

L. W. G. FLYNT.
STEAM GENERATOR.
APPLICATION FILED APR. 10, 1911.

1,024,845.

Patented Apr. 30, 1912.

3 SHEETS-SHEET 1.

Fig. 1.

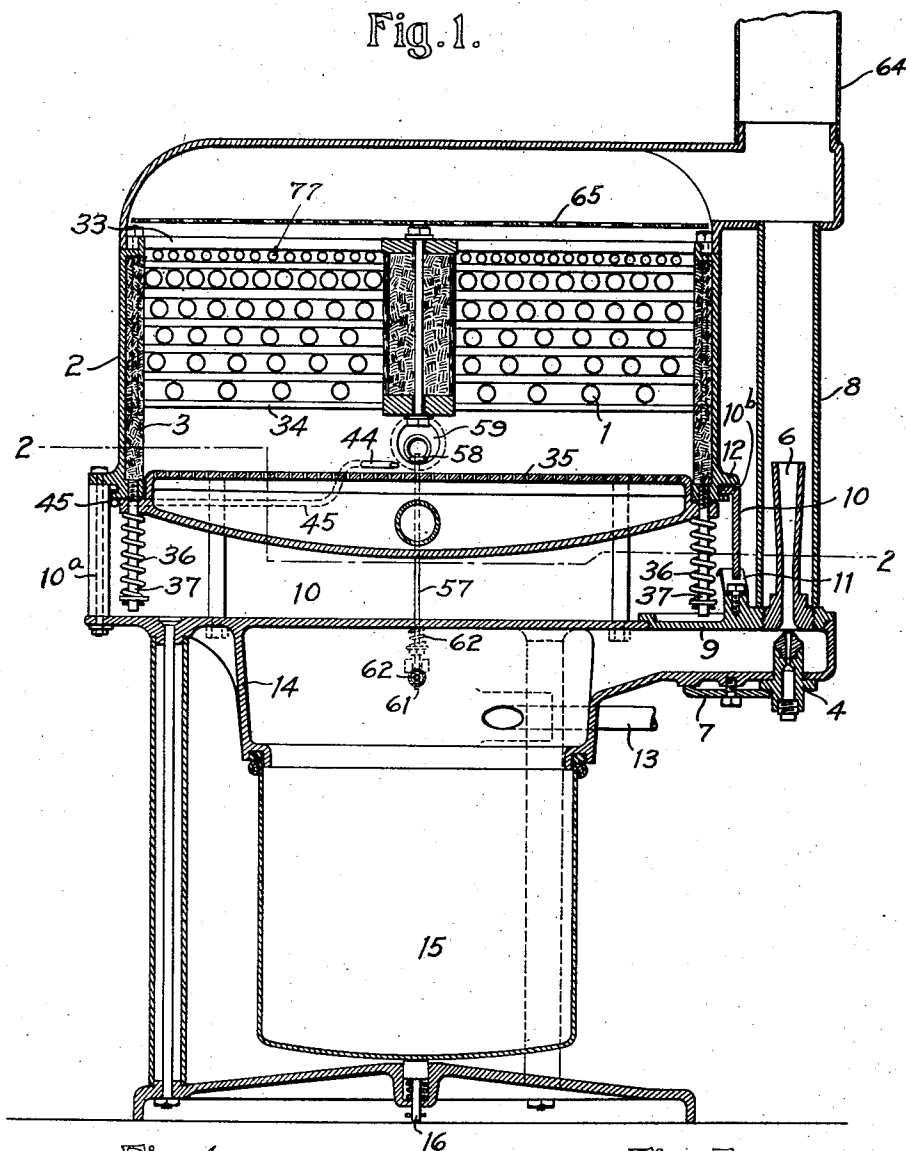


Fig. 6.

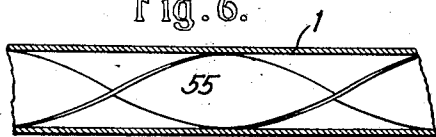
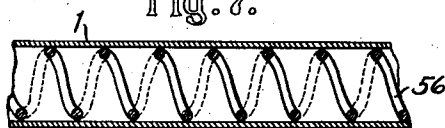


Fig. 7.



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3 SHEETS—SHEET 2.

Fig. 2.

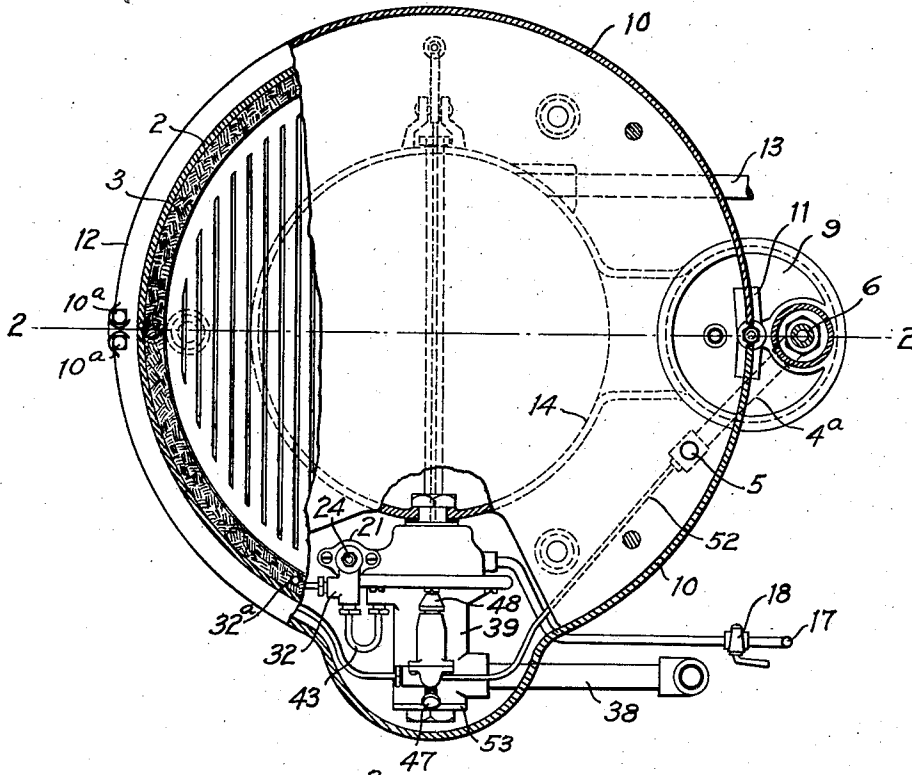
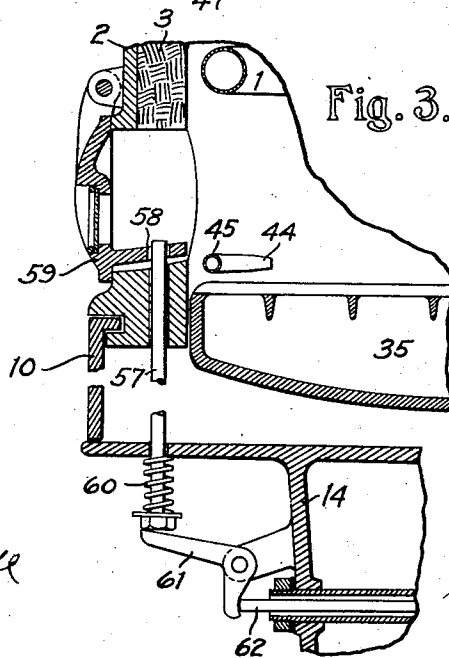


Fig. 3.



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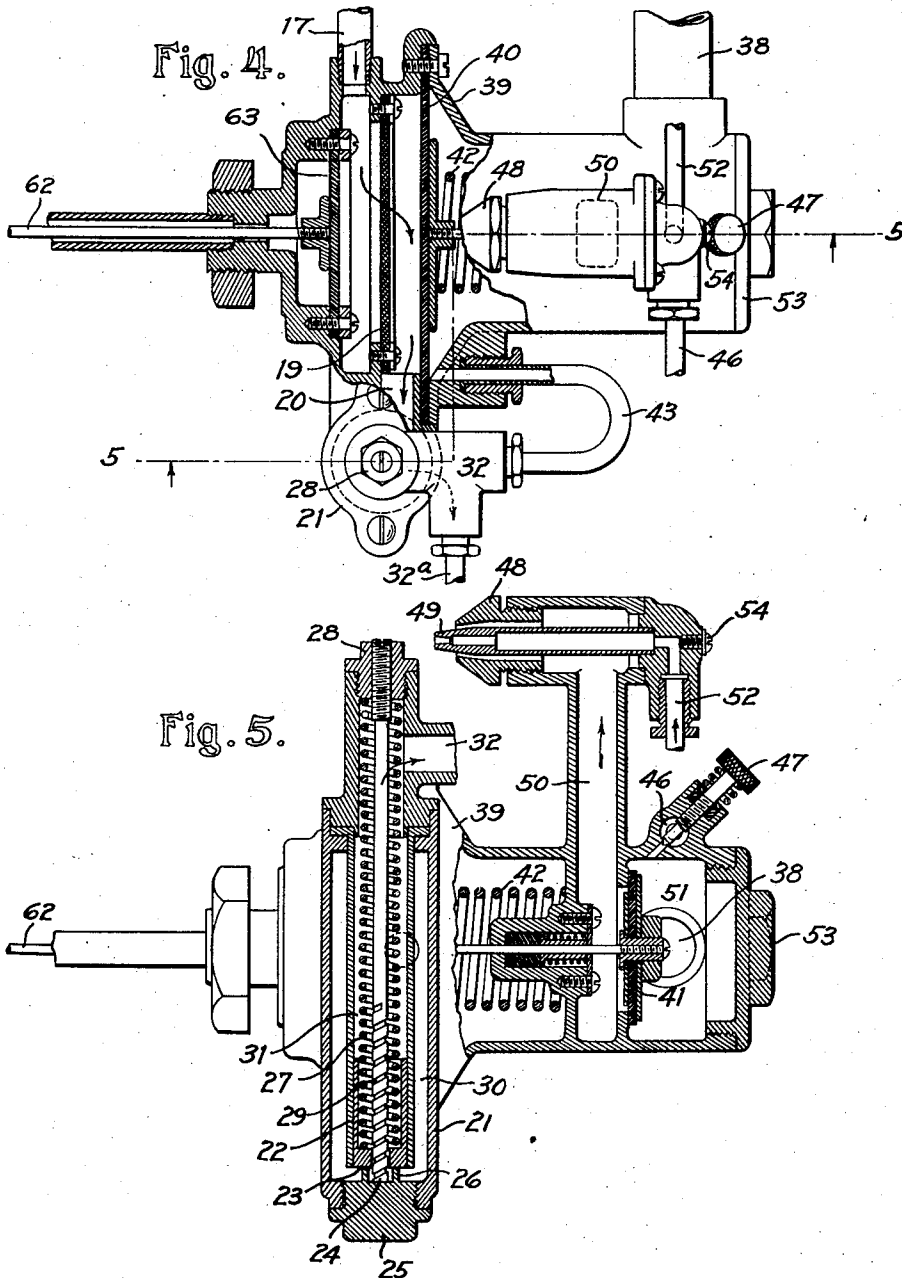
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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

LOUIS W. G. FLYNT, OF ROCHESTER, NEW YORK, ASSIGNOR TO DOMESTIC APPLIANCES COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

STEAM-GENERATOR.

1,024,845.

Specification of Letters Patent.

Patented Apr. 30, 1912.

Application filed April 10, 1911. Serial No. 620,113.

To all whom it may concern:

Be it known that I, LOUIS W. G. FLYNT, a subject of the King of Great Britain, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

This invention relates to steam-generators, and particularly to those in which the feed water is supplied continuously to the boiler and converted instantaneously into steam.

In a previous application filed by me, Serial No. 590,703, I showed how a uniform water feed to the boiler could be obtained, and how with that in operation it became possible to regulate the steam pressure solely by regulation of the fuel supply. In that application, furthermore, I showed two forms of devices whereby uniformity of feed is produced from a source of variable pressure, and claimed generically such a device, and specifically one of said forms. This application is made for the purpose of claiming the other said water feeding device, and other improvements that will be described. These inventions will be described in connection with vacuum-cleaning apparatus.

In the drawings:—Figure 1 is a vertical section of a vacuum-cleaning apparatus embodying the inventions in question on the line 2—2 of Fig. 2; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a vertical section showing a catch for securing the door that gives access to the burner; Fig. 4 is a plan view of a detail of Fig. 2, partially broken away; Fig. 5 is a section on the line 5—5 of Fig. 4; and Figs. 6 and 7 show details of boiler construction.

In the illustrated embodiment of the invention the generator consists of a flash-boiler 1 inclosed within a casing 2 which is lined with nonconducting material 3. The lower end of the boiler is connected with a steam-nozzle 4 by pipes 5 and 4^a, and the steam-nozzle discharges upwardly through a draft-pipe 6, which in conjunction with the steam-nozzle constitutes an air-ejector.

The steam-nozzle 4 is held removably in place by a clamp-plate 7. The draft-pipe 6 discharges through the pipe 8 and is attached to a plate 9. When the pipe 8 is pushed up into the casing 2 the draft-pipe 6

and plate 9 can be removed. The plate 9 is held in place by two doors 10, 10, which are hinged to the casing or frame of the machine opposite the air-ejector, as at 10^a, 10^a, and which engage at their lower edges springs 11, 11, and have their upper edges 10^b, 10^b bearing against a flange 12 on the casing 2.

A vacuum-service main 13 discharges air and dust into a settling chamber 14, from which the air and the finer solid material are discharged by the air-ejector. The lower portion of the settling chamber consists of a removable pan 15 that is forced up into close contact with the lower edge of the settling chamber 14 by a spring-controlled bolt 16.

The water is taken from a service pipe 17, that is controlled by a cock 18 (Fig. 2), and after being filtered by passing through the filter 19, is conducted by a duct 20 to a water-controlling valve that is designed to feed water to the boiler continuously in uniform quantity. This water-controlling valve comprises an outer casing 21 that contains a tube 22 within which is a piston that fits the tube water-tight and is adapted to move along a rod 24 under pressure of the water from below. The casing 21 is closed at one end by a plug 25. This plug has inwardly-extending projections that keep the piston away from the plug and so leave between the plug and the tube 22 some space through which the water can have access to that end of the piston in order to operate it. The piston is normally pressed down upon the projections 26 by a spring 27 that is interposed between it and a nut 28 in the other end of the tube 22 which carries the rod 24 before mentioned. This rod has a tapered groove 29 at its lower end, the larger part of the groove being at the lower end of the rod. In the drawing the groove is represented as running spirally around the rod. The groove constitutes a communicating passage between the chamber (which is formed by the outer casing 21 and the tube 22) and the interior 31 of the tube 22, so that water entering the controlling-valve from the filter by the duct 20 passes through the chamber 30, and coming into contact with the end of the piston 23 forces the latter upwardly against the resistance of the spring 27, at the same time

escaping in a small stream through the groove 29 into the chamber 31 from which it trickles out through the T 32 into the pipe 32^a that leads to a heating-coil 77 arranged above, and discharging into, the boiler coils. As soon as steam pressure accumulates in the boiler the pressure is communicated, by means of the pipe 32^a, to the chamber 31 in which is the spring 27. This pressure tends to carry the piston downward against the water-pressure and so bring a wider portion of the groove 29 into the piston, thereby counteracting the effect of the steam-pressure against the water-pressure. Again, if the water-pressure suddenly rises the piston 23 is moved upward, which brings the narrowest part of the groove 29 into the piston 23, which prevents an increase in the flow of water. By giving the groove the form of a parabola the device can be adjusted to produce a constant feed under all of the conditions of operation.

The boiler coils 1 are represented as so supported by the brackets 33 and 34 within the casing 2 that they can readily be removed from the casing. The burner 35 for heating the boiler is removably supported beneath the boiler coils by means of springs 36, 36 on rods 37, 37, respectively. The gas burner is fed by a gas main 38, and the flow of gas is automatically controlled by a regulating device comprising a casing 39, a diaphragm 40 in the casing (Fig. 4), a valve 41 connected with the diaphragm (Fig. 5), and a spring 42 that provides yielding resistance to the movements of the diaphragm and valve. On the side of the diaphragm 40 opposite the spring 42 the water pipe 17 enters from the service main (Fig. 4), so that when the water is turned on at the cock 18, the pressure of the water opens the valve 41 against the resistance of the spring 42. On the same side of the diaphragm as the spring 42 another pipe 43 enters the casing which leads from the T 32. This pipe 43 is always full of water, received from the chamber 30 of the water-controlling valve, so that when steam is generated in the coils 1 and enters the chamber 31 through the pipe 32^a it subjects the column of water in the pipe 43 to pressure, which is communicated to the diaphragm 40 and added to the force of the spring 42, thus tending to close the valve 41 and so reduce the flow of gas.

When the generator is first thrown into operation it is necessary that the valve 41 should open to a maximum in order to throw the burner into full operation and heat the coils rapidly, so that the water will be converted into steam before it reaches the open steam-nozzle. This result is secured automatically, since the water pressure on the diaphragm is not opposed, initially, by any steam pressure. At this time, therefore, the

spring 42 is put under compression, thereby allowing the gas-valve 41 to open fully until steam has been generated. As the steam pressure rises the gas valve is gradually moved from its fully-open position. Whenever, through any temporary cause, the steam pressure completely overcomes the water pressure and closes the valve 41, the flame is maintained by a pilot-light 44 (Fig. 1) until the steam pressure falls off and the valve reopens. The pilot-light 44 is fed by a pipe 45 that leads from a post 46 (Fig. 5) controlled by a needle valve 47.

From the foregoing description of the operation of the apparatus it is obvious that the steam pressure may rise and fall with fluctuations in the water pressure, but that it can never remain above the water pressure and so stop the flow of water to the generator, for whenever the steam pressure rises within a predetermined margin below the pressure of the water, it increases the pressure on the water in the pipe 43 and the diaphragm chamber, and closes the gas valve.

The mixture of gas and air is forcibly introduced into the burner 35 through a nozzle 48 through which a steam jet 49 discharges. The gas nozzle is connected by the passage 50 with the gas main 38 through the chamber closed by the gas valve 41, and the steam-nozzle 49 is fed by the pipe 52 that leads to the boiler (Fig. 2). A removable cap 53 gives convenient access to the valve 41, and a removable screw 54 makes it possible to clean readily the steam-jet 49.

The boiler is formed from tubing of suitable length that is coiled so as to receive to best advantage the heat from the burner over which it is suspended, as shown in Fig. 1, but before it is coiled it is so formed or equipped that the water in passing through it is forced to take a tortuous passage that brings all parts of it into frequent contact with the heated surface of the tube. Two forms of construction are shown. Fig. 6 represents a strip 55 of metal or other suitable substance that preferably is substantially equal in width to the diameter of the tube 1, and which is first twisted into a helix and then inserted into the tube. In this form the edges of the strip 55 will be adjacent to the inner surface of the tube 1, and the water in its passage through the tube will be so directed by the helical strip that all parts of it will be brought into frequent and intimate contact with the heated surface of the tube. In Fig. 7 a helix of wire 56 is employed which also serves to turn the water from a straight course through the tube, mixing it thoroughly and bringing all parts of it into intimate contact with the heated surface of the tube. By the use of either of these means, or their equivalents, water is uniformly and rapidly heated as it passes

through the boiler, so that it is completely vaporized in its passage through the boiler, and none of it is discharged in globular or spheroidal form from the steam-nozzle.

5 When the pressure of the water-service main is employed to operate the gas-valve to admit gas to the burner in the manner hereinbefore described, it is important to provide means also operated by the water-
10 pressure for locking shut the door that gives access to the burner or combustion-chamber while the gas is turned on, for otherwise if the gas should be turned on when the pilot was not lighted, and an attempt made to
15 light the burner, an explosion might result. It is also desirable that this door should remain locked after the gas has been turned off and until all gas has passed from the chamber. The locking means represented
20 consist of a bolt 57 (Fig. 3) that is adapted to enter a hole 58 in the frame of the door 59, and is operated against the spring 60 which normally retracts it from the door by the lever 61 that is pivoted on the frame 14.
25 The lever is in turn operated by a rod 62 that is attached to a diaphragm 63 located in the casing 39, so that when the water is turned on from the service main by the cock 18 the rod 62 is moved outwardly
30 against the lever. When the cock 18 is shut off the diaphragm 63 will not resume its normal position so as to permit the spring 60 to unlock the door till the water has passed out of the casing 63 through the
35 water-measuring valve and steam has ceased to be discharged from the jet. By the time this has occurred all of the gas within the combustion-chamber will have passed out through the pipe 64 which is connected with
40 a chimney or leads to atmosphere. In order to provide still further against accidents occurring through explosion the burner 35 is supported, as previously explained, upon springs 36, 36, so that the expansion of gas
45 caused by an explosion can force the burner down and so save the rigid casing from being blown out.

In the construction shown in the drawings the hot gases of combustion after passing
50 through the coils of the boiler (Fig. 1) meet and mingle with the steam and dust-laden air that is discharged through the pipe 8, so that their heat is utilized to incinerate the dust before it is discharged through the
55 pipe 64. A diffusing plate 65 is preferably placed above the boiler coils, as shown in Fig. 1.

I claim:—

60 1. A feed-water regulator having, in combination, a fixed stem provided with a tapered groove, a piston perforated to receive the stem with a close sliding fit, a cylinder in which the piston moves provided with inlet and outlet openings on opposite sides of
65 the piston, and a spring engaging the pis-

ton and tending to move it in the direction of the larger extremity of the groove in the stem.

2. A feed-water regulator having, in combination, two valve-members having coöperating surfaces of which one is provided
70 with a tapered groove constituting a water-passage between said members, one member being movable relatively to the other in the general direction of the length of said
75 groove so as to vary the cross-sectional area of the water-passage, and said member being subject, in opposite directions, to the pressures on opposite sides of the water-passage so as to be moved in accordance with
80 the difference in said pressures.

3. A feed water controlling-valve adapted to connect a steam-generator with a source of water supply under pressure, comprising
85 two valve members having coöperating surfaces with a communicating water-passage of graduated size decreasing in area in the direction of the boiler, one of said members being movable with reference to the other and thereby varying the area of said water
90 passage, the movable member being subjected on one side of said water passage to the pressure of the source of water supply and on its opposite side to the steam pressure of the boiler, whereby a continuous flow of
95 water of uniform quantity is had for all differences between the prevailing pressure in the source of water supply and the prevailing steam pressure in the boiler.

4. A feed water controlling-valve adapted
100 to connect a steam-generator with a source of water supply under pressure, comprising two valve members having coöperating surfaces with a connecting water-passage of graduated size decreasing in area in the di-
105 rection of the boiler, one of said members being movable with reference to the other and thereby varying the area of said water passage, the movable member being subjected on one side of said water passage to
110 the pressure of the source of water supply and on its opposite side to both the steam pressure of the boiler and an established yielding resistance, whereby a continuous flow of water of uniform quantity is had to
115 the boiler for all differences between the prevailing pressure in the source of water supply and the prevailing steam pressure in the boiler.

5. A feed water controlling-valve adapted
120 to feed water to a steam generator continuously and in uniform quantity from a source of water supply under pressure, comprising a suitable casing having separated ports for connection with the source of water supply
125 and the generator, respectively, a rod secured in said casing, a piston that fits water tight within the casing and is subjected to the joint and opposing pressures of the source of water supply and the steam in the
130

generator, said rod and piston having a water passage between them of graduated size decreasing in area in the direction of said port leading to the generator.

5 6. A feed water controlling-valve adapted to feed water to a steam generator continuously and in uniform quantity from a source of water supply under pressure, comprising
10 a suitable casing having separated ports for connection with the source of water supply and the generator, respectively, a rod secured in said casing, a piston that fits water tight within the casing and is subjected to the joint and opposing pressures of the
15 source of water supply and the steam in the generator, said rod and piston having a water passage between them of graduated size decreasing in area in the direction of the said port leading to the generator, and
20 a coiled spring surrounding said rod and yieldingly holding said piston away from the said port leading to the generator.

7. A feed water controlling-valve adapted

to feed water to a steam generator continuously and in uniform quantity from a source 25 of water supply under pressure, comprising an outer casing 21, having a port for connection with the source of water supply, a tube 22 within the casing communicating at one end with the steam generator and at the 30 other end with the port leading to the source of water supply, a piston 23 fitting water tight within the tube that is subjected to the joint and opposing pressures of the source of water supply and the steam in the gener- 35 ator, a rod within the tube which in connection with the piston affords a communicating water-passage between the source of water supply and the generator of graduated size decreasing in area in the direction 40 of the port leading to the generator.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."