No. 634,841. Patented Oct. 10, 1899.

A. T. WELCH.

STEAM PRESSURE GENERATOR.

(Application filed Aug. 14, 1895.)

(No Model.) 2 Sheets—Sheet 1.

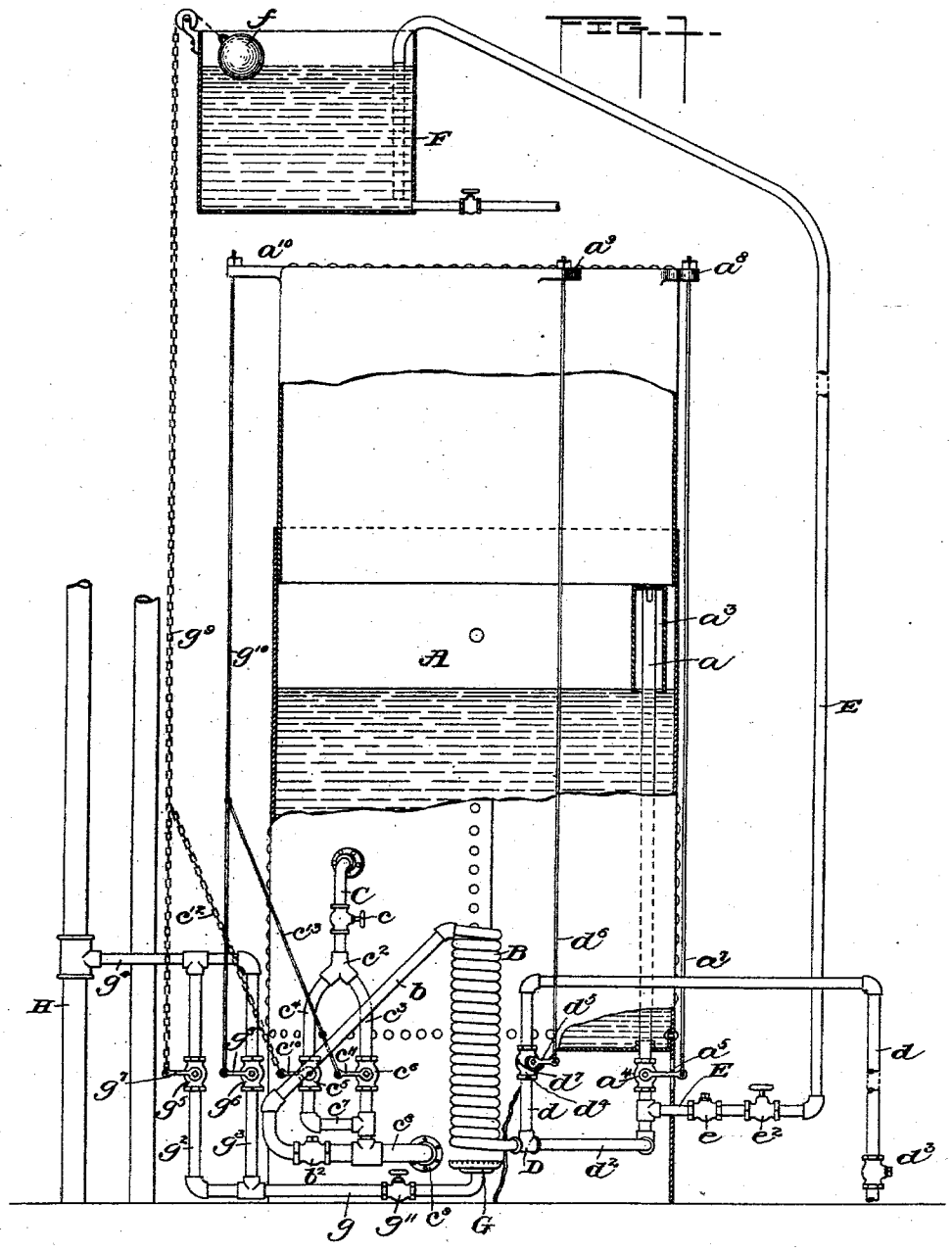

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FIG. 2.

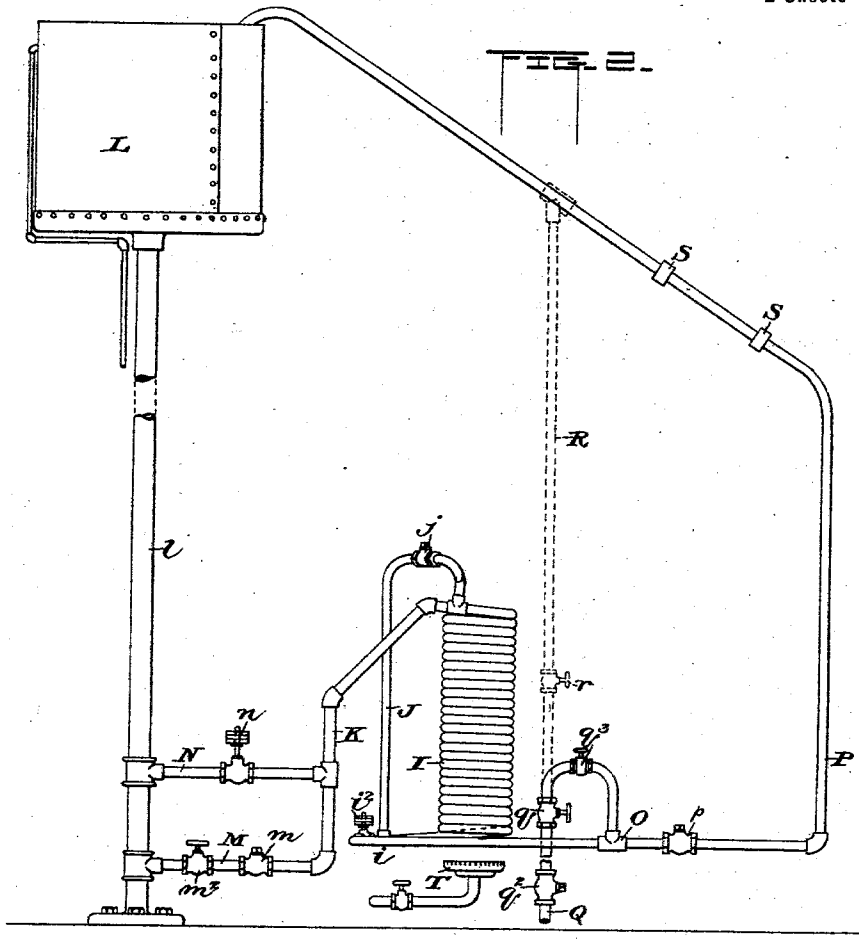


FIG. 4.

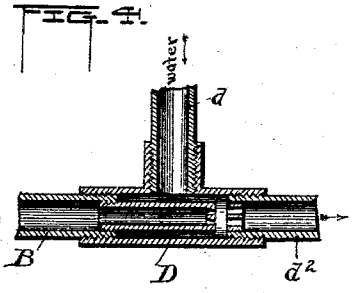
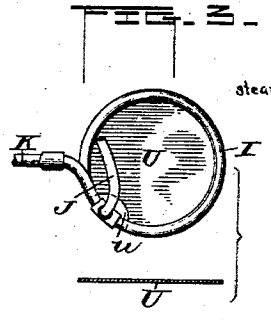


FIG. 3.



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UNITED STATES PATENT OFFICE.

ABRAHAM T. WELCH, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-PRESSURE GENERATOR.

SPECIFICATION forming part of Letters Patent No. 634,841, dated October 10, 1899.

Application filed August 14, 1895. Serial No. 559,271. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM T. WELCH, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Pressure Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to steam-pressure generators.

The objects are to produce an apparatus that will rapidly and economically generate steam under high pressure to be utilized for forcing hot water to a building or other desired point, or for supplying warm or cold air to a building or the like, or for operating lifting and compression machines; furthermore, to produce a steam-pressure generator adapted to be used in conjunction with a gasometer, such as employed in connection with a carbureter, in which the movement of the gasometer in one direction will effect the automatic stoppage of the generator and its movement in the opposite direction effect the automatic starting of the generator.

With these objects in view the invention consists in a steam-pressure-generating apparatus comprising a vapor-generator, a source of liquid-supply therefor, and an ejector operated from the generator and acting to force air or water to any desired point.

The invention further consists in a heating-coil, a liquid-supply therefor, means for automatically regulating the supply of liquid to the coil, and an ejector operated from the coil.

The invention further consists in a heating-coil, a liquid-supply therefor, means arranged between the coil and the liquid-supply for automatically and intermittently establishing communication between the supply and the coil, whereby to permit a charge of liquid thereto, and an ejector operated from the coil.

The invention further consists in a heating-coil, a liquid-supply therefor, means arranged between the supply and the coil for automatically and intermittently establishing communication with the coil to permit a charge of liquid thereto, a safety connection between the coil and the liquid-supply, and an ejector operated from the coil.

The invention further consists in the novel construction and combination of parts of a steam-pressure generator, as will be hereinafter fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like letters of reference indicate corresponding parts, Figure 1 is a view in elevation, partly in section, displaying the steam-pressure generator attached to an ordinary gasometer and showing also the connections between the generator and the gasometer for effecting the automatic stoppage and starting of the generator. Fig. 2 is a view in elevation of the generator alone, showing the arrangement of its parts and also in dotted lines in conventional form a steam or hot-water circulation system that may be employed in connection with the generator for heating a building. Fig. 3 is a view in plan of the top portion of the coil of the generator, showing a deflecting-plate to be used in connection with the generator to direct a flame of gas or the like to a point in the coil, so as to effect a vent in the coil to allow the water to run down the same or to convert the water quickly into steam. Fig. 4 is a longitudinal sectional detail view of one form of ejector that may be employed in connection with the apparatus.

Referring to the drawings and to Fig. 1 thereof, A designates an ordinary gasometer or holder connecting with a carbureter, (not shown,) there being a pipe *a*, provided with an air-trapping hood, for supplying air to the holder in order to cause the cap or cover a^3 of the holder to rise. The pipe *a* in this instance is shown as passing through the bottom of the holder; but it is to be understood that, if desired, it may enter the holder at any other desired point. The holder is connected with a steam-pressure generator or coil B, the connection consisting of the air-pipe *a* and a water-supply pipe C, tapped into the holder, preferably at one side thereof and at a height above the bottom of the generator sufficient to give the water the requisite fall or head to cause it to be projected to the top of the coil, a valve *c* serving to cut off the flow of water when desired. The pipe carries at its

lower end a Y-coupling c^2, the free members of which are engaged by branch pipes c^3 and c^4, respectively, the lower portions of the branch pipes being connected by a cross-pipe c^7. The pipe c^3 is tapped into a pipe c^8, the free end of which is closed and secured to the lower portion of the holder A in any suitable manner, as by a socket c^9. The pipe c^8 connects with a pipe b, leading to the coil B, a check-valve b^2 serving to prevent any backflow from the coil to the pipe c^8 when the generator is in operation. The coil is of the ordinary construction and carries at its lower portion an ejector D, which may be of any preferred construction, and therefore needs no detailed illustration. Connecting with the casing of the ejector are two pipes d and d^2, the pipe d being extended to a source of water-supply to be raised by the apparatus, as a well, cistern, or the like, and the pipe d^2 to the pipe a, extending upward within the holder, a valve d^3 on the pipe d serving to close the pipe to prevent water being raised when the apparatus is to be used for other purposes, as will hereinafter appear.

Tapped into the pipe a is a pipe E, carrying a check-valve e and a globe-valve e^2, the pipe E constituting an air-pipe for supplying air to the holder or a water-supply pipe for supplying water to a tank or cistern F, occupying a plane above the holder. The function of the valve e^2 is to open or to close the pipe E to permit or to prevent the passage of air, steam, or water therethrough, the check-valve e operating to prevent backflow through the said pipe to the coil B.

The pipe d is provided with a three-way valve d^4, to the valve-stem of which is secured a lever d^5, connecting through a rod d^6 with a projection a^9 on the upper portion of the holder, by which the upward and downward movements of the holder will operate to bring the successive ports of the valve into register with the bore of the pipe d and the air-supply opening d^7 in the casing of the said valve, and thus alternately open and close communication with the water-source and the air-supply. The pipe a is provided with an ordinary globe-valve a^4, having secured to its valve-stem a lever a^5, connecting through a rod a^7 with a projection a^8 on the upper portion of the holder, the latter rod operating to perform the same function with relation to the valve a^4 as that described in connection with the valve d^4.

The coil B is heated by a burner G, which may be an ordinary gasolene or other liquid fuel burner; but for obvious reasons it is preferred to employ gas as a heating medium for the coil, and to this end the burner-pipe g is connected with two pipes g^2 and g^3, tapped into a pipe g^4, connecting with a gas-supply pipe H, leading from a suitable source of supply. The pipes g^2 and g^3 carry each a valve g^5 and g^6, respectively, the valve-stem of each of the latter valves having attached thereto levers g^7 and g^8. The lever g^7 connects through a chain g^9 or other flexible connection with a ball-float f in the tank F and the lever g^8 with a rod g^{10}, secured to a projection a^{10} on the upper portion of the holder. To the valve-stem of each of the valves c^5 and c^6 is secured a lever c^{10} and c^{11}, respectively, the lever c^{10} being connected by a chain c^{12} with the chain c^9 and the lever c^{11} by a rod or bar c^{13} with the rod g^{10}.

The operation of the form of apparatus just described is as follows: The machine being at rest, the cap a^3 is at its lowest position, and the valves g^5, g^6, c^5, c^6, d^4, and a^4 are all open, the three-way valve d^4 being in a position to permit air to be pumped into the holder and the valves c and g^{11} closed. The coil is now initially heated by any suitable means to place it in condition to heat the first charge of water. The coil being sufficiently heated, the valve c is opened to allow water to pass to the coil, where it is converted into steam and starts the injector to working. The ports of the three-way valve being in register with the air-supply port or opening d^7 and with the bore of the section of pipe d below the valve d^4, it follows that air will be injected through the valve a^4 and pipe a to the interior of the gasometer, causing the latter to rise and furnish air to operate a carbureter, (not shown,) and thereby supply gas to the burner G. As the cap continues to rise the valve a^4 is closed and the valve d^4 opened, thus shutting off the supply of air to the holder, while at the same time the three-way valve is turned so as to bring its ports into register with the bore of the sections of the pipe d on each side of the valve, thus cutting off the air-supply and establishing communication with the water-supply, and water is now pumped through the pipe E to the tank F. During the time occupied in lifting the cap to its highest point, or to any point between its lowest and its highest position, successive charges of water are automatically supplied to the ejector D. It will be obvious from the location of the burner that the lower series of coils of the steam-generator B will be heated to a high point, while the succeeding coils are progressively cooler, the top coil being the coolest of all. By this arrangement a large charge of water will be allowed to flow down the coil to the point where it is quickly converted to steam under high pressure, whereas if the coils were heated uniformly from bottom to top the charge of water in the pipe b would be driven back by the steam generated on the entry of the first of the charge and the ejector would then only work for a few moments at a time, whereas the gradually-diminished heating of the coils from the bottom toward the top of the generator permits a comparatively large charge of water to be fed at each pulsation, thereby permitting the ejector to work for quite a lengthy period. As soon as the water is converted into steam there is a back action or attempt on the part of the steam to escape from the coil; but this is prevented by the check-valve b^2. When the cap has

reached its highest point, the valves g^5, d^6, c^5, c^6, and a^5, are closed the three-way valve d^4 being in the position to permit air to be pumped to the holder, the closing of the respective valves being effected through the medium of the chains g^9 and c^{12} and rods g^{10}, d^6, and a^7. It may be remarked in this connection that the valve d^4 is never closed, inasmuch as when the holder is raised it establishes communication between the ejector and the water-supply, and when the holder is down it establishes communication between the ejector and the air-supply. The valves just referred to being all closed and the cap being in its highest position, the ejector ceases to work; but the coil is kept constantly warmed by a small flow of gas to the burner supplied from the valves g^5 g^6, which constantly leak for this purpose. Now suppose water from the tank is drawn for any purpose. As the water-level in the tank sinks, the float f will also sink, and the weight of the levers g^7 and g^8 will open the valves g^3 c^5, thereby supplying gas to the burner and water to the coil. The coil will now generate steam and the ejector will operate to pump water to the tank until the latter is again filled and the valves g^5 g^6 closed by the rising of the float f. If air is drawn from the holder for any purpose, the decent of the cap will permit the weight of the lever c^{10} c^{11} to open the valves c^5 c^6, and thus supply gas to the burner and water to the coil in the manner already described. It is to be understood that the rods g^{10}, d^6, and a^7 have a sliding connection with the projections on the cap of the holder, so that it is only on the upward movement of the cap that the rods are moved thereby to close the valves, the weight of the levers attached to the respective valves operating to open them upon the downward movement of the cap.

It will be seen from the foregoing description that the operation of the form of apparatus just described is entirely automatic and needs no attention after being once started.

In the form of apparatus shown in Fig. 2 the generator is displayed as detached from the gasometer and employed for pumping hot water to supply a hot-water-heating system, or for supplying cold water to a tank to be used for domestic or other purposes, or for forcing air, hot or cold, to any desired point. In this illustration of embodiment of my invention the generator I has its lowest coil extended outward from the body of the generator to form an extension i, which is connected by a return-bend pipe J with the top coil of the generator at a point near that of the attachment of the water-supply pipe K with the coil. The pipe J, which constitutes a steam-supply pipe for admitting steam to the top of the coil to force the water therein downward through the coils, so as to effect a rapid generation of steam, is provided with a check-valve j, which operates to permit passage of steam through the pipe J to the coil, but prevents escape of steam from the coil to the said pipe, as will readily be understood. The extension i is provided with a pressure-controlling safety-valve i^2, preferably of the weighted type, which permits escape of steam from the coil when the pressure is too small therein. Water is supplied to the coil from a tank L, from which leads a pipe l, to which is connected two pipes M and N, respectively connecting with the water-supply pipe K. The pipe M constitutes the feed-water pipe, and the pipe N the return or back water pipe to the tank, the latter pipe being provided with a weighted safety-valve n, adapted normally to close communication between the pipes K and l, but to open when the back pressure in the coil is so great as to force the water upward through the coil and out through the pipe N. The valve n will only open when the pressure within the coil has reached a danger-point. The pipe M is provided with a check-valve m, which prevents backflow of the water, and also with a valve m^2, by which the supply of water to the generator may be entirely cut off. At a point near the free end of the bottom coil of the generator, which in this instance is shown as projected some distance to one side of the generator, is arranged the ejector D, and connecting with the ejector is a pipe P, carrying a check-valve p, the pipe P constituting a hot or cold water, a steam, or an air supply pipe, as the occasion may require. A pipe Q, leading to the source of water, also connects with the ejector, the latter pipe being of any preferred shape, but in this instance an inverted U, and carries a valve q, by which the passage of the water from the water-supply to the ejector may be cut off, a check-valve q^2 for preventing backflow, and an air-valve q^3 for supplying air to the ejector when desired. The pipe P leads directly to the tank L and has at any point in its length a branch pipe R, (indicated in dotted lines,) which constitutes a return-pipe when the apparatus is used in connection with a hot-water-circulation system. The pipe P in this latter instance may connect with radiators S, illustrated in a conventional manner in the drawings by small squares. When the apparatus is to be used for pumping water or air, the hot-water-circulation system may be cut out by means of a valve r on the pipe R. The burner T for heating the coil may be any one of the many forms of burners in common use—such as a Bunsen burner, gasolene-burner, or the like—and the heating medium may be gasolene, oil, or gas; but for cleanliness, cheapness, and safety the latter is preferred. The operation of this form of apparatus is as follows: The coil being first heated, water is admitted thereto by opening the valve m^2, whereupon a charge of water will pass through the pipe K to the coil and be converted into steam under high pressure. If the valve r is closed, the ejector will operate to draw water through the pipe

Q and force it through pipe P to the tank L. The ejector will continue to operate until the steam-pressure is practically exhausted, whereupon a fresh charge of water will be fed to the coil, and so on as long as the apparatus is in use. When the apparatus is to be used for pumping water through the radiators S, the valve q is closed and the valves r and q^3 opened. Sufficient water for the purpose is then poured into the pipe P through the valve q^3, after which the said valve is closed. The ejector in working forces the hot water through pipe P, radiators S, and pipe R back to the ejector, and so on, any excess of water resulting from condensation passing into the tank L. When air is to be pumped, the valves r and q are closed and the valve q^3 opened to supply air to the pipe P, which in this instance forms the air-distributing pipe.

In Fig. 3 I have shown an attachment that may be employed in connection with the top coil to effect a vent at the point of entry of the charge of water or to heat the same and convert it quickly into steam. The attachment consists of a disk U, of suitable sheet metal, having in its periphery a semicircular notch u, adapted to form an exit for the flame from the burner directly against the top coil of the generator at a point contiguous to that where the pipe K joins the generator or at the point where the pipe J joins the top coil. The disk is placed immediately beneath the top coil, and thereby closes egress of the flame except at the notch u. By this arrangement the flame is directed against the coil in a jet and rapidly heats the surface with which it contacts and operates either to heat the water immediately on its entrance into the coil or to form a vent to allow the water to pass down the coils.

It is to be understood that the form of generator shown in Fig. 1 may be employed for the same purposes as that shown in Fig. 2, and vice versa; also, that if desired the pipe b in Fig. 1 and K in Fig. 2 may be arranged in different planes to that shown in the drawings, although it has been found that by arranging the said pipes at an angle of about forty-five degrees to the generator very satisfactory results are attained.

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

1. A steam-pressure-generating apparatus, comprising a heating-coil, a liquid-supply therefor, valve mechanism for automatically regulating the supply of liquid to the coil, and an ejector operated by the steam from the coil, substantially as described.

2. A steam-pressure-generating apparatus, comprising a heating-coil, a liquid-supply therefor, valve mechanism arranged between the coil and the liquid-supply for automatically and intermittently establishing communication between the said supply and the coil, whereby to permit a charge of liquid thereto, and an ejector operated by the steam from the coil, substantially as described.

3. A steam-pressure-generating apparatus, comprising a heating-coil, a liquid-supply therefor, valve mechanism arranged between the supply and the coil for automatically and intermittently establishing communication with the coil to permit a charge of liquid thereto, a safety connection between the coil and the liquid-supply, and an ejector operated by the steam from the coil, substantially as described.

4. The combination with a gasometer or the like, of a steam-generating apparatus connecting with an ejector, pipes for supplying gas to a burner, and water to the apparatus, and mechanism operated by the movements of the gasometer to effect the automatic opening and closing of the said pipes, substantially as described.

5. The combination with a gasometer or the like, of a steam-generating apparatus, an ejector in connection therewith, pipes for supplying gas to a burner and water to the apparatus, mechanism operated by the movements of the gasometer to effect the automatic opening and closing of the said pipes, and an air-supply pipe leading from the steam-generating apparatus into the gasometer, and provided with a hood, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ABRAHAM T. WELCH.

Witnesses:
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E. H. PARRY.