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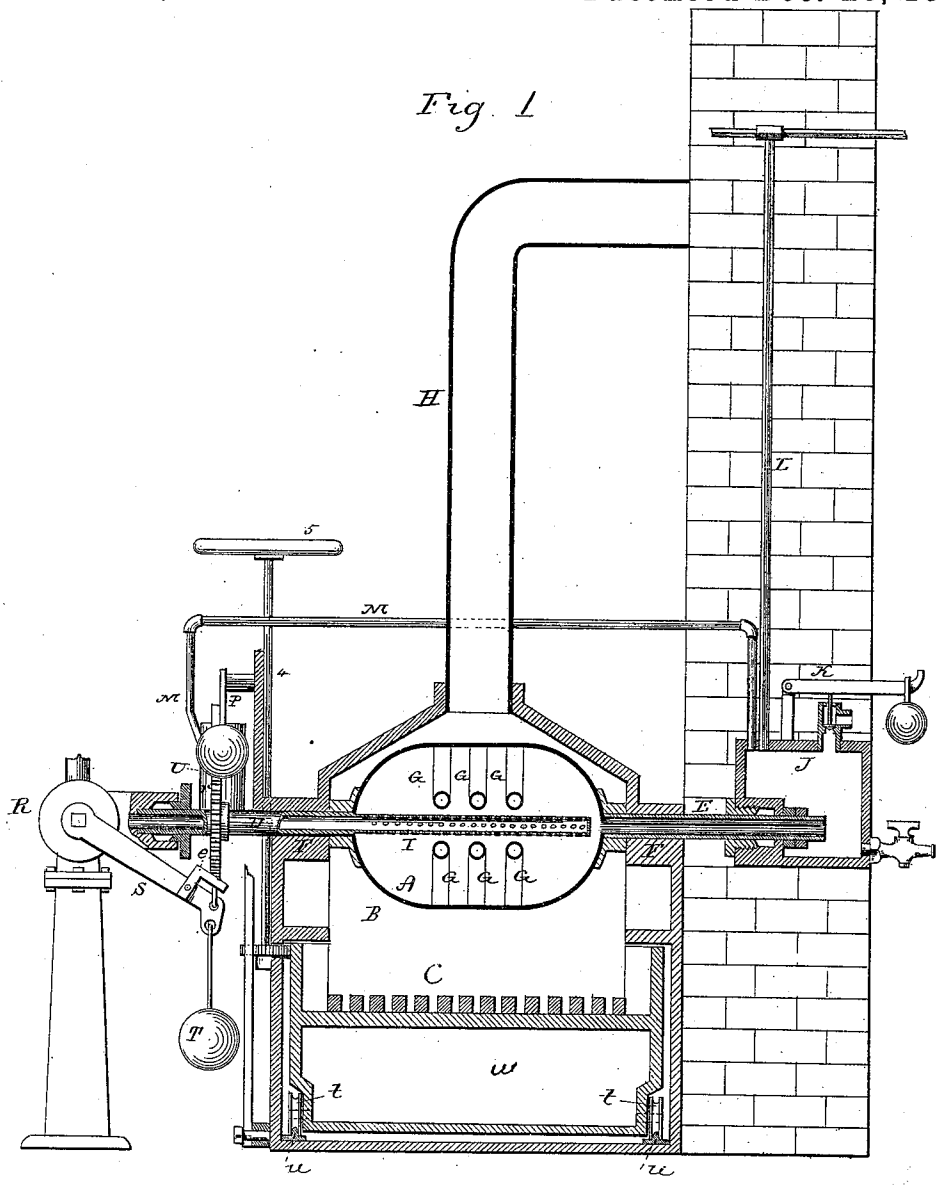
J. B. DOOLITTLE.

STEAM GENERATOR.

No. 355,152.

Patented Dec. 28, 1886.

Fig. 1



Witnesses.
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N. PETERS. Photo-Lithographer. Washington, D. C.

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Fig. 2

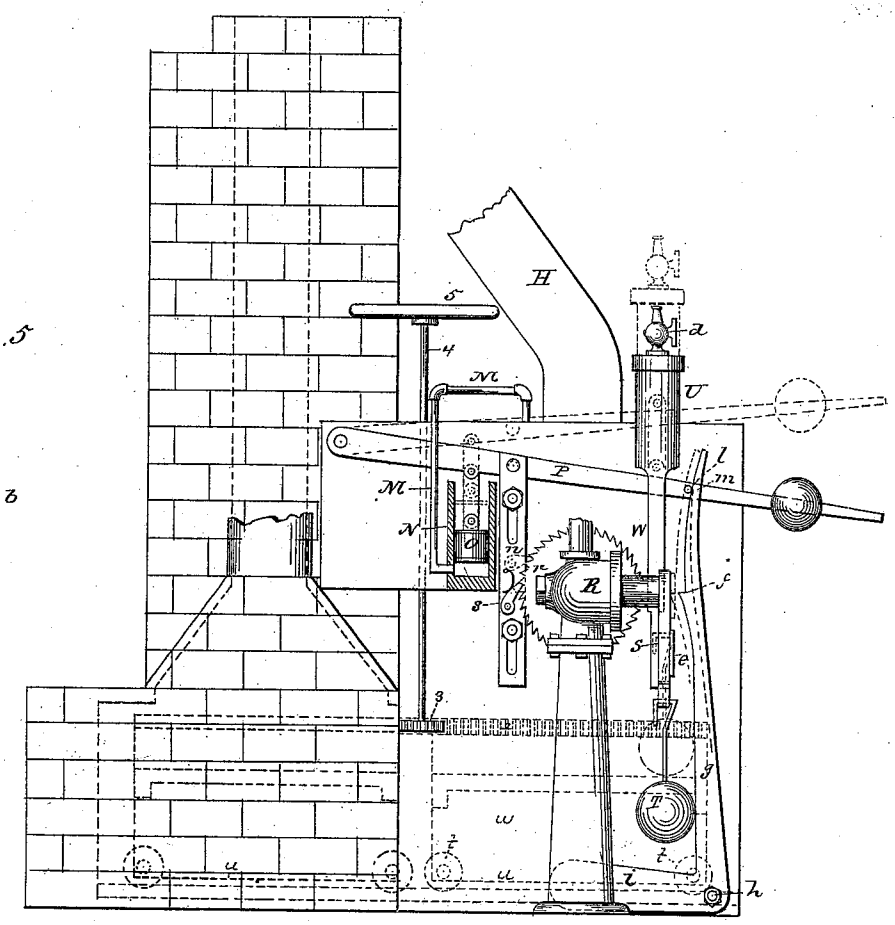
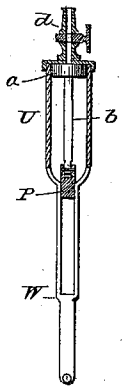


Fig. 5



Witnesses.
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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4

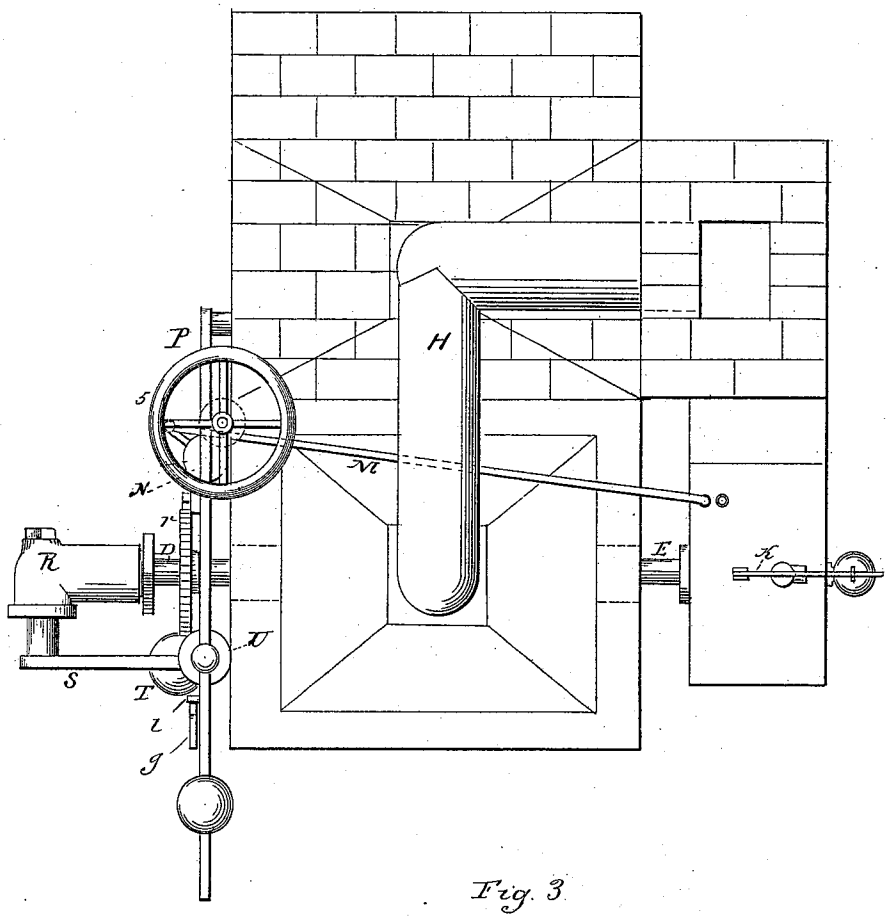
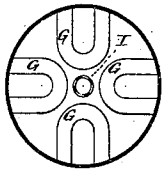


Fig. 3



Witnesses.
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UNITED STATES PATENT OFFICE.

JAMES B. DOOLITTLE, OF WALLINGFORD, CONNECTICUT.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 355,152, dated December 28, 1886.

Application filed August 30, 1886. Serial No. 212,161. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. DOOLITTLE, of Wallingford, in the county of New Haven and State of Connecticut, have invented a new Improvement in Steam-Generators; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a vertical sectional front view; Fig. 2, a side view, parts in section; Fig. 3, a transverse section through the boiler, showing the U-shaped flues; Fig. 4, a plan view of the apparatus; Fig. 5, a detached view showing the cylinder U and its connections with the lever P.

This invention relates to an improvement in apparatus for generating steam, the object of the invention being rapid evaporation, specially adapting the apparatus for heating purposes, but applicable to the generation of steam for power purposes.

The boiler A is arranged in a chamber, B, and upon an axis, so as to revolve in the said chamber, the chamber being above the fire-box C. The axis of the boiler consists of a tubular concentric extension or trunnion, D, at one end, and a like tubular concentric extension or trunnion, E, at the opposite end, these trunnions supported in bearings F, so that the boiler may be revolved in the said bearings. The boiler is best made of cylindrical shape, with hemispherical ends, as seen in Fig. 1.

In the shell of the boiler U-shaped tubes G are fixed, the plane of the U being at right angles to the axis of the boiler, the two legs of the U opening through the shell of the boiler, as seen in Fig. 3, the said U-shaped tubes forming flues through which the heat from the fire may pass. These U-shaped flues are best arranged in series, as seen in Fig. 1, and so that the boiler revolving over the fire, first one of the U's will be presented and then another, but all open into the chamber in which the boiler is supported, and in which chamber there is free circulation of the products of combustion, from whence they may escape through a flue, H, to the chimney. These flues add very greatly to the radiating capacity of the boiler.

Through one of the tubular trunnions D water is admitted to the boiler, and upon the inside of the boiler is a concentric perforated tube, I, forming a continuation of the tubular extension or trunnion D, upon which the boiler revolves, and so that water admitted through the trunnion D, under pressure, will be distributed inside the boiler in the form of spray, and the boiler, being hot from the effects of the fire below, will immediately convert this spray into steam, the steam escaping through the trunnion E at the opposite end of the boiler into a distributing-chamber, J. This chamber is provided with a common safety-valve, K, by which the pressure in the boiler may be regulated. From this chamber J the supply-pipe L leads to wherever the steam is required.

To automatically regulate the supply of water, a pipe, M, leads from the steam-chamber J into a cylinder, N, below a piston, O, therein, and upon this piston a weighted lever, P, rests, the tendency of the lever and its weight being to depress the piston, as seen in Fig. 2.

R represents a rotary valve, to which the supply of water is led, the valve communicating with the trunnion D of the boiler. The valve is best made of a rotary character—such, for illustration, as a plug-valve, not particularly shown or necessary to be shown—and so that when the valve is turned in one direction it opens communication between the supply and the trunnion, and so that water may flow directly through the valve into the trunnion, thence to the boiler, or when the valve is turned in the opposite direction the supply of water is cut off from the boiler. The valve is actuated by a lever, S, hung to the axis of the valve, and so as to swing in a vertical plane. It is provided with a weight T, so that when the lever is free to fall the weight will draw the lever downward, as seen in Fig. 1, and correspondingly open the valve. The lever S is in connection with the lever P, so that as the lever P rises, as seen in broken lines, Fig. 2, it will cause the lever S to rise and cut off the supply of water; but when the lever P falls the valve-lever is freed, so that it may fall

and open the supply of water to the boiler. This connection between the lever P and the valve-lever S, I prefer to make so that the valve-lever may cushion to prevent its closing so suddenly as to produce water-hammer. To this end I provide a cylinder, U, above the lever P, and from which a rod, W, extends down into connection with the lever S. In the cylinder is a piston, *a*, carried by a rod, *b*, which rod is hung to the lever P, as seen in Fig. 5. When the lever P is in its down position and the valve closed, the piston stands substantially against the upper end of the cylinder, the lower end of the cylinder being substantially open, and in the cylinder, above the piston, is a small opening, preferably made by a cock, *d*, so that the opening may be regulated. If, now, the lever P rise, it will cause the cylinder to rise with it, because it bears against the upper end of the cylinder, and thus rising to the position seen in broken lines, Fig. 2, the valve will be closed, and when the valve is closed the lever S, by means of a hook-like projection, *e*, will engage a shoulder, *f*, on a lever, *g*, hung below on a fulcrum, *h*, the said lever being counterbalanced, as at *i*, to permit the lever *g* to yield, that the hook *e* may pass over and onto the shoulder *f*. Thus the valve will be held in the closed position. If, now, the lever P descends, it will take with it the piston, leaving the cylinder with the lever S in the up position until, as the lever approaches its down position, a shoulder or stud, *l*, on the lever will strike an incline, *m*, on the lever *g* above the shoulder, and so as to turn the lever *g* out of engagement with the lever S, thus leaving the lever S free to fall under the action of its weight T, and as the lever S so descends the cylinder descends with it, and the air in the cylinder cushions the piston, and gradually escapes through the aperture above until the cylinder arrives at its extreme down position.

There being fire beneath the boiler, water is admitted thereto and discharged therein in the form of spray, as before described, and is rapidly converted into steam, passing to the chamber J, and thence to the points of consumption. Steam at the same time passes through the pipe M, beneath the piston O in the cylinder N, and so soon as the pressure of steam shall have risen so as to counteract the weight upon the lever P the piston will rise, taking with it the lever, as indicated in broken lines, Fig. 2, and immediately cut off the further supply of water; but so soon as the pressure of steam shall fall below the power of the weighted lever P, then the piston O will descend, and the descent of the lever will open the supply of water to the boiler. More water being then admitted, steam will be generated, and the pressure again raised and the water-supply cut off, and so continuing, there being substantially no supply of water in the boiler other than that which enters it in the form of spray, the boiler in the working condition immediately converting that spray into steam, and the supply of water must be regulated according to the consumption, and this may be done by a common globe or other suitable valve. (Not shown.)

To impart rotative movement to the boiler, I hang to the lever P a vertical bar, *n*, and on the axis of the boiler I arrange a toothed wheel, *r*. On the bar *n* is a pawl, *s*, arranged to work in teeth of the wheel *r*, and so that as the lever P rises the pawl engages the teeth of the wheel *r*, and imparts to the wheel and the boiler a rotation corresponding to the extent of vertical movement of the bar *n*, the pawl escaping from the teeth of the wheel as the bar descends. Thus at each rise of the lever P the boiler receives a step in its rotation. Under this arrangement the rotation of the boiler will be intermittent.

The force of water to the boiler may be produced by a mechanical or automatic pressure such as commonly used for boiler-feeding purposes.

Under this construction, whereby very rapid conversion of the water is produced, the apparatus is specially adapted for heating purposes, for the reason that there is no large body of water necessary to be heated before the generation of steam commences. The boiler itself is heated before the water is admitted, and being hot generates steam instantly, and the heating of the empty boiler over the same fire will require but a small proportion of the time which would be necessary to heat the water in the boiler as usually constructed for heating purposes. The rapid generation and consequently possible high heat affords a very considerable advantage in generating steam for power purposes.

In case no steam is required, and yet there be a fire under the boiler, it is desirable that the fire shall be removed from possible effect upon the boiler. To do this I construct the fire-box as a carriage, and arrange it upon wheels *t*, to run on rails *u* in the bottom of the pit. This carriage also carries the ash-pit *w*. The pit is opened at the forward end for supplying the fire for the removal of ashes, &c., by a door, in the usual manner. The pit also extends to the rear of the boiler-chamber, as seen in Fig. 2, and so that the carriage carrying the fire may be moved rearward from beneath the boiler, and when in its rear position it will stand beneath the flue, so that the products of combustion may pass directly therein, as seen in broken lines, Fig. 2, and without effect upon the boiler; but when the fire is again required the carriage with the fire may be drawn outward beneath the boiler. To thus operate the carriage, I provide it with a longitudinal rack, 2, upon one side, and into this a pinion, 3, works, fixed to a vertical shaft, 4, operated by a hand-wheel, 5, and so that the person in charge, taking hold of the hand-wheel, may move the carriage from one position to the other, as may be required. The draft continues to keep the fire burning while the carriage stands away from the boiler. While this

adjustment of the fire is particularly desirable in a revolving or rotating boiler, it is not essential thereto, and I do not wish to be understood as limiting my invention to the combination of the movable carriage with the rotating boiler.

Instead of the cylinder and piston to actuate the cut-off and supply for the water, the well-known diaphragm mechanism may be substituted for the piston and cylinder. This arrangement of diaphragm is a too well-known substitute for the piston to require illustration. By the terms "cylinder" and "piston" therefore I wish to be understood as particularly including such well-known equivalents therefor.

While I prefer to impart intermittent rotation to the boiler through the water-supply mechanism, the rotation may be constant, as by applying power directly to the axis of the boiler in any of the well-known methods of communicating rotative movement to shafts.

The counterbalancing-weight on the lever P should be made adjustable, so that the pressure may be varied to suit circumstances.

In case the lever P is employed, as I have described, to impart the rotative movement to the boiler, the power required for such rotation must be taken into account as a part of the weight or resistance to the raising of the lever.

If at any time the boiler should become filled with water above its axis it will flow into the steam-chamber J, and thence may be drawn out by a cock opening therefrom, and in such case the water standing in the boiler below its axis will be evaporated by heat, and when so evaporated the fresh supply will commence.

While I prefer the perforated tube I to distribute the water in the boiler in the form of spray, the tube may be omitted and the water delivered directly into the boiler.

The construction of the boiler which I have described is preferable over any construction known to me, yet other forms of boiler which are adapted to be rotated may be introduced.

The cylinder, with its piston and the lever P, may be employed only for the purpose of imparting rotation to the boiler, the movement being produced by the rise and fall of the pressure of steam.

I claim—

1. The combination of a fire box, a chamber over said fire-box, and a rotating boiler of cylindrical shape hung in said chamber upon tubular trunnions at each end, the one adapted to receive through it a supply of water and the other to permit the escape of steam from the boiler, the said boiler of cylindrical shape with series of U-shaped flues arranged therein and in planes substantially at right angles to the axis of the boiler, the legs of the said U-shaped flues opening through the shell of the boiler, substantially as described.

2. The combination of a fire-box, a boiler hung above the said fire-box upon tubular trunnions, one of said trunnions adapted to receive a supply of water through it to the boiler, a rotative valve communicating with said trunnion for the supply of water, the second trunnion opening into a steam-chamber, a cylinder and piston, a pipe leading from said steam-chamber to said cylinder beneath the piston, a lever supported upon said piston and counterbalanced, and a second lever fixed to the axis of said rotative valve, with a connection therefrom to said lever, substantially as described.

3. The combination of a fire-box, a boiler hung above said fire-box upon tubular trunnions, one of said trunnions adapted to receive a supply of water through it to the boiler, a steam-chamber, J, into which the second of said trunnions opens from the boiler, a valve, R, adapted to open and cut off the supply of water to or from the first of said tubular trunnions, a lever, S, fixed to the axis of said valve, a cylinder, N, piston O, counterbalance-lever P, resting on said piston, pipe leading from said steam-chamber to said cylinder beneath the piston, a cylinder, U, above, and with a connection therefrom to the valve-lever S, a piston, *a*, in said cylinder U, carried by said lever P, the upper end of the said cylinder provided with an aperture for the slow escape of air, and the lever *g*, constructed with a shoulder, *f*, and with an incline, *m*, with a corresponding stud, *l*, on said lever P, substantially as and for the purpose described.

4. The combination of a fire-box, a boiler hung upon tubular trunnions, one of said trunnions adapted to receive through it a supply of water to the boiler, a steam-chamber into which the second trunnion opens, a cylinder, a piston therein, a pipe leading from said steam-chamber to the cylinder beneath the piston, a counterbalanced lever, P, a toothed wheel on the axis of the boiler, and a pawl in connection with said lever P, adapted to engage the teeth of the wheel on the boiler, substantially as described, and whereby the up-and-down movement of the lever P will impart rotative movement to the boiler.

5. The combination of a boiler-chamber, a pit below said boiler-chamber and extending to the rear thereof, a flue leading from the boiler-chamber, and a second flue from the pit in rear of the boiler-chamber, the boiler hung upon an axis in said chamber and adapted to revolve therein, the axes of said boiler tubular for the admission of water and exit of steam, with a carriage arranged in said pit beneath the boiler carrying the fire-box, said carriage adapted to be moved from beneath the boiler-chamber to the portion of the pit in rear of the boiler-chamber and return, substantially as described.

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Witnesses:
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