United States Patent [19]

Schaefer

[11] **3,791,349**

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[54] **STEAM GENERATOR**

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[52] **U.S. Cl.** **122/11,** 122/26
[51] **Int. Cl.** **F22b 3/06**
[58] **Field of Search** 122/11; 126/26, 247

[56] **References Cited**

UNITED STATES PATENTS

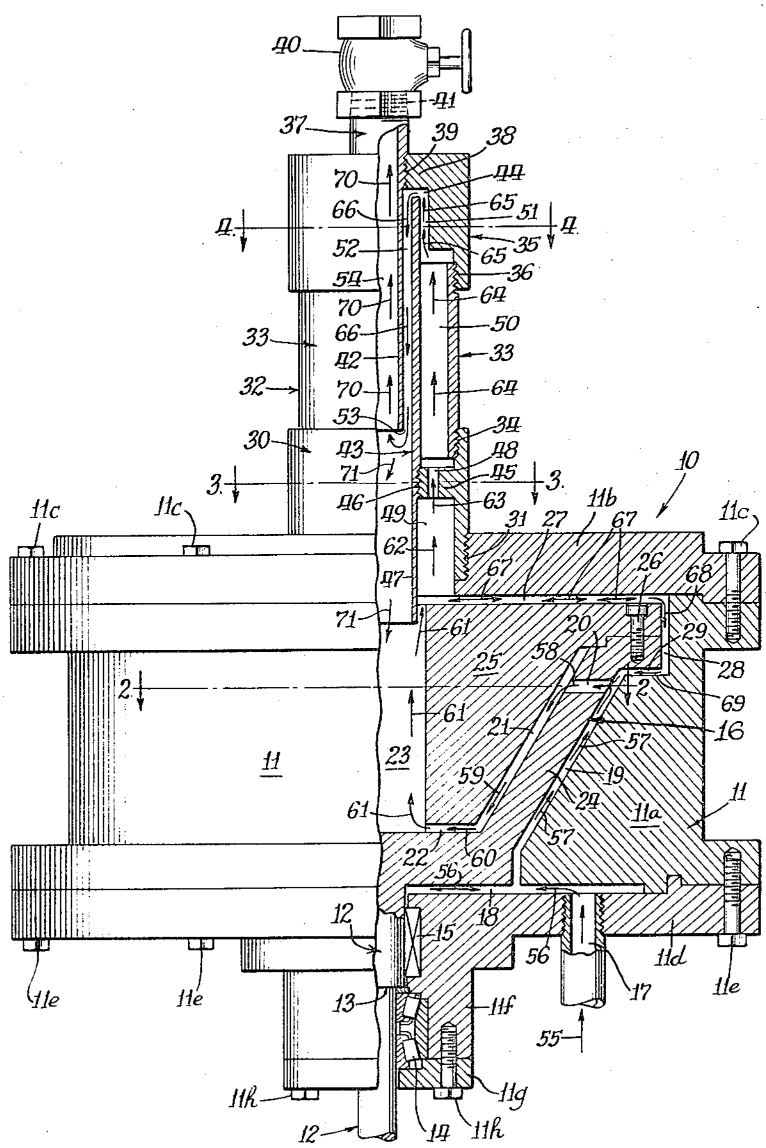
1,758,207	5/1930	Walker	122/26
2,316,522	4/1943	Loeffler	122/11
2,991,764	7/1961	French	122/26
3,508,402	4/1970	Gray	122/11 X
3,690,302	9/1972	Rennolds	122/11
3,720,372	3/1973	Jacobs	122/26

Primary Examiner—Kenneth W. Sprague
Attorney, Agent, or Firm—Kenneth T. Snow

[57] **ABSTRACT**

An apparatus and method for the production of steam and pressure by the intentional creation of shock waves in a distended body of water. The created shock waves are in the nature of water hammer and it is this water hammer which is repeated and intensified to such an extent the heat and pressure developed in the water converts the water into usable steam.

15 Claims, 8 Drawing Figures



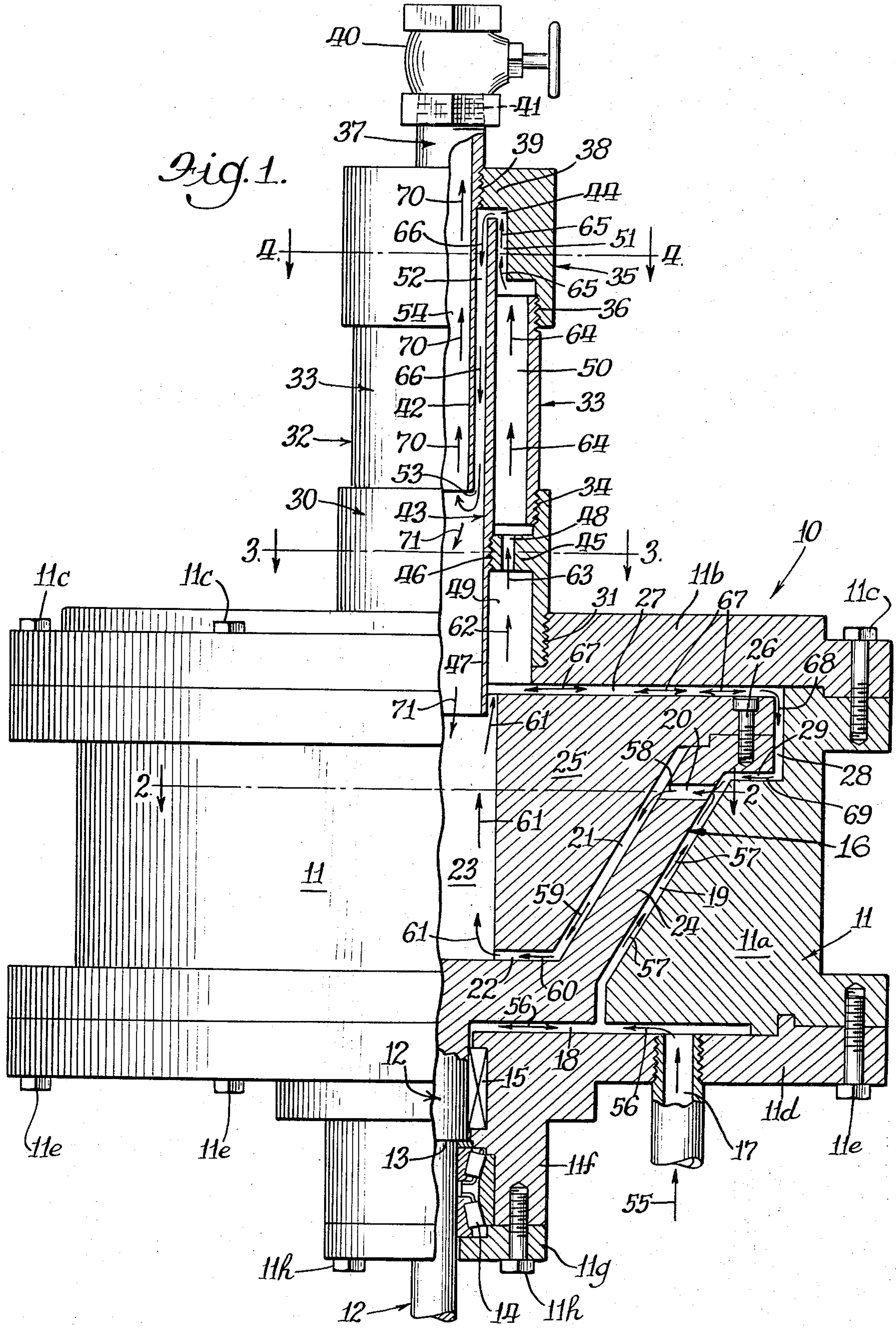


Fig. 1.
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Fig. 2.

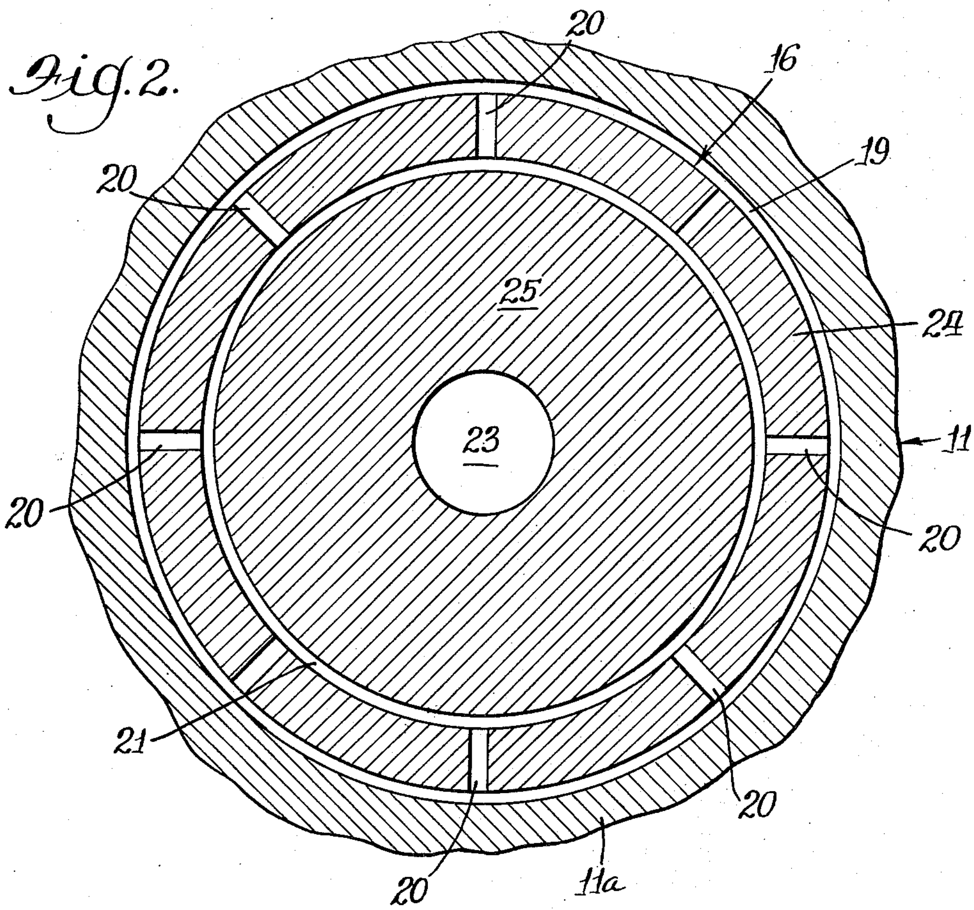


Fig. 3.

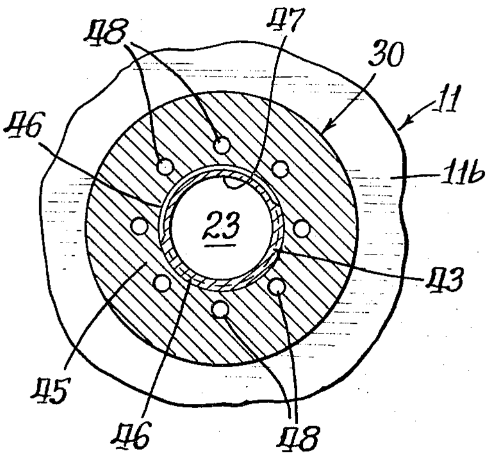


Fig. 4.

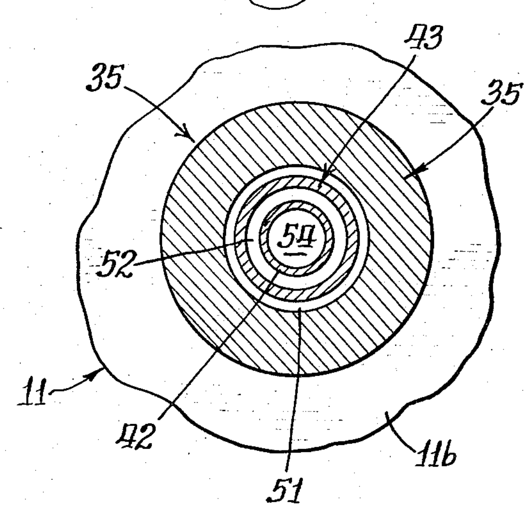


Fig. 5.

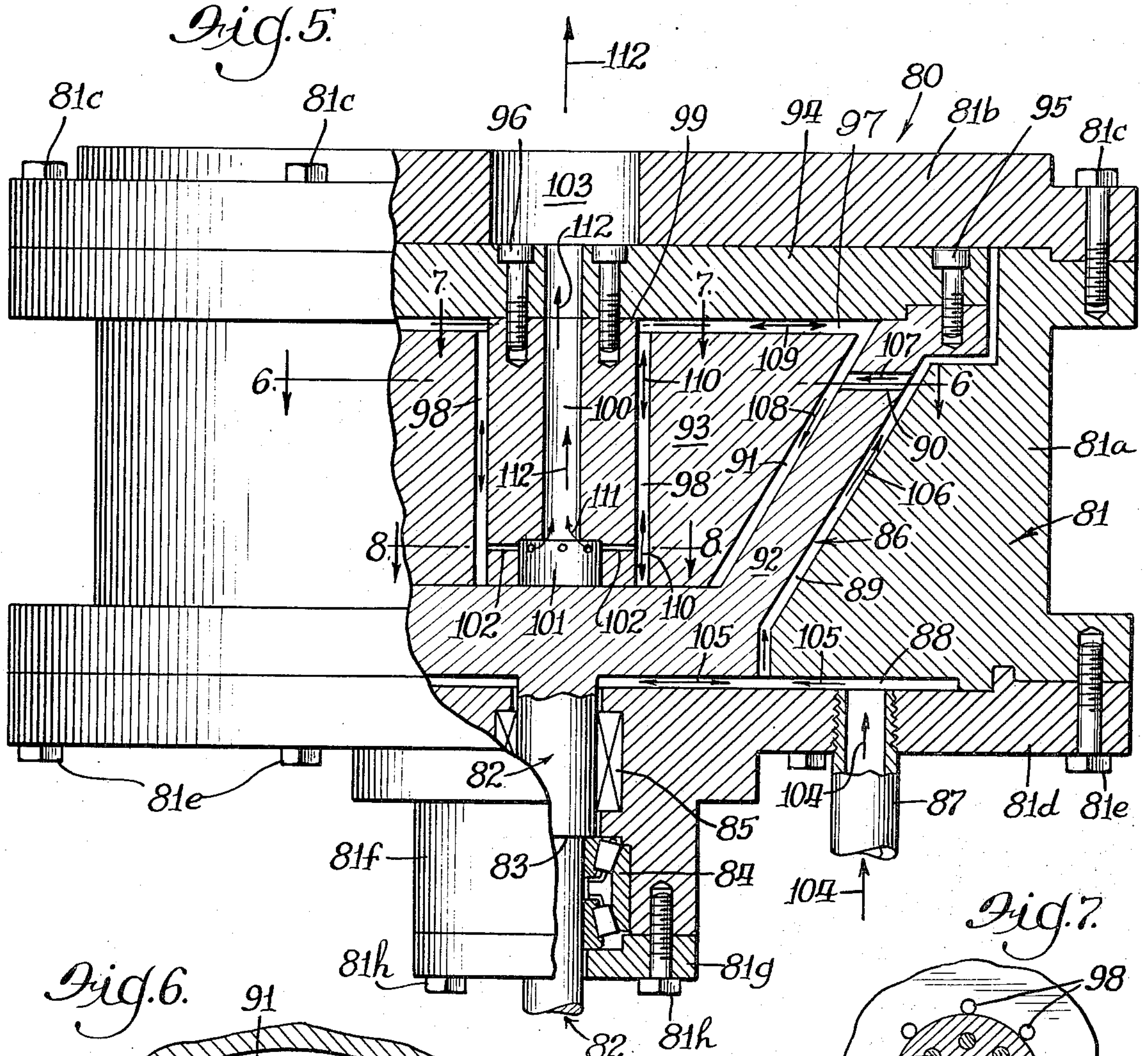


Fig. 6.

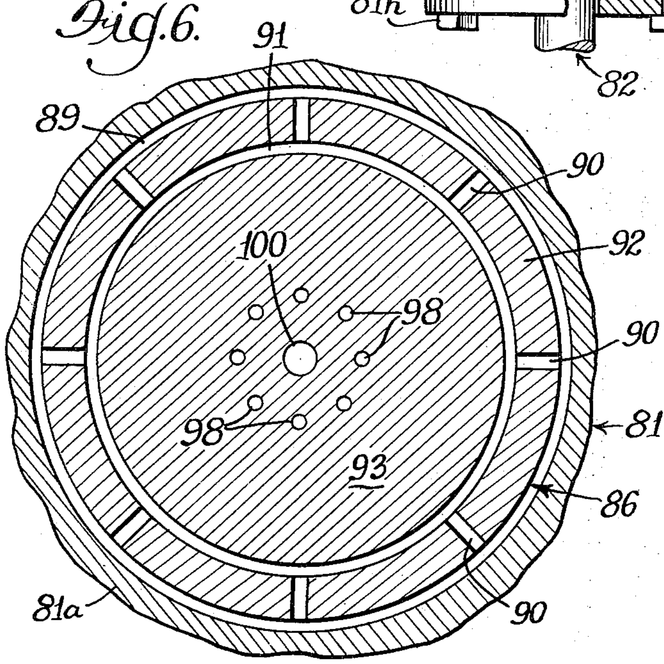


Fig. 7.

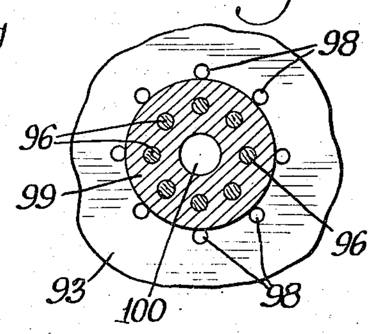
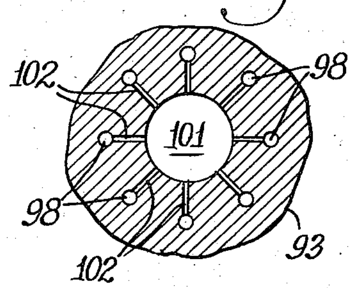


Fig. 8.



STEAM GENERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

Steam generators have been in use for many years. Such generators have primarily employed burnable fuels to raise the temperature of a body of water until the water changes into steam. The uses of steam generators have been many. Many building heating systems employ steam as the heating medium. Many chemical processes employ steam to produce certain chemical reactions. Some of these use the steam as a source of heat or to contribute to the reaction while others use the steam as a catalyst to promote the desired reactions. Many physical problems are aided by the use of live steam. For example, certain types of mining operations employ steam to expedite the removal of minerals from the ground. Also, in the drilling for petroleum and gas it is often desired to use live steam to cause the start of the upward discharge of these liquids and gases once pockets of them have been reached by drilling.

It is concluded that steam generators in the past have been useful and will continue to be useful in the future — especially if a more economical steam generator is available. The steam generator of this present invention is such an economical device.

2. Description of the Prior Art

The use of water hammer for the generation of steam has just not been previously done to the best of our knowledge. However, physicists and engineers have long known of the existence of water hammer. Various books and texts have discussed water hammer and its attendant characteristics. Attention is directed to:

B. S. Massey: *MECHANICS OF FLUIDS*, Van Nos Rinhold, 1971, (pages 412 to 427).

John N. Bradley: *SHOCK WAVES IN CHEMISTRY AND PHYSICS*, London: Metchuen, New York: Wiley, American Press 1962, (pages 172 and 173).

Horace Williams King: *HANDBOOK OF HYDRAULICS, FOR THE SOLUTION OF HYDRAULIC PROBLEMS*, 4th Edition, Revised by Ernest F. Brater, New York, McGraw-Hill, 1954, (pages 6–21 to 6–27).

A patent search has been made on the device as disclosed herein and this search has confirmed out belief that no one heretofore has conceived of such a device.

U.S. Pat. No. 3,141,296 to Jacobs, Jr., et al. describes the utilization of shock waves produced in a liquid by an electric discharge to perform useful work. The shock waves are created by discharging electricity in a liquid filled chamber and the useful work is defined as a pump for the liquid.

U.S. Pat. No. 3,398,686 to Guin describes a motor which utilizes the power of shock waves created in a liquid by the discharge of electricity across a spark gap. Thus both Jacobs, Jr. and Guin are very similar to each other and it is obvious neither one produces shock waves in a body of liquid to produce an appreciable rise in temperature of that liquid. Also, neither one has created shock waves in a body of liquid by a mechanical means corresponding to water hammer to cause the temperature of that water to rise sufficiently to convert the water to steam.

Other steam generators having water chambers appearing similar to applicant's water chambers are: Loeffler, U.S. Pat. No. 2,316,522; Gray, U.S. Pat. No. 3,508,402; Rennolds, U.S. Pat. No. 3,690,302. However, no one of these patented devices uses shock waves to cause the heating of the water — rather each one employs a combustible gas to effect a heating of the water for its conversion to steam. And, on close analysis each chamber is entirely different from applicant's chamber and lacking in the shock wave generating mechanisms as subsequently defined in this specification.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide a novel steam generator.

An important object of this invention is to provide a steam generator having a distended body of water which is subjected to shock waves.

Another important object of this invention is to provide a novel device to produce and intensify a series of water hammers within a distended body of water to thereupon substantially raise the temperature and pressure of such water.

Still another important object of this invention is to provide a novel means for creating a water hammer within a body of water.

An important object of this invention is to provide a device as set forth in the preceding object in which the water hammer is caused by alternating forces — first a centrifugal action and second a vacuum action — causing the body of water to be first pulled in one direction and then to snap back in an opposite direction.

Another and still further important object of this invention is to provide a device of the preceding two objects in which the distended body of water includes at least one closed bottom passageway in which the movement of water therein is suddenly extinguished and in which the snapping back and forth action of the water column occurs to thereby intentionally impart a water hammer to the body of water and substantially raise the temperature of the water so that a portion thereof is being continuously converted to live steam.

Other and further important objects and advantages will become apparent from the disclosures in the following specification and accompanying drawings.

IN THE DRAWINGS

FIG. 1 is an elevational view of a preferred embodiment of the steam generator of this invention with portions thereof in cross section.

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 1.

FIG. 5 is an elevational view of a modified embodiment of the invention and with portions thereof in cross section.

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5.

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 5.

FIG. 8 is a sectional view taken on the line 8—8 of FIG. 5.

AS SHOWN IN THE DRAWINGS

The reference numeral 10 indicates generally the preferred embodiment of the steam generator of this invention. A stationary housing 11 encloses the steam generator 10. The housing comprises a main body portion 11*a*, an upper cap 11*b* fastened to the central body portion 11*a* by a circularly arranged series of cap screws 11*c*, an under cap 11*d* fastened to the body portion 11*a* by a circularly arranged series of cap screws 11*e*, a downwardly projecting central tubular portion 11*f* forming a part of the under cap 11*d*, and a bottom cover 11*g* fastened by a series of circularly arranged cap screws 11h to the central tubular portion 11*f*.

A vertically disposed motor driven shaft 12 having an annular shoulder 13 therearound is journally carried within the central tubular portion 11*f* of the housing 11 by means of a roller bearing 14. The inner race of the bearing 14 is disposed between the annular shoulder 13 of the rotating shaft 12 at its top and the stationary cover 11*g* at its bottom. An annular seal 15 is held within the housing 11 and brushes against the rotating shaft 12 to effect a sealing of the chamber above the seal from communication with the device below the seal.

A rotor designated generally by the numeral 16 is carried on and with the upper end of the motor driven shaft 12. The outer surface of the rotor 16 is cone shaped and is adapted to rotate within the outer housing 11. The housing and the rotor carried therewithin together define a generally distended chamber for the body of water which has its temperature and pressure materially raised by subjecting it to shock waves. A water inlet 17 is provided in the housing cap 11*d* and is the means for delivering water to the distended chamber within the housing 11 and in and around the rotor 16. The chamber is defined as distended because it is not just an open one part chamber but rather is broken up into many small passageways which project in many directions. Webster's defines "distend" as "to stretch out or extend in more than one diection." The water body chamber includes a horizontally disposed ring shaped passage 18 located between the housing under cap 11*d* and the rotor 16. The rotor is vertically spaced above the housing on its underside to define the ring shaped passage 18. The water inlet 17 directly communicates with the ring shaped passageway 18 as best shown in FIG. 1. An upwardly and outwardly flaring annular cone shaped passageway 19 is located between the housing body portion 11*a* and the rotor 16. Again, there is a spacing between these elements to define the cone shaped passageway 19. A plurality of radially inwardly extending arcuately spaced apart passageways 20 are adapted to pass through a portion of the rotor 16. At their outer ends these passages 20 join the cone shaped passageway 19. An inwardly inclined conical shaped passageway 21 is concentrically disposed radially inwardly of the conical shaped passageway 19. The inner ends of each of the plurality of horizontal passageways 20 run directly into the conical shaped passageway 21. This joining of the many passageways is shown in FIG. 1 and further in the sectional view of FIG. 2. A radially inwardly extending ring shaped passageway 22 is provided near the bottom of the rotor and joins the lower end of the conical shaped inner passageway 21. The inner end of the ring shaped passageway 22 enters a vertically disposed central chamber or core 23 within the rotor 16.

The rotor 16 includes an outer cup-shaped portion 24 and a combination inner and top portion 25. This combination inner and top portion is fastened around its outer circumference by a plurality of arcuately spaced cap screws 26 to the outer body portion 24. The rotor 16 comprising the two main parts is nevertheless a unitary device rotating as one mass. The two piece construction permits the easy making of the passageways 21 and 22 and before assembly permits the drilling of the plural passageways 20 near the top of the outer cup shaped portion 24 of the rotor. Over the top of the rotating rotor there is defined a ring shaped passageway 27 beneath the upper cap member 11*b*. A vertically disposed cylindrical ring shaped passageway 28 has its top joining the top passageway 27 at the upper outside of the rotor 16. The outer periphery of a radially inwardly extending annular passageway 29 joins the lower end of the passageway 28 and at its inner periphery joins the upper end of the cone shaped passageway 19.

A specially constructed fitting 30 has an externally threaded portion at its lower end at 31 which is threadedly engaged with internal threads within a central opening portion of the upper cap 116 of the housing 11. This fitting 30 forms the base for a superstructure 32 disposed over the basic unit contained within the housing 11. Of course the superstructure then becomes an extension of the stationary housing 11. An outer pipe 33 has its lower end threadedly engaging the upper end of the special fitting 30 at 34. A special cap fitting 35 threadedly engages the upper end of the outer pipe 33 as shown at 36. An inner concentric pipe 37 and a radially inwardly projecting annular flange 38 of the cap fitting 35 are joined to one another by a threaded engagement as shown at 39. The juncture 39 is located at an intermediate position between the top and bottom of the vertically disposed inner concentric pipe 37.

An adjustable value 40 is provided on the top of the inner pipe 37 to control the discharge of steam as the steam is generated in the device of this invention. The valve 40 is threadedly engaged at 41 to the pipe 37.

The lower end 42 of the inner pipe 37 has its outer surface milled or turned down so the pipe wall is relatively thin and thus may be assembled with the other concentric members by passing downwardly through the internal threads on the annular flange 38. An intermediate concentric pipe 43 has its upper end disposed between the cap fitting 35 and the inner pipe 37. The upper end of the intermediate pipe 43 stops short of contact with the underside of the flange 38, leaving a space 44 thereover.

An annular flange 45 is provided intermediate the top and bottom of the special fitting 30. External threads are provided on the intermediate pipe 43 near its bottom and these threads cooperatively engage with internal threads on the inner aperture of the special fitting flange 45 as shown at 46. The pipe 43 includes a lower extension 47 which has its surface milled or turned down to permit it to pass by the threads 46 on the flange 45 during assembly. This is similar to the turning down of the lower extension of the inner pipe 37.

The intermediate inwardly extending annular flange **45** of the fitting **30** is provided with a plurality of arcuately spaced apart vertically disposed holes **48**. These holes constitute restricted passageways of the water in the steam generator of this invention from the lower chamber **49** defined by the fitting **30** to an upper portion or chamber **50** defined above the annular flange **45** and between the intermediate pipe **43** and the outer pipe **33**. The upper limits of the chamber **50** are defined by the inner and underside of the special cap fitting **35**.

A thin annular chamber **51** is disposed between the cap **35** and the intermediate pipe **43**. A second thin elongated annular chamber **52** is concentric with the chamber **51** and is located between the intermediate pipe **43** and the lower end **42** of the inner concentric pipe **37**. By reason of the space **44** over the top of the intermediate pipe **43** the thin annular chambers **51** and **52** are joined one to the other. The elongated annular passageway **52** is provided with an annular opening **53** located at the bottom of the lower extension **42** of the inner concentric pipe **37**. A central passageway **54** is provided within the inner pipe **37** and is utilized to carry generated steam to the controlling valve **40** at the top thereof.

OPERATION OF THE DEVICE OF FIG. 1

To commence operation, water under normal line pressures is admitted to the inlet pipe or fitting **17** so that water flows in the direction of the arrow **55** to the distended or tortuous path chamber which comprises a single body of water. The arrow **56** shows movement of water from the inlet **17** through the annular passageway **18** and to the cone shaped passageway **19** where the water proceeds upwardly in the direction of the arrow **57**. From there the water enters the several radial holes **20** and moves in the direction of the arrow **58** to the inner cone shaped passageway **21** where the water moves downwardly in the direction of the arrow **59**. The passageway **21** is joined at its bottom to the annular ring shaped passageway **22** and as shown by the arrow **60** water moves radially inwardly to the central passage **23** within the rotor **16**. The water then proceeds upwardly as indicated by the arrows **61**. Here the water enters the special fitting lower chamber **49** and as indicated by the arrow **62** moves upwardly therethrough into the restricted apertures **48** and continues upwardly through such vertically disposed apertures as indicated by the arrow **63**. At this point the water enters the annular chamber **50** and moves upwardly therethrough as indicated by the arrows **64**. The upper end of the chamber **50** joins the thin annular ring shaped chamber **51** and as indicated the water moves further upwardly in the direction of the arrows **65** to the space **44** just beneath the annular flange **38** of the special cap **35**. Now the water changes its direction of flow and starts moving down and through the thin annular ring shaped chamber **52** in the direction of the arrows **66**. In addition to the water moving vertically into the chamber **62** a portion thereof moves radially outwardly through the passageway **27** in the direction of the arrows **67**. At the outer end of the ring shaped passageway the water moves down the vertical ring shaped annular passageway **28** in the direction of the arrow **68**. Now the water travels radially inwardly through the ring shaped horizontal disposed annular passageway **29** in the direction of the arrow **69** and hence back to the outer conical shaped passageway **19** between the rotor **16** and the main body portion **11***a* of the housing **11**.

Water now fills the entire distended chamber which as explained contains numerous passageways forming a tortuous path and providing a cycle for the movement of water therethrough. Prior to the complete filling of the system with water, rotation of the shaft is commenced. The shaft **12** is rotated by coupling a motor thereto and the rotor **16** with its several unitary parts **24, 25** and **26**, is rotated at a relatively high speed causing the water to be thrown centrifugally outwardly within the chamber through any passageway thereof having a radial disposition or a radial component. The large horizontally disposed ring shaped annular passageway **27** is one such radial passageway. This immediately results in water being drawn downwardly out of the closed bottom passageway comprising the chambers and passageways **49, 50, 51** and **52.** The water suddenly and positively pulled downwardly from this closed bottom channel creates a vacuum in the bottom of this channel which in the device of FIG. **1** is at the top of the stationary superstructure at the space **44.** This newly created vacuum now sets up a pull of its own which exceeds and overcomes the centrifugal forces and the body of water comes back into the bottom of the closed bottom channel with a snapping action. This sudden striking of the closed bottom extinguishes movement of the column of water and there is a substantial shock imparted to and within the body of water. This water hammer or shock brings with it a rise in pressure and temperature of the body of liquid. In Horace King's "Handbook of Hydraulics" published by McGraw-Hill, 4th Edition, page 6–21 there is a discussion of water hammer and its creation. The King handbook states that if a passageway in a pipe line is suddenly closed (corresponding to the closed bottom channel in applicant's device),

"a dynamic pressure, in addition to the normal static pressure, is created within the pipe. This dynamic pressure is commonly called water hammer. It is caused by the sudden transformation of kinetic energy to pressure energy." J. N. Bradley's "Shockwaves in Chemistry and Physics" discusses The Measurement of Thermodynamic Quantities in Chapter V. Page 172 of that book and states that

" . . . a shock wave in a liquid medium is characterized by a small rise in temperature and an extremely large change in pressure." Applicant is thus intentionally creating shock waves in this distended body of water causing both temperature and pressure rises. Although the temperature rise created by each shock is small, the shocks are repeated over and over again, one upon the other, and thereby intensified causing a material rise in temperature of the entire body of water. Each shock caused by the sudden extinguishment of flow of water at the dead ended channel creates a force of approximately 63.4 pounds per square inch of every foot of extinguished velocity. Although this degree of pressure is only held momentarily the succeeding shock waves are cumulative and although the pressure dissipates throughout the body of water the temperature rises materially and is not so easily dissipated as the pressure. The rise in temperature and the maintenance of that temperature rise is so spectacular that steam is almost instantaneously created and starts up the pipe **37** through its center passage **54** in the direction of the arrows **70.** Unconverted steam in the form of water in various stages of heat is pulled downwardly in the direction of the arrows **71** whereupon the cycle is repeated with the rapidly increasing shock waves causing the water to be more easily converted to steam and that steam being discharged upwardly in the direction of the arrows **70** and thence through the adjustable valve **40.** Of course, water is always being admitted to the inlet **17** to keep the system full and constantly replenish that portion of the water that has been converted to steam and has been discharged through the valve **40** for some external use.

The modified or alternative construction of FIG. **5** is similar to the preferred device of FIG. **1,** but is shown primarily to emphasize that various body chambers may be employed. As explained for the device of FIG. **1** the water chamber is distended in nature — not any particular shape — but expressly including one or more closed bottom channels within which a vacuum may be drawn and at least one or more radial passages or passages with radial components to produce a centrifugal action. The steam generator of FIG. **5** is generally designated by the numeral **80.** The generator is provided with a stationary housing **81.** The housing comprises a main body portion **81***a*, an upper cap **81***b* fastened to the central body portion **81***a* by a circularly arranged series of arcuately spaced apart cap screws **81***c*, an under cap **81***d* fastened to the body portion **81***a* by a circularly arranged series of arcuately spaced apart cap screws **81***e*, a downwardly projecting central tubular portion **81***f* forming a part of the under cap **81***d*, and a bottom cover **81***g* fastened by a series of circularly arranged arcuately spaced apart cap screws **81***h* to the central tubular portion **81***f*.

A vertically disposed motor driven shaft **82** having an annular shoulder **83** therearound is journally carried within the central tubular portion **81**f of the housing **81** by means of a roller bearing **84.** The inner race of the bearing **84** is disposed in a vertical position between the annular shoulder **83** of the rotating shaft **82** at its top and the stationary cover **81**i g at its bottom. An annular seal **85** is held within the housing **81** and brushes against the rotating shaft **82** to effect a sealing of the chamber above the seal from communication with the device below the seal.

A rotor, conical in overall shape, is designated generally by the numeral **86.** The rotor is carried on and with the upper end of the motor driven shaft **82.** The rotor **86** is adapted to rotate within the outer housing **81.** The housing and the rotor carried therewithin together define a generally distended chamber for the body of water which has its temperature and pressure materially raised by subjecting it to shock waves. A water inlet **87** is provided in the housing cap **81**d and is the means for delivering water to the distended chamber within the housing **81** and in and around the rotor **86.** The chamber is defined as distended for the same reasons as applied to the chamber in the device of FIG. **1.** The water body chamber includes a horizontally disposed ring shaped annular passage **88** located between the housing under cap **81**d and the rotor **86.** The rotor is vertically spaced above the housing on its underside to define the ring shaped annular passage **88.** The water inlet **87** directly communicates with the ring shaped passageway **88** as best shown in FIG. **5.** An upwardly and outwardly flaring annular cone shaped passageway **89** is located in the space between the housing body protion **81**a and the rotor **86.** A plurality of radially inwardly extending arcuately spaced apart passageways **90** are adapted to pass through a portion of the rotor **86.** At their outer ends these hole like passages **90** join the cone shaped passageway **89.** An inwardly inclined conical shaped passageway **91** is concentrically disposed radially inwardly of the conical shaped passageway **89.** The inner ends of each of the plurality of horizontal passageways **90** run directly into the conical shaped passageway **91.** This joining of the many passageways is shown in FIG. **5** and further in the sectional view of FIG. **6.** The inner cone shaped passageway **91** forms one of the closed bottom passageways of this distended chamber of the device of FIG. **5.**

The rotor **86** includes an outer cup-shaped member **92,** an intermediate member **93** generally nesting within the cup portion **92** and a circular or disc shaped cap member **94.** A plurality of arcuately spaced apart cap screws **95** define an outer ring around the cap **94** and constitute the means of joining the cap **94** to the outer portion **92** of the rotor **86.** A plurality of similar arcuately spaced apart cap screws **96** define an inner ring around the cap for joining the cap **94** to the intermediate portion **93** of the rotor **86.** These three body members with their cap screws **95** and **96** together constitute a unitary rotor which rotates within the stationary housing **81** and thereby creates the shock waves for effecting the rise in the temperature of the distended body of water to generate steam.

The rotor **86** includes an annular ring shaped passage **97** disposed between the intermediate portion **93** and the cap **94.** The top of the outer annular portion of the intermediate portion **93** is milled or turned down to provide the space for the annular passageway **97.** The rotor also includes a plurality of arcuately spaced apart vertically disposed closed bottom channels **98.** The arrangement of these holes or channels **98** is in a circular path which is generally arranged concentric to the center of the composite rotor. The inner annular surface **99** of the top of the intermediate portion of the rotor has not been milled down and thus having its full height closely abuts the underside of the cap **94.** Thus when the cap screws **96** are drawn up tightly the unmilled central ring portion **99** of the member **93** acts as a spacer for the remainder of the top of that member from the underside of the cap **94.** This clearly defines the radial passageway **97** which joins the inner cone shaped passageway **91** with the open topped closed bottom holes **98.** The rotor is further provided with a central vertically disposed passageway **100** about it vertical centerline. At the juncture of the bottom center of the intermediate member **93** of the rotor with the bottom of the cup shaped outer member **92** of the rotor the central passageway **100** is enlarged as shown at **101.** A plurality of relatively small diameter radially disposed holes or passageways **102** join each of said closed bottom channels **98** with the enlarged chamber **101** at the center of the rotor. These radial passageways **102** are disposed at a position spaced above the closed bottoms of the holes **98.** It is generally through these minute relief holes **102** that generated steam is permitted access to the center of the rotor where it moves upwardly through the passage **100** and thence into an enlarged steam passageway **103** located above the channel **100.** Steam may be permitted free escape from this passageway **103** or may be selectively discharged by a suitable adjustable valve means such as that shown at **40** in FIG. **1.**

OPERATION OF THE DEVICE OF FIG. 5

As for the steam generator of FIG. 1 water is admitted to the system of FIG. 5 by passing through the inlet **87** in the direction of the arrows **104.** The water then moves in the annular ring shaped passageway **88** in the direction of the arrows **105** to the juncture with the cone shaped passageway **89.** The water now moves upwardly in the direction of the arrows **106** to the juncture of the full annular passageway **89** with the plural radial passages **90.** Water then moves inwardly in the direction of the arrows **107.** As previously stated, an inner concentric cone shaped passageway **91** joins these several radial holes **90** and thus the incoming water fills that passageway as shown by the arrows **108.** As the ring shaped bottom of the passage **91** is effectively closed the water then moves radially inwardly across the top of the outer portion of the intermediate member **93** of the rotor in the passageway **97** as shown by the arrows **109.** Here the inner circumference of the annular ring shaped passageway **97** joins with the tops of the plural closed bottom passages **98** and incoming water then moves down these holes as shown by the arrows **110** to thus fill the entire distended chamber formed by this maze of multi-directional passageways. Most of the arrows just described for the movement of water in the various chambers and passageways are two headed indicating that water during the operation of the device moves in both directions.

Prior to the system being completely filled with water, rotational drive is imparted to the shaft **82** and thereupon its integral rotor **86** is also rotated. Rotation is at relatively high speeds. The initial response to the body of water is its centrifugal action through all radial passageways and passageways having radial components. In this device the primary centrifugal action is created in the elongated radially outwardly extending annular ring shaped horizontally disposed passageway **97.** The imposition of this force in the body of water cuases the columns of water in the multiple closed ended channels **98** within the rotor to be drawn upwardly out of their closed bottoms.

Almost immediately there is a multiplicity of vacuums created in each closed bottom with the result that the vacuums overcome and exceed the opposite force of centrifugal action to thereby cause the columns of water to snap back into the closed bottoms of these channels. As previously explained for the operation of the device of FIG. 1 the extinguishment of the motion of the body of water by the closed bottoms of the channels imposes shock waves in the distended body of water so that there is an incremental increase in both temperature and pressure of the body of water. The repeated and continuous rotation of the rotor causes multiple shock waves or water hammer and actually an intensification of the shocks when they are occasioned one upon the other. Thus what would have been only a small rise in temperature is now substantial. The pressures similarly rise but they quickly dissipate in the system. The water commences its conversion to steam generally in the area of the closed bottoms of the channels **98** where the greatest effect of the snap action shocks takes place. This newly created steam is permitted to escape radially inwardly through the restricted holes **102** in the direction of the arrows **111.** Once in the central chambers of the rotor the steam moves vertically upwardly through the successive passages **101, 100** and **103** as indicated by the arrows **112.**

Both the devices of FIGS. **1** and **5** act to generate steam. Their common attributes are their stationary housings with rotors therein which together define distended chambers with tortuous passageways and at least one closed bottom passageway and a passageway permitting centrifugal action to create forces in the body of water opposite to the vacuum created forces in the closed bottom channels. In FIG. **1** the closed bottom channel is located in the stationary housing portion of the device whereas in FIG. **5** the closed bottom channels are located in the moving rotor. It is thus apparent that the steam generator of this invention may take many and varied forms without departing from the principles disclosed herein. Thus it is not my intention to limit the patent granted hereon otherwise than as necessitated by the appended claims.

What is claimed is:

1. A steam generator comprising a stationary housing, a rotor journally mounted for rotation within said stationary housing, said housing and rotor together defining a distended chamber, means delivering water to said distended chamber, at least one portion of said distended chamber comprising a closed end passageway and at least another portion of said distended chamber comprising another passageway capable of being subjected to centrifugal force, means rotating said rotor when the distended chamber has water therein whereby such rotation creates shock waves in the body of water in said distended chamber by reason of centrifugal action occurring in said another passageway and a vacuum occurring in the closed end passageway and the two forces alternately conflicting and overcoming one another to produce and intensify shocks in said body of water to thereby cause a substantial rise in temperature and pressure of the body of water, thereby converting a portion of said body of water to steam, and means for removing steam created in the body of water.

2. A steam generator as defined in claim **1** in which said rotor is generally cone shaped on its outer surface and the distended chamber comprises a series of generally narrow passageways joined in a multi-directional manner.

3. A steam generator as defined in claim **1** in which said closed end passageway is disposed in the stationary housing.

4. A steam generator as defined in claim **1** in which said closed end passageway is disposed in the rotor.

5. A steam generator as defined in claim **1** in which said stationary housing includes a superstructure offset from said portion housing said rotor.

6. A steam generator as defined in claim **5** in which said superstructure comprises a plurality of concentric pipe members and wherein the closed end passageway comprises concentric thin annular ring shaped passageways at one end of said superstructure.

7. A steam generator as defined in claim **6** in which said superstructure of concentric pipes includes a series of alternately large and smaller passageways.

8. A steam generator as defined in claim **2** in which there is included a first thin cone shaped annular passageway disposed between the stationary housing and the rotor, a second thin cone shaped annular passageway disposed within said rotor and generally concentric to said first of said cone shaped passageways, and a plurality of arcuately spaced apart radially disposed passages in said rotor joining said first and second cone shaped passageways.

9. A steam generator as set forth in claim **8** in which there is included a central vertically disposed passageway within said rotor and a radially disposed passageway communicating between said second cone shaped passageway and said central vertically disposed passageway within said rotor.

10. A steam generator as set forth in claim **8** in which there is included a central vertically disposed passageway within said rotor, and said radially directed passageway communicating with at least one of said cone shaped passageways and directly communicating with said closed end passageway, and means discharging steam converted from said water to the central vertically disposed passageway within said rotor.

11. A steam generator as set forth in claim **10** in which said means discharging steam comprises an auxiliary passageway from said closed end channel to said central vertically disposed passageway in said rotor.

12. A steam generator as set forth in claim **8** in which the closed end passageway includes a plurality of generally vertically disposed closed bottom holes in said rotor and arranged in arcuately spaced apart position to define a generally circular path, said rotor having a central passageway, said series of passageways including radial passageways joining said second thin cone shaped passageway and the tops of said plurality of generally vertically disposed closed bottom holes, and restricted passageways joining said central passageway and each of said plurality of closed bottom holes intermediate their tops and bottoms, whereby steam is permitted to escape radially inwardly through said restricted passageways to said central rotor passageway.

13. A steam generator comprising a stationary housing, a cone shaped rotor journally mounted for rotation within said stationary housing, said housing and rotor together defining a distended multi-passageway chamber, means delivering water to said distended chamber, at least one passageway of said distended chamber having a closed end, and at least another passageway of said distended chamber having a radial component, means rotating said cone shaped rotor when the distended chamber has water therein whereby such rotation creates water hammer shock waves in the body of water in said distended chamber by reason of the centrifugal action created in said radial component passageway and the vacuum created by the closed end passageway causing the movement of water in that passageway to be suddenly extinguished, and the alternating of the centrifugal action and the vacuum continuing to create shocks and cause a rise in temperature and pressure of the body of water, and means for removing steam created in the body of water.

14. A steam generator as defined in claim **13** in which said closed end passageway comprises an annular ring shaped passageway in said stationary housing.

15. A steam generator as defined in claim **13** in which said closed end passageway comprises a plurality of vertically disposed closed bottom holes in said rotor.

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