide 29, connecting-rod 30, and crank-disk 31, with the driving-shaft 26.

Connected with the compressor 23 by means of an air-conductor 32 is the air-receiver 33, which in turn is connected, by means of a conductor 34, with the combustion-chamber 1 at a point below the grate 4. Inserted in the conductor 34 is a shut-off valve 35, adapted to be operated by hand.

Inserted in the conductor 34, between the valve 35 and the chamber 1, is a check-valve 36 of any ordinary type and designed to prevent backflow through the conductor 34.

Connected at one end to the conductor 34 by means of a T 37 is a conductor 38, the other end of which is connected to the chamber 2. In the said conductor 38 is inserted a valve 39, adapted to be operated by hand. In the said conductor between the valve 39 and the chamber 2 is inserted a check-valve 40, similar to and used for a purpose similar to valve 36.

Adjacent to the compressor 23 is an oil-supply tank 41, in the upper end of which is provided an opening for filling the tank and closed by a plug 42. Connecting the upper end of the tank 41 with the conductor 32 is a conductor 43, in which is inserted a valve 44 for shutting off air from the tank 41. One end of a horizontal pipe 45 is connected to the lower end of tank 41 by means of an elbow 46. The other end of said pipe connects with a valve 47, used to shut off the oil by hand. The valve 47 is connected by a pipe 48 with a valve-casing 49, from which extends a horizontal pipe 50, which extends into and discharges in the conductor 38 to the right of the valve 40, as viewed in Fig. 1. The valve-casing 49 has mounted rotatably in it and connected by it with a screw-thread connection a vertical valve-stem 51, to the upper end of which is rigidly secured a horizontal crank-arm 52, to which is pivotally secured one end of a link 53, the other end of which is pivotally secured to a crank-arm 54, rigidly mounted on the vertical rotatable valve-stem 55, mounted in a valve-casing 56, which is inserted in the conductor 34 between the air-receiver 33 and the T 37.

A conductor 57 is connected at its lower end to a T 58, inserted in the conductor 19 between the valve 17 and the T 20. The said conductor 57 extends upwardly from the T 58 and connects with one end of a cylinder 59, disposed horizontally and having mounted therein a longitudinally-movable piston 60. Upon the right side of the said piston, as viewed in Fig. 1, is pivotally connected a horizontal connecting-rod 61, which is also connected pivotally with the crank-arm 54. The right end of the cylinder 59 is provided with a hole sufficiently large to permit of the operation therethrough of the rod 61. Encircling the rod 61 and bearing at its left end,

as viewed in Fig. 1, upon the piston 60, is a coil-spring 62, the other end of which bears upon the inner right end of the cylinder 59. The tension of said coil-spring 62 is such as to tend to force the piston to the left, as viewed in Fig. 1. By reciprocation of the piston 60 the valve-stems 51 and 55 may be caused to rock, thus opening or closing the valves in which they form each a part.

In Fig. 1 we have shown in connection with the chamber 2 one means of igniting the combined air and fuel admitted through the conductor 38. In this form an upwardly-inclined pipe 63, provided with horizontal ends, extends through the bottom of the chamber 2 upwardly and through the side thereof and adjacent to the discharge end of the conductor 38. In the lower end of the pipe 63 is inserted the end of the discharge-pipe 64 of an ordinary Bunsen burner designed to burn gasolene. This burner may be of the ordinary type and needs no description in this connection. By operating the said Bunsen burner gasolene-vapor is discharged from the pipe 64 into the pipe 63, air being taken in around the pipe 64 to mingle and unite with the gasolene-vapor. By this means the pipe 63 may be heated to incandescence, thus igniting the mixed air and oil-vapor discharged into the chamber 2 through the conductor 38.

In Fig. 9 we have illustrated an ordinary jump-spark electric igniter mounted in the wall of the chamber 2. In this form of igniter a plug 65 is inserted in a hole provided in the wall of the chamber 2. Centrally through a hole provided in the plug 65 is mounted an electrode 66, insulated by a sleeve 67 from the plug. The other electrode is secured in the plug 65 inside the chamber 2 and parallel with but not touching the electrode 66. Any suitable means for causing a spark to jump between the inner ends of the electrodes 66 and 68 may be employed for igniting mixed gas and air in chamber 2. An ordinary hand-operated air-pump 69, having an operating-handle 70, is connected by a conductor 71 with the air-receiver 33. A check-valve 72 is inserted in the said conductor.

In Fig. 7 is shown the cylinder and steam-chest of an ordinary Corliss engine. The parts of such an engine are so well known as not to require herein a detailed description thereof. In the cylinder 15 is mounted the ordinary piston 27, provided with the double piston-rod 28, extending to the right and left through the cylinder-heads. The said piston-rod 28 is hollow at each side of the piston 27 and is provided with radial holes 73, disposed adjacent to the piston 27 for discharging water into the cylinder 15 at the proper time. The water may be brought into the hollow portions of the piston-rod 28 in any manner desired.

In operating our invention with the use of the combustion-chamber 1 alone the valves 21, 17, 47, and 39 are first closed. The closure 8 of chamber 1 is secured in place, as is the closure 10 in said chamber, after the fuel 5 has been placed in the chamber and ignited. Air is then forced into the receiver 33 by operating the hand-pump 69 by means of the handle 70. The air from said receiver 33 will then pass into the chamber 1 under grate 4 through the conductor 34, the valves 35 and 36 being open. The valve in the casing 56 will also be open, the tension of the spring 62 being sufficient to force the piston 60 in a direction such that the valve-stem 55 will be turned to the open position by means of the crank-arm 54 and connecting-rod 61. The fuel 5, being consumed in the chamber 1 by uniting with the oxygen of the air forced therein from the receiver 33, will produce products of combustion which having no means of escape from the chamber will create a pressure therein. When a sufficiently high degree of pressure has been obtained to perform the work desired, the valves 17 and 18 are opened, thus permitting a portion of the gaseous products of combustion in the chamber 1 to pass through the conductor 16 into the steam-chest 14, and thence past the valves ordinarily used in such engines, as the one illustrated, into the cylinder 15, where the products of combustion are caused to reciprocate the piston of the engine and through the mechanism already described impart rotation to the driving-shaft 26 of the engine. As is well understood with reference to Corliss engines, the valves controlling the inlet and exit of the propelling fluid entering the cylinder 15 can be arranged so as to cut off the cylinder from the direct pressure of the boiler or other source of supply before the piston has traveled the entire distance of movement in one direction, thus permitting the propelling fluid to act expansively upon the piston. With our invention this same arrangement of the valves may be employed, and the products of combustion entering the cylinder 15 may be made to work expansively upon the piston. Furthermore, any ordinary means of condensing the fluid in the cylinder after it has performed its work may be employed, thus further economizing power by the production of a partial vacuum in the cylinder at the side of the piston toward which the return movement of the piston will be directed. In Fig. 7 we have shown one ordinary means for causing this condensation in the cylinder. As shown in said figure, it is assumed that the piston has traveled to the left and, as shown, is at the limit of its stroke in that direction. At this point the water is permitted to enter the piston-rod 28 to the right of the piston. From the hollow rod the water escapes into the cylinder through the openings 73 at the right side of the piston 27. The water causes a condensation of the expanded products of combustion in the right end of the cylinder, and a partial vacuum is formed in said end of the cylinder. The

same operation is performed when the piston has traveled to the end of its stroke in the other direction. The products of combustion are permitted to enter and escape from the cylinder by any of the well-known valve mechanisms that are used with engines of this type, so that a detailed description of the operation of such valve mechanisms is not deemed necessary. When the driving-shaft 26 is rotated by the movement of the piston 27, it will, through the eccentric 25, eccentric-strap 24, and connecting-rod 22, operate the air-compressor 23, which may be of any well-known kind. The air-compressor 23 being thus operated will drive air into the receiver 33, from which it may be drawn for use in continuing combustion in the chamber 1, as already described hereinbefore. The tension of the coil-spring 62 is such that the valve in the casing 56 will be held open until the requisite working pressure desired to operate the engine 13 may be attained in the chamber 1. When this pressure has been attained, the pressure in the chamber 1, communicating through the conductor 19, T 58, and conductor 57 with the cylinder 59, will cause the piston to move toward and against the pressure of the coil-spring 62, thus closing the valve in the casing 56 and shutting off the air-supply from the receiver 33. As the pressure in the chamber 1 becomes reduced below the predetermined point, due to withdrawing products of combustion to drive the engine 13 or for any other purpose, the coil-spring 62 will cause the piston to move, so as to again establish communication between the chamber 1 and the receiver 33. In case the pressure becomes too great in the chamber 1 the safety-valve 12 on the pipe 11 will operate to permit the escape of some of the gaseous products of combustion in the chamber. The limits between which the pressure in the chamber 1 may vary can be controlled by adjustment of the safety-valve 12 in the ordinary manner and by using the spring 62 of proper strength. When it is desired to renew the fuel in the chamber 1 or remove ashes therefrom, the valve 17 may be closed and the valve 12 raised to permit the escape of the gaseous products of combustion. The closures 8 and 10 in the chamber 1 may then be removed, the ashes extracted, and the fuel renewed, after which the closures may be replaced and the apparatus started again in the manner hereinbefore set forth.

Various modifications of the mechanism for introducing fuel and extracting ashes may be resorted to while keeping within the bounds of our invention, and we do not restrict our invention to the particular means shown and described.

If it is desired to operate combustion-chamber 2 in connection with the chamber 1, the valves 17 and 35 are left open. Otherwise these valves are closed. In operating the chamber 2 the valve 21 in the rear thereof is first closed and the pipe 63 heated to incandescence or sufficiently hot to ignite mixed air and vapor entering the chamber 2 through the conductor 38. The hand-pump 69 is then operated and the valve 39 opened, thus causing air to enter chamber 2 through the conductor 34, valve-casing 56, T 37, conductor 38, past valves 39 and 40 from the receiver 33. The chamber 2 being connected with the cylinder 59 by means of conductors 19, T's 20 and 58, and conductor 57 and the pressure at first being low in said chamber the coil-spring 62 will have forced the piston to a position such that the valve in the valve-casing 56 will be open, thus permitting passage of air from the receiver 33 to the chamber 2. The valve-stem 51 will also be turned by means of the connecting-rod 61, crank-arm 54, link 53, and crank-arm 52, so that the valve in the casing 49 will be in the open position, thus permitting oil to pass therethrough from the tank 41 after the valves 44 and 47 have been opened. The oil, such as gasolene, passing from the tank 41 past the valve 47, through the valve-casing 49, conductor-pipes 45, 48, and 50, and elbow 46 will enter the conductor 38 and, vaporizing, will mingle with the air coming through said conductor 38. The mixed vapor and air entering the chamber 2 will be ignited by the heated pipe 63, and the products of combustion formed thereby will be retained under pressure in the chamber 2, from which they may be withdrawn for use in the engine 13 in the same manner as described with reference to the products formed in chamber 1 after the valve 21 has been opened.

In lieu of the heated tube 63 for igniting the mixed vapor and air entering the chamber 2 through the conductor 38 the form of electric igniting device shown in Fig. 9 may be employed. In such case any suitable means may be employed to cause a jump-spark to pass at the proper time between the electrodes 66 and 68, the inner ends of said electrodes being disposed in the combustion-chamber 2 adjacent to the discharge end of the conductor 38.

It will be understood that while we have shown our invention used in connection with a Corliss engine that it may be applied to any other engine or mechanism in which the pressure of a fluid is employed as the propelling power.

As already stated hereinbefore, the compressed products of combustion may be used also for other purposes than to be converted into mechanical energy.

Many modifications may be made in the carrying out of the principles of our invention without departing from the spirit thereof.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an apparatus for the production of

mechanical energy, the combination with a combustion-chamber in which the products of combustion are held under pressure, of an air-injecting means connected with the combustion-chamber, a valve controlling said air-injecting means, a fuel-supply connected with the said combustion-chamber, a valve controlling said fuel-supply, a cylinder connected with the combustion-chamber, a piston movable in one direction by the pressure from the combustion-chamber, means for resisting movement of the said piston in said direction, and means by which movement of the piston controls the said two valves.

2. In an apparatus for the production of mechanical energy, the combination with a combustion-chamber in which the products of combustion are held under pressure, of an air-injecting means connected with the combustion-chamber, a valve controlling said air-injecting means, a fuel-supply connected with the combustion-chamber, a valve controlling said fuel-supply, a cylinder connected with the combustion-chamber, a piston movable in said cylinder in one direction by the pressure from the combustion-chamber, a spring for resisting movement of the said piston in said direction, and means by which movement of the piston controls the said two valves.

3. In an apparatus for the production of mechanical energy and heat, the combination with means for effecting combustion of fuel under substantially uniform pressure, of means for converting portions of the products of combustion thus formed into mechanical energy, and means, actuated by the said mechanical energy and controlled by the pressure of the products of combustion not converted into mechanical energy, for replacing with fresh products of combustion those converted, thus retaining a continuous supply of the products of combustion under pressure.

4. The combination with means for effecting combustion of fuel under substantially uniform pressure, of means for converting the products of combustion thus formed into mechanical energy, and means actuated by said energy and regulated by the pressure of the products of combustion for supplying air to the burning fuel.

5. The combination with means for effecting continuous combustion of fuel under substantially uniform pressure, of means for converting the products of combustion thus formed into mechanical energy, and means controlled by the pressure of the products of combustion for regulating the combustion of the fuel.

6. The combination with means for effecting continuous combustion of fuel under substantially uniform pressure, of an engine, means for propelling the engine by the products of combustion, and means actuated by the engine and regulated by the pressure of the products of combustion for continuing combustion of the fuel.

7. The combination with a combustion-chamber, of means for effecting continuous combustion of fuel therein under substantially uniform pressure, an engine, means for propelling the engine by the products of combustion formed in the combustion-chamber, and means actuated by the engine and regulated by the pressure in the combustion-chamber for continuing combustion of the fuel in the combustion-chamber.

In testimony whereof we have signed our names to this specification in presence of two subscribing witnesses.

GEORGE J. WEBER.
CHARLES H. WEBER.

Witnesses:
WARREN D. HOUSE,
HENRY F. ROSE.