(No Model.) 2 Sheets—Sheet 1.

P. E. JAY.

APPARATUS FOR GENERATING STEAM.

No. 344,277. Patented June 22, 1886.

Fig. 4.

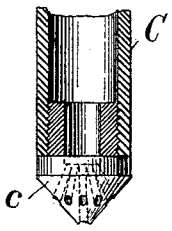


Fig. 5.

Fig. 6.

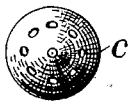


Fig. 1.

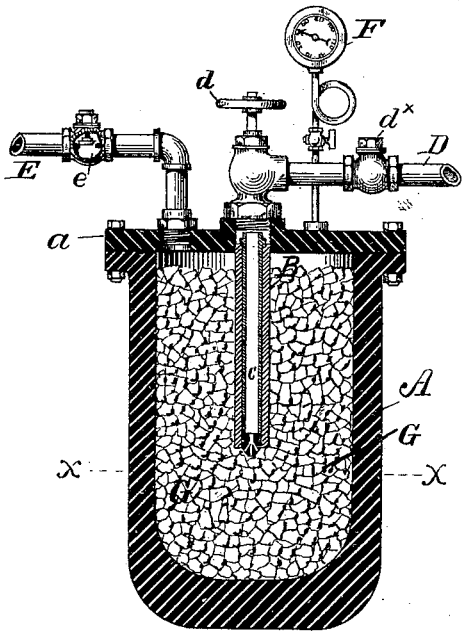


Fig. 7.

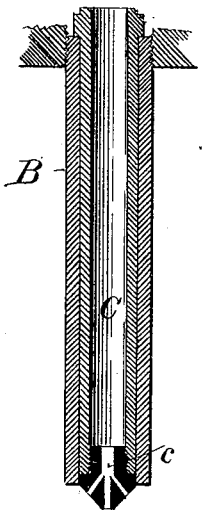


Fig. 2.

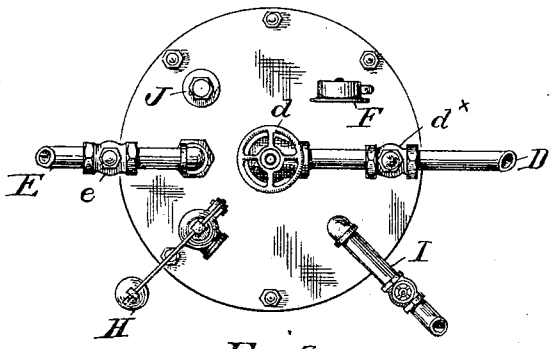
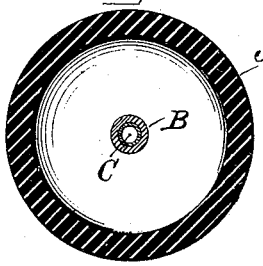


Fig. 3.



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F. N. Dixon.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 9.

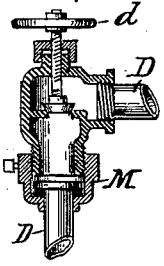

Fig. 8.

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UNITED STATES PATENT OFFICE.

PIERRE EYMARD JAY, OF NEW YORK, N. Y.

APPARATUS FOR GENERATING STEAM.

SPECIFICATION forming part of Letters Patent No. 344,277, dated June 22, 1886.

Application filed March 16, 1886. Serial No. 195,382. (No model.)

To all whom it may concern:

Be it known that I, PIERRE EYMARD JAY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Modes of and Apparatus for the Generation of Steam, of which the following is a specification.

The object of this invention is the practically-instantaneous generation of steam. Further objects are, economy of fuel, avoidance of conditions of explosion, and a reduction in the cost of the apparatus employed, coupled with simplicity and durability in its construction.

The invention is to be contradistinguished from a well-known class of so-called "instantaneous generators," in which steam is generated by the injection or flashing of water upon the interior surfaces of heated tubes, vessels, or other recipients, all such so-called "instantaneous generators" being, in fact, but special forms of boilers.

The invention is also to be contradistinguished from such a steam-generator as was patented to D. Renshaw under date of March 31, 1874, in and by United States Letters Patent No. 149,061, in which the generation is alleged to be effected by the injection of water upon a mass of heated bone-charcoal, the statement being made that metal is not applicable to the same purpose—a statement the error of which is evidenced by the results practically achieved by me.

I have discovered that water can be, to all intents and purposes, instantaneously converted into steam by dispersing, flashing, injecting, dropping, or pouring it or otherwise introducing it into and among a subdivided, fragmental, or granulated charge or mass of heated metal, alloy, or kindred metallic substance. The substance which I employ to constitute the fragmental charge or mass is preferably copper or other oxidizable metal, metallic substance, or alloy, which, in the form of broken pieces, cuttings, clippings, scraps, lumps, filings, or any other convenient state of subdivision, fragmentation, or granulation, is inclosed in a proper recipient or recipients, with the surface of which latter the water does not come into contact, and to the exterior of which heat is applied, so as to cause the thorough heating of the contained mass or charge. Any suitable degree of heat is to be thus applied to the charge; but I prefer a temperature of at least 752° Fahrenheit, at or above which temperature water, as is well known, passes instantaneously into steam without boiling and without assuming a spheroidal or globular state. This discovery of a method of practically instantaneously generating steam can be effectuated and practically employed by the aid of many forms of apparatus. Apparatus, however, of the character represented in the accompanying drawings, and described in this specification, conveniently embodies my invention, so far as the latter relates to apparatus, the entire subject-matter which I claim as novel, and which, as stated, embraces a method, being, however, hereinafter particularly claimed.

In the said drawings, Figure 1 is a central vertical sectional elevation of a generator embodying my invention, and which is inexpensive, safe, and durable. Fig. 2 is a top plan view of the said generator, and Fig. 3 a sectional plan of the same in the plane of the dotted line *x x* of Fig. 1. Fig. 4 is a side elevational and partly sectional detail of an injection-nozzle which I find it convenient to employ. Fig. 5 is a top plan view of said injection-nozzle removed from the injection-tube. Fig. 6 is a bottom plan view of the said nozzle. Fig. 7 is a magnified central vertical sectional elevation of the injection tube and nozzle as contained within a protecting sleeve fixedly applied to the generator. Fig. 8 is a central vertical sectional elevation through such a generator as is represented in Fig. 1, mounted in a suitable furnace, and also provided with an injection-tube adapted to be rotated. Fig. 9 is a sectional detail through an inlet-valve and stuffing-box shown in Fig. 8.

Similar letters of reference indicate corresponding parts.

In the drawings, A represents the generator, the same being a closed vessel or recipient of any preferred form, and made of steel, iron, or other metal or suitable incombustible material.

a is the lid of the generator, through which, preferably at the center thereof, is introduced a depending sleeve, B, for containing the injection-tube C.

D is a water-inlet or feed-water pipe, which communicates with the injection-tube, and is

provided with an inlet-valve, *d*, for regulating the water-supply, and with a check-valve, $d^{\times}$, of any preferred construction.

E is an outlet or steam pipe, through which the steam generated in the recipient is led off. *e* is a check-valve applied thereto.

G is a fragmental mass or charge, composed, as stated, of scraps or pieces of broken metal or other metallic substance, or of chippings, filings, or the like, which mass, in a condition of compacted subdivision, so to speak, is contained within the generator, and which wholly or almost wholly fills it.

F is a steam-gage, H a safety-valve, and I a blow-off pipe, each of any desired construction, and all preferably applied to the lid of the generator.

J is a plug removably applied to a charging-orifice conveniently formed in the lid, through which the fragmental charge is introduced into or removed from the generator. The injection-tube preferably terminates in an injection-nozzle, *c*, formed of any non-combustible and non-corrosive material, which nozzle is in the drawings represented as a plug provided with injection orifices applied to the lower extremity of the injection tube, and opening below the lower extremity of the containing-sleeve, so as to permit of the injection or introduction of water into the heart of the fragmental charge, preferably near its base.

The generator is adapted in any suitable manner to be heated to the desired heat, but preferably to such a heat as to raise and maintain its charge at a temperature of at least 752° Fahrenheit, the said fragmental metallic charge being of such character as in its nature to be capable of being regularly and evenly maintained at such heat.

In Fig. 8 I have represented a furnace, K, in which the generator can be mounted. The furnace, however, may be of any preferred character, and be arranged to receive either one or a series of generators. In said Fig. 8 I have also represented the injection-tube as adapted to be rotated within its incasing-sleeve B, it being above the lid of the generator conveniently housed within bearings L, being provided with a stuffing-box, M, at the point of its union with the feed-water tube proper, and being adapted to be rotated by a bevel-gear, N, or other suitable device.

Such being a description of a good form of apparatus, by the aid of which to practice my invention, it is to be understood that the heat-conductive metallic substances contained in the generator, be they scraps or broken or cut pieces of copper or other metal, or filings, chiselings, or other forms of metallic substances or alloys, are preferably, but not necessarily, of such material as is readily oxidizable at the temperature employed, and that a certain amount of the steam will at said temperature be decomposed, its decomposition being, as is well understood, attended by increased heat, and consequently increased pressure.

The fragmentary condition or state of subdivision or granulation of the contained metallic mass causes it to present a largely-increased effective heated surface or area, while the edges and points presenting into its interstices serve to break up the mass of injected or otherwise introduced water, and consequently to aid its evaporation. The contained mass having been raised to the desired temperature, the water introduced is practically instantly upon its introduction converted into steam, the heated fragmental metallic material used to vaporize the water holding, so to speak, the vapor formed, and maintaining its high temperature up to the time of its being led off as steam.

Such sufficient amount only of water as is required to produce the quantity of steam needed for immediate use is permitted to enter the receiver. The machine, engine, or other device to the operation of which the steam produced is directed, is preferably of a character designed to utilize such steam as is produced as it is produced, so that when the water is shut off the receiver is left not only empty of water, but devoid of any appreciable amount of steam. The generator, therefore, being in no sense an accumulator, is always perfectly safe. The safety-valve shown and mentioned as applied is not needed for the protection of the generator, but to avoid excess of pressure above that actually demanded. The water is preferably injected or introduced by a pump capable, in the first instance, of being operated by hand, but subsequently adapted to be driven by the engine which the steam generated is utilized to drive.

I have not regarded it as essential to represent an engine or other machine or motor to be driven, as it is obvious that the invention may be employed in connection with any device—as, for instance, a fog horn or signal for the operation of which steam is used; nor have I deemed it necessary to show any pump or other contrivance for supplying water, as it is obvious, especially when a low pressure is desired, that water can be supplied in any convenient manner and by the aid of any preferred instrumentality, it being possible to drop, spray, or simply pour it in required quantities into the generator. Injection or flashing under force is, however, probably the best and only applicable mode of introduction when high pressures are desired.

In the employment of an injector or other water-introducing device it is preferable that the point of injection or introduction should be somewhere near the bottom of the fragmental charge and at a point remote from the walls or bottom of the recipient. In order, when desired, to from time to time change the direction of discharge of the injection-jets, it is well to be able to rotate the injector, either by hand or, for instance, by such a contrivance as is represented in Fig. 8. If desired, moreover, more than a single injector or introduction tube or orifice may be employed; or, again, an injector having a series of in-

jecting-nozzles upon different levels; or, still again, a series of separate injectors may be used.

It is preferable that the injecting tube or tubes or other water-introducing device should be contained in a protecting sleeve or sleeves, so that such device can be removed for examination or repairs and be then replaced without disturbing the contained charge of broken or fragmental metallic material.

The degree of pressure to be obtained, or the amount of power to be produced, can be regulated at will by the quantity of water introduced and degree of heat of charge, as well as by the magnitude and number of generators employed, as, of course, as stated, the apparatus may be multiple as well as single.

The blow-off pipe can be brought into play at any indicated pressure in advance of the pressure at which the safety-valve is set to blow off, and it is convenient when at any time it is temporarily desired to shut off the escape or eduction of steam without stopping the injection of water.

It is obvious that the charge in the generator, being of metal, is practically indestructible, the waste by oxidation being infinitesimal.

Having thus described my invention, I claim—

1. The method of converting water into steam by dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into a fragmental, subdivided, or granulated mass of heated metal, alloy, or other metallic substance.

2. The method of converting water into steam by dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into a fragmental, subdivided, or granulated mass of heated metal, alloy, or other metallic substance contained in a closed recipient, to the exterior of which heat is applied.

3. The method of converting water into steam by dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into a fragmental, subdivided, or granulated mass of metal, alloy, or other metallic substance heated to a temperature at which water passes to steam without boiling or assuming a spheroidal or globular state, substantially as set forth.

4. The method of converting water into steam by dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into a fragmental, subdivided, or granulated mass of metal, alloy, or other metallic substance contained in a suitable recipient, to the exterior of which the heat is applied, and heated to a temperature at which water passes to steam without boiling or assuming a spheroidal or globular state, substantially as set forth.

5. The combination, to form an apparatus for the conversion of water into steam, of a closed generator, recipient, or containing-vessel, a fragmental, granulated, or subdivided mass or charge of metal, alloy, or other metallic substance contained therein, a furnace or other suitable means for heating the foregoing charge or mass, means for dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into said mass or charge, and means of exit for the steam generated.

6. The combination, to form an apparatus for the instantaneous conversion of water into steam, of a closed generator, recipient, or containing-vessel, a fragmental, granulated, or subdivided mass or charge of metal, alloy, or other metallic substance contained therein, a furnace or other suitable means for heating the foregoing charge or mass to a temperature at which water is instantly converted into steam, means for dispersing, flashing, injecting, pouring, dropping, or otherwise introducing water into said mass or charge, and means of exit for the steam generated, substantially as set forth.

7. The combination, to form an apparatus for the instantaneous conversion of water into steam, of a closed generator, recipient, or containing-vessel, a fragmental, granulated, or subdivided mass or charge of metal, alloy, or other metallic substance contained therein, a furnace or other suitable means for heating the foregoing charge or mass to a temperature at which water is instantly converted into steam, an injector for the injection of water into the contained mass or charge, and means of exit for the steam generated, substantially as set forth.

8. The combination, in an apparatus of the class herein set forth, of the generator A, the contained metallic mass G, the water-inlet or feed-water pipe D, the injection-tube C, and the outlet or steam pipe E, substantially as described.

9. The combination, in an apparatus of the class herein set forth, of the generator A, the contained metallic mass G, the water-inlet or feed-water pipe D, the injection-tube C, the outlet or steam pipe E, and the depending containing-sleeve for said injection-tube, substantially as described.

10. The combination, to form an apparatus of the class herein recited, of a furnace, a closed generator erected in connection with said furnace in such manner as to be heated thereby, a fragmental, subdivided, or granulated charge of metal, alloy, or other metallic substance contained therein, and means for injecting or otherwise introducing water to the heart of the charge, substantially as set forth.

In testimony whereof I have hereunto signed my name this 10th day of March, A. D. 1886.

PIERRE EYMARD JAY.

In presence of—
J. BONSALL TAYLOR,
JORDAN L. MOTT, Jr.