

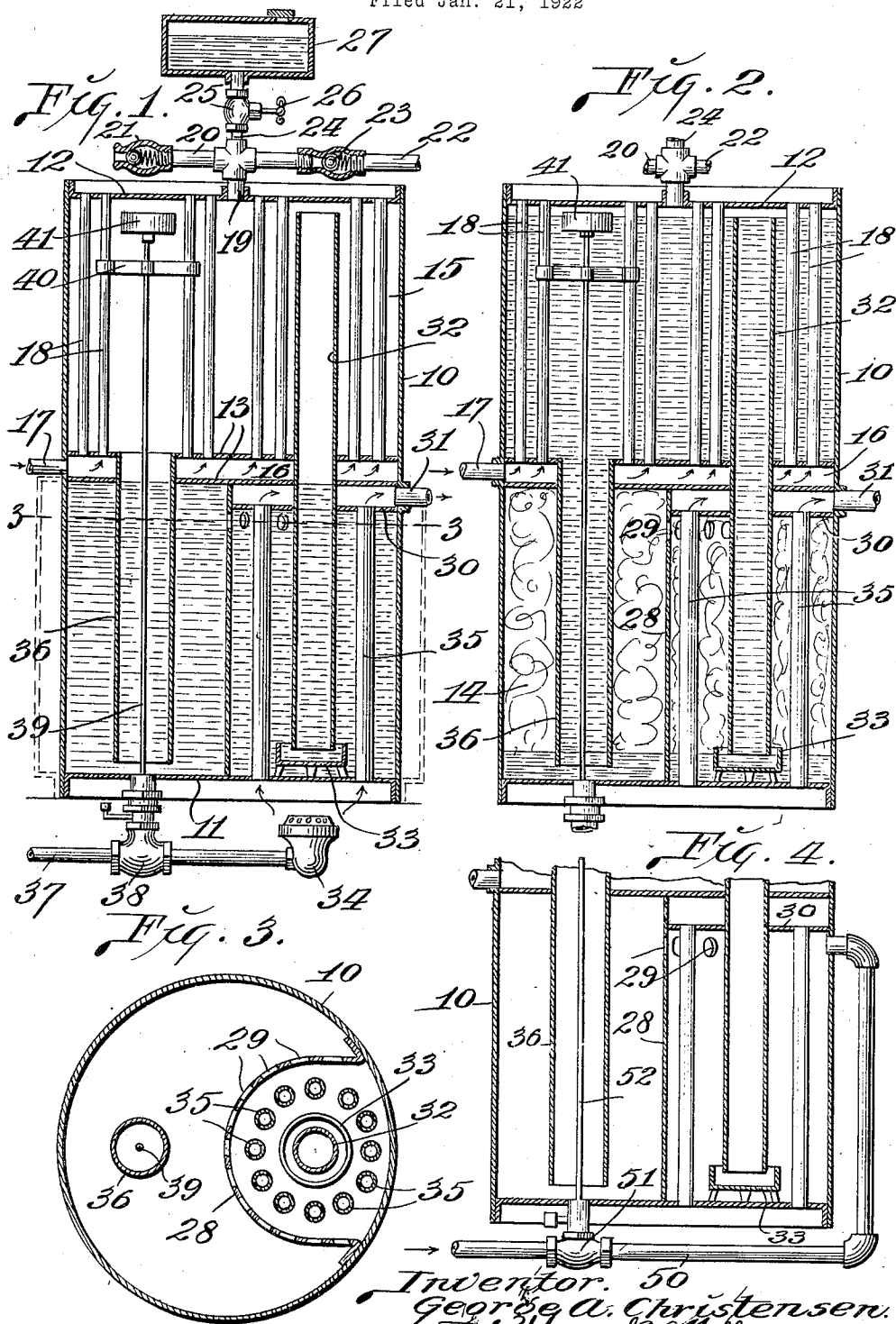
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FLUID COMPRESSOR

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UNITED STATES PATENT OFFICE.

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FLUID COMPRESSOR.

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To all whom it may concern:

Be it known that I, GEORGE A. CHRISTENSEN, a citizen of the United States, residing at San Simeon, in the county of San Luis Obispo and State of California, have invented new and useful Improvements in Fluid Compressors, of which the following is a specification.

My invention relates to a fluid compressor, the principal object of my invention being to provide a relatively simple, practical and efficient compressor wherein the fluid compressing action is effected as a result of the generation of steam within a container and as a result of the hydrostatic pressure of the water from which the steam is generated.

Further objects of my invention are to provide a fluid compressor that is of relatively simple structure, requiring no periodic mechanical manipulation of valves, and that is capable of being easily and cheaply produced, adaptable for a wide variety of uses and, further, to produce a compressor wherein the same body of water is continuously used in compressing the air or other fluid.

With the foregoing objects in view, my invention consists in the features of construction and combination and arrangement of parts hereinafter more fully described and claimed, reference being had to the accompanying drawings, wherein:

Figure 1 is a vertical section taken through the center of a fluid compressor of my improved construction, showing the body of water in the heating chamber thereof;

Figure 2 is a vertical section similar to Figure 1, showing the body of water elevated by steam pressure so that it partially fills the fluid compressing chamber of the apparatus;

Figure 3 is a horizontal section taken on the line 3—3 of Figure 1;

Figure 4 is a vertical section taken through the lower portion of a modified form of the compressor.

In the construction of the form of compressor herein shown, 10 designates a housing, preferably cylindrical in form, and closed at its ends by heads 11 and 12. Arranged within the housing, and preferably at a point midway between the heads 11 and 12, is a pair of horizontally disposed partitions 13 that divide the space within the housing into a steam generating chamber

14, a compression chamber 15 and a relatively narrow intermediate chamber 16. A fluid cooling medium supply pipe 17 leads to chamber 16 and leading from said chamber 16 upwardly through the compression chamber 15 is a series of fluid cooling medium circulating pipes 18. The capacities of the chambers 14 and 15 should be equal so that at the beginning of the cycle of operations the entire space within the steam generating chamber is occupied by water, which volume of water should completely fill the compression chamber when forced upwardly thereinto under steam pressure. Leading from the head 12 that closes the upper end of the housing 10 is a compressed fluid outlet pipe 19 having a branch 20 in which is located an inwardly opening check valve 21, and leading from pipe 20 to a suitably compressed fluid container (not shown) is a branch pipe 22 in which is located an outwardly opening check valve 23.

Leading upwardly from pipe 19 is a pipe 24 in which is located a check valve 25, the size of the orifice of which may be varied by manipulation of a valve stem 26, and connected to the upper end of pipe 24 is a container 27 that is adapted to receive water for the purpose of maintaining a constant volume of water within the apparatus and to replenish any water that may be carried out by the air or fluid compressed within chamber 15.

If desired, the lower portion of the housing 10 or that portion surrounding the steam generating chamber 14 may be provided with double walls, as shown in dotted lines in Figure 1, and the space between said walls packed with a suitable heat insulating material and, if desired, suitable means may be provided for cooling the compression chamber 15.

Located within the steam generating chamber 14 is a vertically disposed substantially semi-circular partition 28 that extends from the lower head 11 to the lower one of the partitions 13, and formed through the upper portion of this partition 28 is a series of apertures 29. Arranged within the upper portion of the chamber, that is, enclosed by partitions 28 and just above the apertures 29, is a horizontally disposed plate 30, and leading outwardly from the space between said plate and the adjacent portion of partition 13 is a vent pipe 31.

A vertically disposed pipe 32 extends

through the central portion of plate 30 and through openings in the partitions 13, the lower end of said pipe terminating in a plane slightly above the bottom of plate or head 11, and the upper end of said pipe terminating in a plane a short distance below the upper head 12. Positioned immediately beneath the lower end of this pipe is a shallow pan shaped baffle member 33.

Arranged beneath the lower head 11 and preferably at a point below the baffle member 33 and pipe 32 is a burner 34. Extending from the lower head 11 upwardly through plate 30 and disposed about the pipe 32 is a series of flues 35 that convey the heat and products of combustion from the burner 34 upwardly into the space between plate 30 and the lower one of the partitions 13, said head and products of combustion finding exit through vent pipe 31.

Depending from the upper one of the partitions 13 and on the side opposite from the side through which pipe 32 passes is the upper end of a vertically disposed pipe 36, the open lower end of which terminates adjacent to the plate or head 11 at the bottom of the housing, and in a plane a short distance below the plane occupied by the open lower end of pipe 32. The open upper end of pipe 36 communicates with compression chamber 15.

Located in the pipe 37 that conveys gaseous fuel to burner 34 is a valve 38, the passage way through which is controlled by the lower end of a stem 39, which latter extends upwardly through pipe 36 and upwardly through compression chamber 15. The upper portion of this stem bears in a guide 40 that is suitably supported in the upper portion of the compression chamber, and the upper end of said stem carries a float 41.

In the operation of my improved fluid compressor, chamber 14 is filled with water and when burner 34 is lighted the body of water within said chamber 14 is heated, thereby generating steam. The heat and products of combustion from the burner 34 pass upwardly through flues 35, thereby very rapidly heating the water, and particularly that portion thereof contained in the chamber enclosed by partitions 28. As steam is generated and pressure developed, said pressure will gradually force the body of water downwardly through chamber 14, and this water will be forced upwardly through pipe 32 into the fluid compressing chamber 15 and the air that previously entered said compression chamber through pipes 19 and 20, which latter is provided with the inwardly opening check valve 21, will be forced outwardly through pipe 22, past check valve 23, into the tank or container to which said pipe 22 is connected. As the pressure of the steam generated within chamber 14 increases, the water will

continue to be forced upwardly into chamber 15 until the level of the water within the steam generating chamber reaches the lower end of pipe 32.

Increased pressure of the steam will break the water seal at the lower end of pipe 32, thereby permitting a considerable volume of steam to enter the lower end of said pipe, and pass upwardly therefrom, and this steam in passing upwardly through said pipe will displace a corresponding volume of water from the upper end of the pipe which water will be forced into the compression chamber 15 to mingle with the body of water therein, which latter is considerably cooler than the relatively small volume of water within the steam generating chamber 14 and which difference in temperature is due to the fact that chamber 15 is entirely separated from chamber 14 and said chamber 15 is cooled by the surrounding atmosphere and by a circulation of cooling medium through tubes 18.

The volume of water forced from the upper end of pipe 32 by the steam arising therefrom will disturb the equilibrium of the hydrostatic pressure within the compressor, and a corresponding volume of water will be forced out of the open lower end of pipe 36 into the lower portion of chamber 14, and this water being substantially cooler than the relatively small volume of water remaining within said chamber 14 will exert a cooling effect on the body of steam within chamber 14, thereby condensing said steam and permitting a considerable volume of the water from chamber 15 to flow back into chamber 14. During such action, atmospheric air will be drawn past check valve 21 through pipes 20 and 19 into chamber 15, and this air will be compressed on the succeeding movement or flow of water from chamber 14 into chamber 15, which movement will be effected by the generation of steam and increase of pressure within chamber 14.

As the water fills compression chamber 15 and the level of said water reaches a plane near the top of said chamber, float 41 will be elevated, thereby correspondingly elevating stem 39 and partially closing or cutting off the supply of gaseous fuel to burner 34. This arrangement saves fuel during the reverse motion of the liquid in the compression chamber and when the liquid has discharged from the upper chamber the float drops and valve 38 is completely opened to again supply the full volume of gaseous fuel to burner 34. The lower portion of valve stem 39 operates through a gland that prevents the flow of water into the valve 38. This float and fuel control valve is not essential to the successful operation of my improved compressor, although the addition of such fuel control is effective

in reducing the cost of operation of the apparatus.

The cycle of operations just described will continue as long as burner 34 is in operation, and the same volume of water is continuously used for the generation of steam and for exerting pressure on the air that is intermittently drawn into the compression chamber.

Each time a volume of compressed air is expelled through pipe 22 a certain percentage of moisture is carried out with said compressed air and to compensate for this intermittent loss of moisture the container 27 and inlet check valve 25 having a variable orifice are provided, and thus with each condensation stroke of the apparatus a small jet of water is drawn into the chamber 15 from the supply within container 27 to maintain the required volume of water in said apparatus. In Figure 4 I have illustrated a construction wherein the compressor may be operated by a steam supply from a separate generator such as a boiler, the steam being carried to the apparatus by a pipe 50 in which is located a valve 51, the opening through which is controlled by the lower end of a valve stem 52, and the upper end of the latter is provided with a float that is located in the top of the compression chamber. This form of compressor will function in exactly the same way that it does in the self-contained apparatus except that where the float and valve arrangement is employed the incoming steam supply is controlled instead of the fuel supply.

The compressor of my improved construction is comparatively simple and may be advantageously employed wherever fluid pressure is desired.

It will be understood that minor changes in the size, form and construction of the various parts of my improved fluid compressor may be made and substituted for those herein shown and described without departing from the spirit of my invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a fluid compressor requiring no periodic mechanical manipulation of valves, a container having a steam generating chamber and a compressing chamber, said compressing chamber being disposed entirely above the steam generating chamber and spaced therefrom, and a conduit leading from the lower portion of the steam generating chamber into the upper portion of the compressing chamber.

2. In a fluid compressor, a container having a steam generating chamber and a compressing chamber, said compressing chamber being disposed above the steam generating chamber, a conduit leading from the lower portion of the steam generating cham-

ber into the upper portion of the compressing chamber, and means for heating water within the steam generating chamber.

3. In a fluid compressor, a container having a steam generating chamber and a compressing chamber, said compressing chamber being disposed above the steam generating chamber, a conduit leading from the lower portion of the steam generating chamber into the upper portion of the compressing chamber, and a conduit leading from the lower portion of the compressing chamber downwardly into the lower portion of the steam generating chamber.

4. In a fluid compressor, a container having a steam generating chamber and a compressing chamber, said compressing chamber being disposed above the steam generating chamber, a conduit leading from the lower portion of the steam generating chamber into the upper portion of the compressing chamber, means for heating water within the steam generating chamber, and a conduit leading from the lower portion of the compressing chamber downwardly into the lower portion of the steam generating chamber.

5. In a fluid compressor, a housing provided with a compressing chamber and with a steam generating chamber, means for conveying steam from the lower portion of the steam generating chamber to the upper portion of the compressing chamber, and a conduit leading from the lower portion of the compressing chamber to the lower portion of the steam generating chamber.

6. In a fluid compressor, a housing provided with a compressing chamber and with a steam generating chamber, means for conveying steam from the lower portion of the steam generating chamber to the upper portion of the compressing chamber, and a conduit leading from the lower portion of the compressing chamber to the lower portion of the steam generating chamber, said compressing chamber being provided with a valve controlled inlet and with a valve controlled outlet.

7. A fluid compressor having a steam generating chamber and a fluid compressing chamber, said steam generating chamber being adapted to contain a body of water, means for heating said water to generate steam, and means for utilizing the pressure of the generated steam to force the water from said generating chamber into the compressing chamber.

8. A fluid compressor having a steam generating chamber and a fluid compressing chamber, said steam generating chamber being adapted to contain a body of water, means for heating said water to generate steam, means for utilizing the pressure of the generated steam to force the water from said generating chamber into

the compressing chamber, and means for utilizing the cooling effect of the water within the compressing chamber to condense the steam within the steam generating chamber.

9. In a fluid compressor, a container having a steam generating chamber and a compressing chamber, said compressing chamber being disposed above the steam generating chamber, a conduit leading from the lower portion of the steam generating chamber into the upper portion of the compressing chamber, means for heating water within the steam generating chamber, means actuated by the height of the water in the compression chamber for controlling the heating means, and a conduit leading from the lower portion of the compression chamber downwardly into the lower portion of the steam generating chamber.

10. A fluid compressor having a steam generating chamber and a fluid compressing chamber, said steam generating chamber being adapted to contain a body of water, means for heating said water to generate steam, means actuated by the height of the water in the compression chamber for controlling the heating means, and means for utilizing the pressure of the generated steam to force the water from said generating chamber into the compressing chamber.

11. A fluid compressor having a steam generating chamber and a fluid compressing chamber, said steam generating chamber being adapted to contain a body of water, means for heating said water to generate steam, means actuated by the height of the

water in the compression chamber for controlling the heating means, means for utilizing the pressure of the generated steam to force the water from said generating chamber into the compressing chamber, and means for utilizing the cooling effect of the water within the compressing chamber to condense the steam within the steam generating chamber.

12. A fluid compressor having a steam generating chamber and a fluid compressing chamber, said steam generating chamber being adapted to contain a body of water, means for heating said water to generate steam, means for utilizing the pressure of the generated steam to force the water from said generating chamber into the compressing chamber, and means automatically supplying additional water to the volume of water within the compressor to compensate for the water drawn from the apparatus by the fluid compressed therein.

13. In a fluid compressor, a container having a steam generating chamber and a compressing chamber, the capacities of which chambers are practically equal, a conduit establishing communication between the lower portion of the generating chamber and the upper portion of the compressing chamber, and a conduit establishing communication between the lower portion of the compressing chamber and the lower portion of the generating chamber.

In testimony whereof I have signed my name to this specification.

GEORGE A. CHRISTENSEN.