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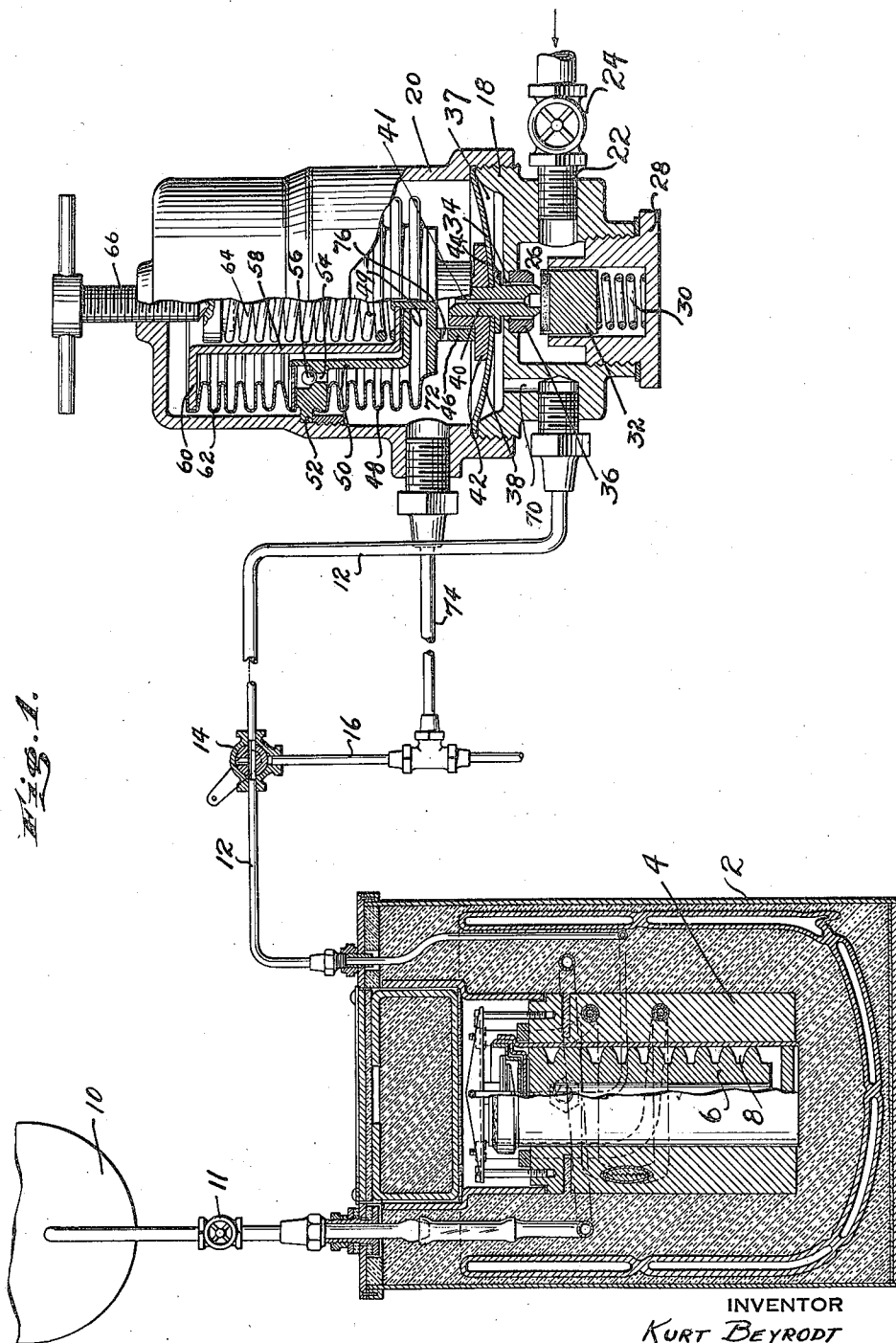
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2,141,705

DEMAND FEED SYSTEM

Filed April 27, 1937

2 Sheets-Sheet 1



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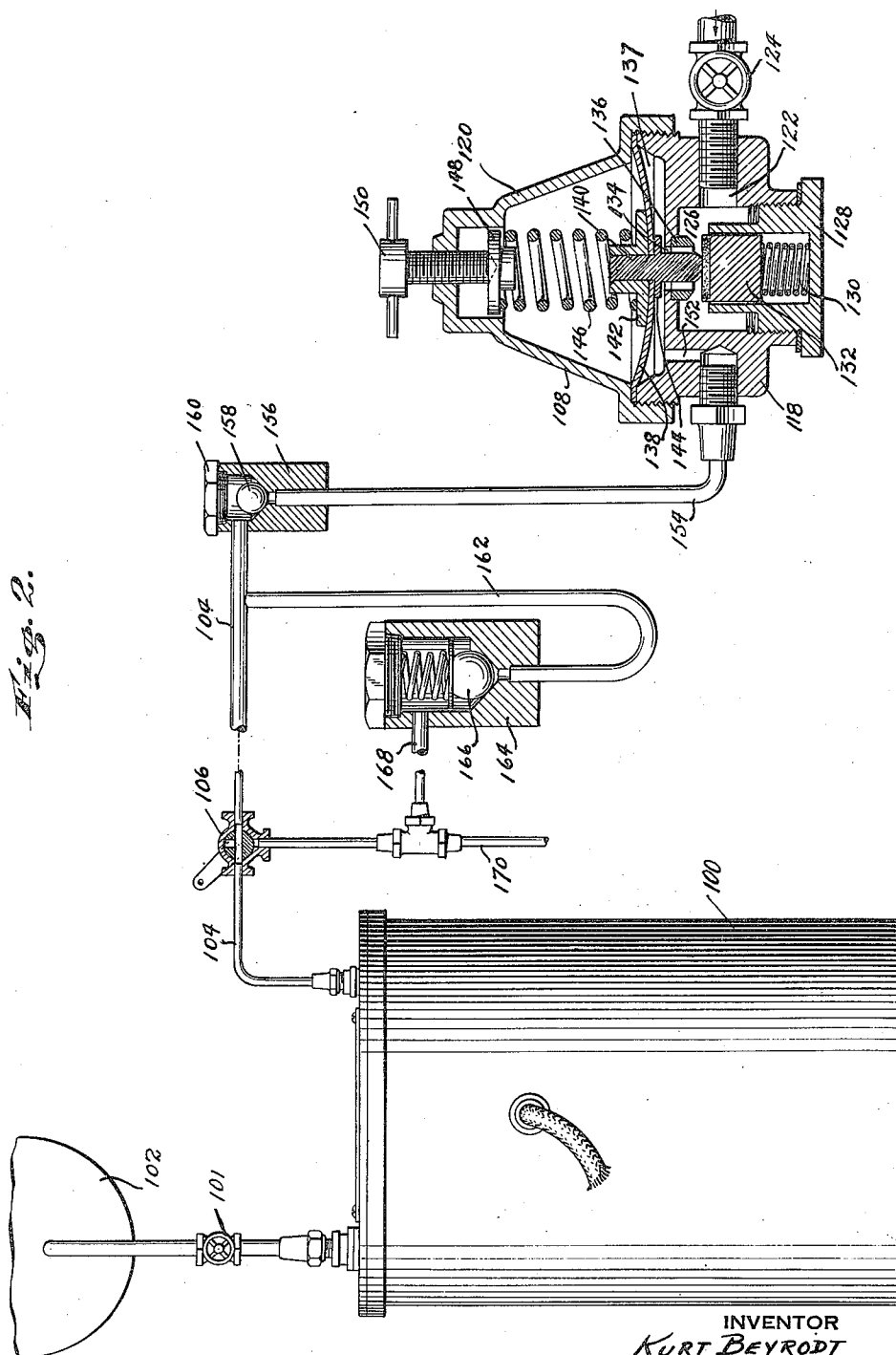
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2,141,705

DEMAND FEED SYSTEM

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Application April 27, 1937, Serial No. 139,165

5 Claims. (Cl. 50—23)

This invention relates to pressure regulators or may be more appropriately referred to as a demand feed system, or a damping device for pressure regulators.

5 The demand feed system is particularly well adapted for use in conjunction with instantaneous electric vapor generators such, for example, as that disclosed in my copending application Serial No. 71,883.

10 One of the objects of the present invention is the provision of a demand feed system which in cooperation with a generator of the character indicated will maintain a constant steam or vapor pressure, will automatically regulate the
15 feed water or fluid supply according to the demand of the steam or vapor generator and which will eliminate the objectionable bumping and surging which create impulses in the feed line.

Other objects of the present invention will be
20 manifest from the following description and the accompanying drawings, in which drawings:

Fig. 1 is a sectional elevational view of my improved system in conjunction with an instantaneous vapor generator; and

25 Fig. 2 is an elevational view partly in section illustrating my improved system in conjunction with a commercial pressure regulator and an instantaneous vapor generator.

Referring to the drawings in detail and first
30 of all to the form illustrated in Fig. 1. The electric steam or vapor generator, designated 2, is of the type disclosed in my copending application above referred to and comprises a metal mass 4 surrounding an evaporating surface which
35 takes the form of a metal casting 6 extending into the metal mass and provided with a downwardly inclined groove 8 extending helically about the periphery of the casting. Generated steam is conducted upwardly through the center of the
40 generator to an outlet adjacent the top thereof, as disclosed in my copending application above referred to, into an autoclave, pressure cooker, radiator or other pressure vessel 10 for use.

The feed water is supplied to the generator
45 through a pipe line or conduit 12 in which there is a two-way valve 14 providing for either cutting off the water supply and connecting the feed water inlet of the steam generator through pipe line 16 to waste, or connecting the feed water
50 supply directly to the steam generator.

The regulator of the present invention comprises a base 18 and cap 20 screw threaded to each other. The base 18 is provided with an inlet 22 controlled by a valve 24, the inlet lead-
55 ing into a chamber 26. The base member 18

is closed at its lower end with a plug 28 having a central bore for the reception of a spring 30 and a valve 32.

The base 18 has a central opening 34 provided with a bushing 36 in its lower end which constitutes a seat for the valve 32 so that when the valve is seated in this bushing the opening 34 is closed, as will be pointed out hereinafter.

Clamped between the base 18 and the cap 20 is a diaphragm 38 provided with a central valve member 40 having a longitudinal bore through the center thereof. This valve member 40 is held to the diaphragm 38 by means of a shouldered sleeve 42 on the upper end of the diaphragm and an annular projection or flange 44
15 on the valve member 40 below the diaphragm 38, the shouldered sleeve and projection clamping the diaphragm whereby the valve member 40 will move with the diaphragm. The shouldered sleeve 42 is surrounded by a collared syphon bellows head support 46 which supports a syphon bellows 48.

The cap or housing 20 is provided with a cup-shaped member 50 rigidly secured thereto and receiving the upper end of the syphon bellows
25 48. The cup 50 has an annular flange 52 whereby the same is secured to the housing 20, this flange having a port 54 controlled by a check valve 56. Within the cup-shaped member 50 is another cup-shaped member 58 having a laterally projecting annular flange 60 at its upper end.

A second syphon bellows 62 is connected between the flanges 52 and 60. The syphon bellows 48 and 62 communicate with each other
35 through the port 54 above referred to. Within the cup-shaped member 58 there is provided a spring 64 the tension of which is adjustable by means of a screw 66.

The base 18 of the regulator is provided with an outlet port 70 which communicates with the feed water line 12. A chamber 72 formed between the housing 20 and the syphon bellows 48 communicates with a conduit 74 leading to the waste line 16.

45 My improved apparatus may be operated continuously or intermittently, as desired, and under these conditions will maintain a constant steam or vapor pressure within the limits of the apparatus and at the same time the feed water
50 or fluid supply will be automatically regulated according to the demand of the steam or vapor generator.

Assuming that the valve 14 is in the position shown in Fig. 1, in which case the fluid supply 55

line to the generator is open. With the inlet valve 24 and the valve 11 to the autoclave 10 open, water is free to flow past the valve 24 and into the chamber 26 of the regulator, the water passing from this chamber through the opening 34 around the valve member 40 to the chamber 37 beneath the diaphragm 38 and by way of port 70 to feed line 12, through this line past the valve 14 to the generator 2. The electric power circuit to the generator 2, we will assume, is closed. In accordance with the operation of the generator 2, as fully described in my copending application above referred to, Serial No. 71,883, steam will at once be generated and pass into the autoclave 10. As the steam pressure in the autoclave 10 rises, depending of course upon the demands on the autoclave, a back pressure will be built up so that the diaphragm 38 will be raised to restrict the passage of water to the chamber 37, the raising of the diaphragm 38 raising the valve 40 and permitting the valve 32 to rise under the action of the spring 30. This upward movement of the valves 40 and 32 is resisted by the spring 64 and the bellows 48 and 62. The bellows 48 and 62 contain a liquid such as oil, for instance, and the upward movement of the diaphragm 38 to contact the bellows 48 will force fluid out of this bellows through the port 54, past check valve 56 into the bellows 62. This movement is fairly rapid.

The demands on the autoclave 10, that is to say, the demands on the steam generated in the generator 2 may be such that the valve 32 will in time seat on the seat 36 and prevent the entry of water from the supply source into the chamber 37. There will always be, of course, a certain amount of radiation from the generator and from the autoclave 10 and it will be quite apparent that as the steam pressure drops due to this radiation the valve 32 will open slightly so as to admit just enough water to the chamber 37 to make up for the steam lost by radiation. When a predetermined steam pressure is reached in the autoclave 10, depending of course upon the design of the apparatus, then a back pressure will be built up on the regulator and on the lower side of the diaphragm 38, raising this diaphragm still further against the action of the spring 64 and the bellows 48 and 62 so that only the lower end of the valve 40 is above the lower end of the valve seat 36, in which case water and steam can pass from the chamber 37, passage 34 and between the lower end of the valve 40 and the face of the valve 32, upwardly through the port 41 in the valve 40 and through the port 76 and into the space 72 above the diaphragm 38, and from thence by way of line 74 to waste, thereby relieving the pressure in the autoclave 10, and the valve 40 will move downwardly to its original position, that is to say, flush with the lower face of the valve seat 36, assuming that the valve 32 is still closed. This downward movement of the valve 40 is retarded by the fluid in the bellows 48 and 62. It will be understood that on this downward movement of the valve 40 and hence expansion of the bellows 48 and 62 the fluid cannot pass the check valve 56, that is to say, in passing from the bellows 62 to the bellows 48, the fluid is required to pass from the bellows 62 into the bellows 48 through restricted passageway 49 between the members 58 and 50.

If desired the valve 14 may be rotated 90° counterclockwise so that the generator 2 is open to the waste line 16 when the apparatus is not in

use. The valves 24 and 11, under these conditions, may be left open, if desired.

Referring now to the form illustrated in Fig. 2, an electric steam or vapor generator, designated 100, similar to that of Fig. 1 is provided having a conduit leading to an autoclave, pressure cooker, radiator or other vessel 102, this conduit being controlled by a valve 101. Feed water is supplied to the generator through a pipe line or conduit 104. The line 104 is equipped with a valve 106 similar to the valve 14 of Fig. 1.

A pressure regulator 108 is provided in this embodiment of my invention without the contained damping device of Fig. 1. This regulator comprises a base 118 and a cap or housing 120 screw threaded to each other. The base 118 is provided with an inlet port 122 controlled by a valve 124 leading into a chamber 126.

The base 118 is closed at its lower end by a plug 128 having a central bore for the reception of a spring 130 and a valve 132. The base 118 is also provided with a central bore 134 equipped with a bushing 136 in its lower end which is adapted to be engaged by the valve 132 to close the opening 134. A diaphragm 138 having its edge clamped between the base 118 and housing 120 is provided with a central valve member 140 extending through the bushing 136. This central valve is held in the diaphragm 138 by means of a shouldered sleeve 142 on the upper end of the diaphragm and an annular flange 144 on the valve member 140 on the bottom of the diaphragm. A spring 146 is positioned on the shouldered sleeve 142 and has its upper end in engagement with a stop 148 on a thumb screw 150 by which the tension of the spring is adjusted.

The outlet port 152 of the regulator of Fig. 2 has a conduit or pipe line 154 leading therefrom to the line 104, past interposed check valve assembly 156 which comprises a housing enclosing a ball 158 and a cap 160. A conduit or bypass 162 leads from the feed line 104 to a relief valve assembly 164. This assembly comprises a housing containing a check valve 166. This valve has been shown as spring-loaded for purposes of illustration, it being understood that other types may be used if desired. The spring of the check valve is set for slightly higher pressure than in the regulator. A conduit 168 leads from the relief valve assembly 164 to a waste line 170.

In operation and assuming the parts in the position shown in Fig. 2 with the valves 124 and 101 open: The water can flow into the chamber 126 and through passage 134 to the chamber 137 beneath the diaphragm 138 and from thence through port 152, line 154, line 104, raising the check valve 158 and from thence past the valve 106 to the generator 100.

Should the pressure generated in the autoclave 102 exceed a predetermined amount then it will be appreciated that a back pressure is created sufficient to raise the spring loaded check valve 166 opening the line 104 to waste. Under these conditions, however, the check valve 158 remains closed with the result that the diaphragm 138 will be moved up still further against the action of the spring 146 until the valve 132 seats on the seat 136 which will prevent any more water passing to the chamber 137. The parts will remain in this position until the pressure in the autoclave 102 is lowered whereupon the valve 166 will again seat due to the action of its spring and water may then pass from the chamber 137

past the check valve 158 to the generator to supply more water to the same.

If desired the valve 106 when the device is to be out of operation for some time may be moved anti-clockwise 90° to disconnect the feed line 104 from the generator and to connect the feed water terminal of the generator to the waste line 170.

It is to be understood that my improved demand feed system is particularly well adapted for use in steam generators such as disclosed in my copending application above referred to. The device can be employed with such generators in conjunction with any type of pressure vessel such as the autoclave illustrated, or where steam is employed for heating, cooking, sterilizing, expansion processing, etc.

An important feature of the demand feed system of the present invention resides in the fact that there is no steam under pressure in the entire installation after the autoclave has been completely exhausted and no water can enter the steam generator through leakage of the valve 14 since such water would run into the waste through line 16.

It is to be understood that the device of my present invention may be employed without an autoclave, in which case the valve 11 of Fig. 1 or the valve 101 of Fig. 2 would always be open to the air and the generator kept dry by operation of the valve 14 of Fig. 1 and 106 of Fig. 2 by manipulation of a foot pedal for instance. Such use of my improved device would be advantageous in the practice of clothes pressing machines, for example.

It will be understood from the foregoing that I have provided a demand feed system or damping device which when used in cooperation with a steam generator as herein described will result in a constant steam or vapor pressure and which will automatically regulate the feed water or fluid supply according to the demand.

It is to be understood also that by connecting the generator feed water terminal to the waste line when the generator is being shut off will permit the steam pressure in the generator and/or the pressure vessel to drive all residual water out of the generator and the supply line and thus help to instantaneously stop the generation of steam.

It is to be understood that various changes and modifications may be made in the structures herein illustrated and described without departing from the spirit and scope of my invention.

What I claim is:

1. A pressure regulating device for use in an instantaneous vapor generator system comprising a housing having a liquid inlet and a liquid outlet, a chamber adjacent said inlet, a chamber adjacent said outlet, a port between said chambers, a diaphragm, a valve carried by said diaphragm for opening said port, a pair of intercommunicating cooperating syphon bellows in engagement with said diaphragm and acting upon said diaphragm against liquid pressure built up in the last mentioned chamber for controlling the admission of liquid supplied to the generator through said outlet in accordance with the demand for vapor upon the generator.

2. A pressure regulating device for use in an instantaneous vapor generator system comprising a housing having a liquid inlet and a liquid outlet, a chamber adjacent said inlet, a chamber adjacent said outlet, a partition dividing said

chambers, a port in said partition, a diaphragm, a valve carried by said diaphragm for opening said port, a pair of intercommunicating cooperating syphon bellows containing a pressure medium, said bellows acting upon said diaphragm against liquid pressure built up in the last mentioned chamber for controlling the admission of liquid supplied to the generator through said outlet in accordance with the demand for vapor upon the generator.

3. A pressure regulating device for use in an instantaneous vapor generator system comprising a housing having a liquid inlet and a liquid outlet, a chamber adjacent said inlet, a chamber adjacent said outlet, a port between said chambers, a diaphragm, a valve carried by said diaphragm for opening said port, a pair of syphon bellows in engagement with said diaphragm, cup-shaped members in each of said bellows and telescoping each other, a spring in the inner one of said cup-shaped members, and means for adjusting the tension on said spring, said bellows under the tension of said spring acting upon said diaphragm against liquid pressure built up in the last mentioned chamber for controlling the admission of liquid supplied to the generator through said outlet in accordance with the demand for vapor upon the generator.

4. A pressure regulating device for use in an instantaneous vapor generator system comprising a housing having a liquid inlet and a liquid outlet, a chamber adjacent said inlet, a chamber adjacent said outlet, a port between said chambers, a diaphragm, a valve carried by said diaphragm for opening said port, a pair of superimposed syphon bellows on the side of said diaphragm opposite said last mentioned chamber, a pressure medium in said bellows, a check valve providing one way communication for said pressure medium between said bellows whereby upon the raising of said diaphragm due to pressure being built up in said chamber adjacent the outlet the pressure medium will be forced from one bellows to the other, and an orifice providing communication between said bellows whereby upon pressure being released at the underside of said diaphragm the pressure medium will be slowly returned to the bellows from which it was forced by way of said check valve, whereby to control the admission of liquid supplied to the generator through said outlet in accordance with the demand for vapor upon the generator.

5. A pressure regulating device for use in an instantaneous vapor generator system comprising a housing having a liquid inlet and a liquid outlet, a chamber adjacent said inlet, a chamber adjacent said outlet, a port between said chambers, a diaphragm, a valve carried by said diaphragm for opening said port, said valve having a central bore providing a passage for the liquid from one side of said diaphragm to the other side as the diaphragm raises said valve off its seat, a pair of intercommunicating syphon bellows in engagement with said diaphragm and acting upon said diaphragm against liquid pressure built up in the last mentioned chamber for controlling the admission of liquid supplied to the generator through said outlet in accordance with the demand for vapor upon the generator.

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