

March 24, 1931.

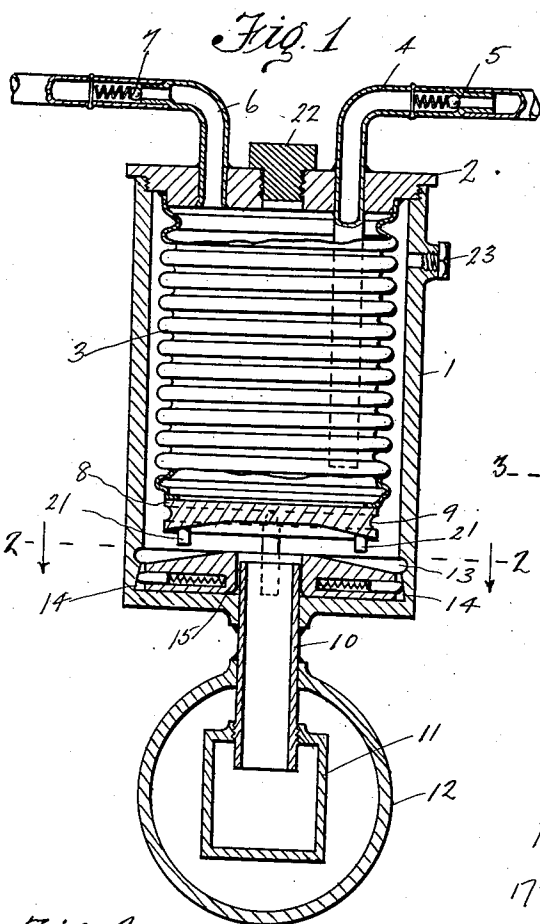
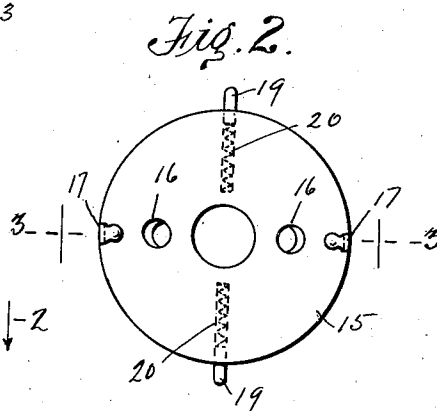
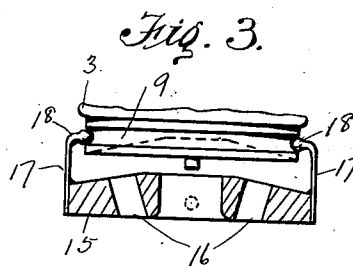
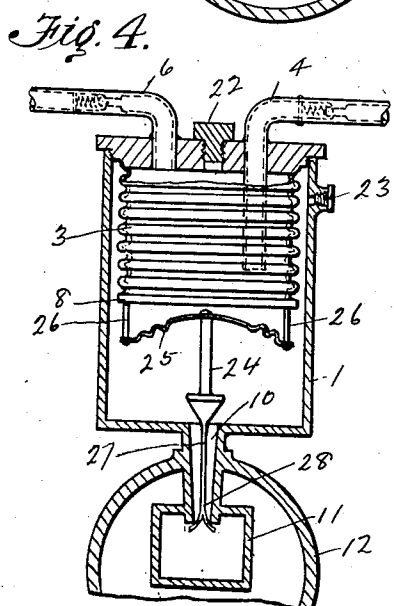
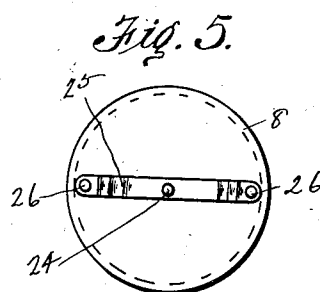
C. L. STOKES

1,797,533

LIQUID PUMPING AND CIRCULATING SYSTEM

Filed Jan. 13, 1925

2 Sheets-Sheet 1



INVENTOR.
Charles L. Stokes

March 24, 1931.

C. L. STOKES

1,797,533

LIQUID PUMPING AND CIRCULATING SYSTEM

Filed Jan. 13, 1925

2 Sheets-Sheet 2

Fig. 6.

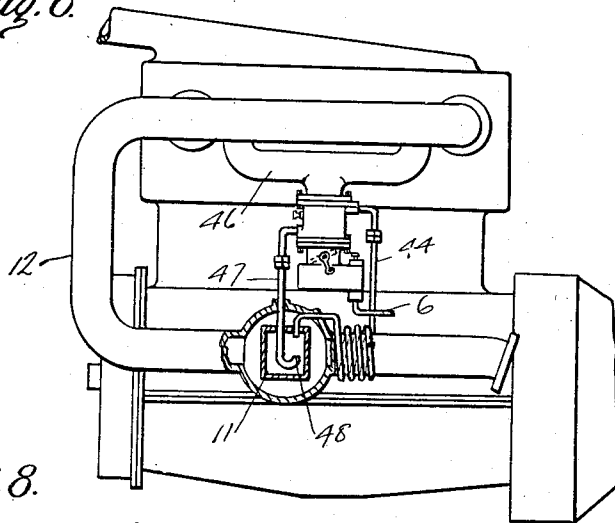


Fig. 8.

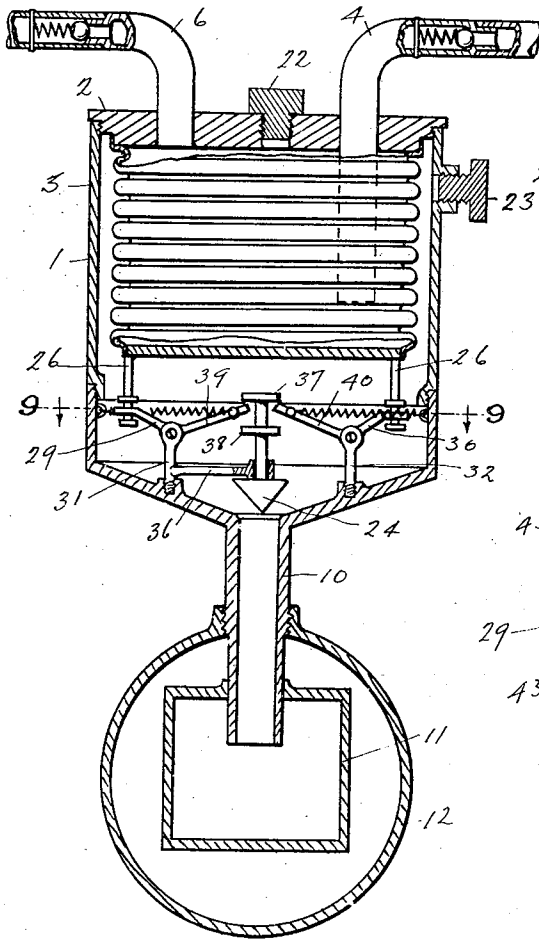


Fig. 7.

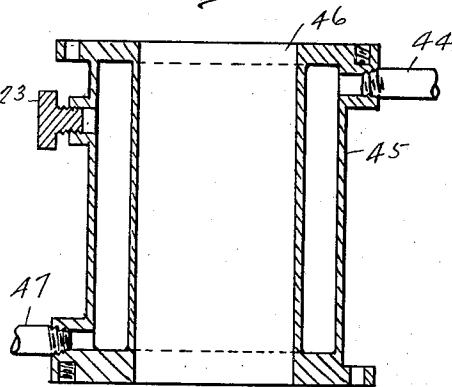
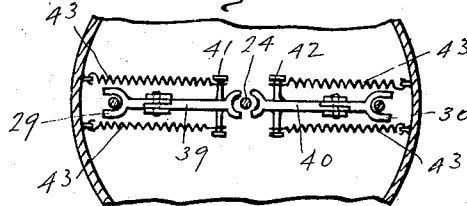


Fig. 9.



INVENTOR.

Charles L. Stokes

UNITED STATES PATENT OFFICE

CHARLES LAWRENCE STOKES, OF LOS ANGELES, CALIFORNIA

LIQUID PUMPING AND CIRCULATING SYSTEM

Application filed January 13, 1925. Serial No. 2,136.

My invention relates to improvements in liquid pumping and circulating systems, especially applicable to systems of the class described in my co-pending application Serial No. 748,932, filed November 10, 1924.

The principal object of my invention is to utilize the expansive force of a liquid in a closed system subjected to the heat of an internal combustion engine and subjected to a cooling effect derived from the liquid fuel supplied to the engine.

A further object of my invention is to provide improved mechanism for intermittently causing a surge in the condensed liquid and returning the same to be evaporated by the engine heat.

Referring to the drawings in which the same numbers indicate like parts—

Fig. 1 is a vertical section, partly in view of an improved form of my intermittently acting mechanism.

Fig. 2 is a view along the lines 2—2 of Fig. 1.

Fig. 3 is a sectional view along the lines 3—3 of Fig. 2.

Fig. 4 is a modification of the structure shown in Fig. 1.

Fig. 5 is a view of the bottom of the apparatus shown in Fig. 4.

Fig. 6 is a view of an engine showing some of my improvements attached thereto.

Fig. 7 is a cross-section of a part of Fig. 6.

Fig. 8 is a modification of Figs. 1 and 4.

Fig. 9 is a view along the lines 9—9 of Fig. 8.

In my aforesaid application I have described a closed system whereby a liquid, preferably water, is maintained in a closed system, normally under vacuum at low temperatures, part of which system is subjected to exhaust heat from an internal combustion engine for evaporating the liquid and circulating the vapor from the same to give up its latent heat to the fuel being fed to the engine.

Included in said application were structures designed to give intermittent circulation to said condensed vapors and in my present application, referring particularly to Figs. 1, 2 and 3, is embodied positively

acting intermittent apparatus for like purposes.

A casing 1 is designed to be closed by a cover 2 to which is firmly attached a sylphon, or metal bellows, 3 and extending through 2 is a pipe 4 adapted to draw liquid fuel past a spring pressed check valve 5 from a source of liquid fuel supply (not shown) at a lower level. The pipe 4 extends within 3 towards the bottom thereof for passing the liquid fuel through the interior of 3 and thence through a pipe 6 past a spring pressed check valve 7 to the carburetor of an internal combustion engine, such as for instance as is shown in Fig. 6.

The bottom of 3 is closed by a disc 8 in which a groove 9 is cut and the lower part of 1 contains a pipe 10 leading to an evaporating chamber 11 placed within the engine exhaust pipe 12.

The lower part of 1 contains a groove 13 and a tapered portion 14 together with a surge weight 15, 15 being constructed to centrally fit close on 10 and having its upper surface cut at an angle of about 10°, substantially parallel to the lower portion of 8.

Holes 16 are drilled from the upper to the lower faces of 15 to permit the passage of condensed fluid therethrough prior to its return to 10 and 11.

On opposite sides of 15 are placed springs 17 having bent in heads 18 adapted to fit in the groove 9 and substantially at right angles of 17 are placed pins 19 pressed outwardly by springs 20 for sliding in the taper 14 and catching in the groove 13. Two or more buttons 21 are firmly fastened to the bottom of 8.

The operation of this device is as follows:

A small quantity of a liquid, preferably distilled water, is placed in 11, the weight 15 being approximately in the position as shown in Fig. 1 wherein the spring heads 18 are engaged in the groove 9. The interior of 3 is filled with gasoline, or other liquid desired to be pumped, through the plug 22 in the head of 2 and the plug 23 is removed.

Upon applying heat from 12 to 11, the water will be turned into steam and when the steam issues from 23, 23 is then replaced to

make a tight joint so that upon cooling the system a vacuum will be created inside of 1.

The system is then ready for continuous operation whereby when 11 is reheated the steam pressure in the system will compress 3 thus forcing liquid through 7 to an engine or other place of delivery. The compression of 3 causes the weight 15 to be lifted by the spring 17 until 19 comes into registry with the groove 13 whereupon, the tension of the springs 17 being less than the tension of springs 20, the heads 18 will become disengaged from 9 permitting the full compression of 3. This compression of 3 will continue until all the liquid in 11 has been evaporated whereupon the vapors from the liquid will condense in 1 and drain back to the bottom of 1 below the bottom of 15.

3 will then start to expand, thus drawing in a fresh supply of fuel through 4 which is directed on the upper side of 9 to cool the same and the shoulders 21 will come into contact with the upper surface of 15 and inasmuch as the spring tension of 3 is greater than the spring tension of springs 20, the points 19 will be forced from the groove 13 and owing to the taper 14 the weight 15 will rapidly drop to the bottom of 1 causing a surge of the condensed liquid in 1 through the holes 16 and into 10.

The liquid thus entering 10 causes a rapid condensation of any steam therein and is projected into 11 without touching the sides thereof and is immediately flashed into vapor upon striking the bottom 11 whereupon the cycle already described is repeated.

A modification is shown in Figs. 4 and 5 wherein a valve 24 is constructed to be centrally arranged of a corrugated kick spring 25 for opening and closing the upper part of 10 for a similar purpose as already described.

The spring 25 is supported by two studs 26 fastened on 8 and in order to get the proper intermittent action of 24, a stem 27 extends through 10 into 11 having a bifurcation 28 at the lower end with light spring tension sufficient for the purpose of permitting the insertion of 28 through the upper end of 10 but the bifurcation 28 has a stronger tension on the bottom of 10 than the tension of spring 25.

It will be noted that the pipe 10 in this case is preferably tapered in order to give quicker action to the entering condensed liquid by means of the more rapid condensation of steam.

The operation of this device is as follows:

In the position as shown in Fig. 4, the sylphon 3 is about fully compressed whereby the bifurcation 28 is held on the lower part of pipe 10. A slight further compression of sylphon 3 then causes spring 25 to snap over dead center and close valve 24 tight. Steam in 1 then condenses and collects in the bot-

tom thereof and sylphon 3 expands drawing in liquid through 4, until substantially full condensation of the steam, or a desired portion thereof, takes place when the spring 25 will again snap over dead center and fully open the valve 24 permitting the condensed steam to drop quickly into chamber 11 where it is flashed into steam and the cycle is repeated.

A modification of the structures described for Figs. 4 and 5 is shown in Figs. 8 and 9, wherein the studs 26 are caused to actuate the ends of two levers 29 and 30 which are pivoted respectively on 31 and 32. In the present case the valve 24 is guided by an arm 36 and has discs 37 and 38 at its upper end arranged to receive the ends of another pair of arms 39 and 40 which are also respectively pivoted on 31 and 32 and permitting a suitable amount of space between discs 37 and 38 for a purpose to be hereinafter described.

A cross bar 41 is fastened to one end of 39 and a cross bar 42 is fastened to one end of 40 and pairs of springs 43 are connected at one of their ends to both 41 and 42, the other ends of 43 being suitably fastened to the lower half of 1, the whole being arranged to provide suitable kick spring mechanism for actuating the valve 24 responsive to the extensions and contractions of 3.

The operation of this device is as follows:

In the drawings as shown in Figs. 8 and 9, the sylphon 3 is almost completely compressed by the expansion of steam from the boiler 11 and studs 26 will be about to exert sufficient pressure on the ends of 29 and 30 so that, by a relatively small further compression of 3, the arms 39 and 40 will have brought the springs 43 to dead center and upon passing thereover, the same will cause a snap action closing valve 24.

It is to be noted that the arms 29 and 39 as well as arms 30 and 40 are interlocking and may be made unitary in bell crank form and that sufficient lost motion is permitted in the spacing of the stops on the ends of studs 26 so that the snap action imparted to 24 will take place at correct periods relative to the travel of 3 and the amount of liquid placed in the system.

The closing of 24 causes a condensation of the vapor contained in 1 and the cycle of operation thereafter is the same as already described for Figs. 4 and 5.

Referring to Figs. 6 and 7 a modification of my steam heating system, as described in my aforesaid co-pending application Serial No. 748,932, is shown wherein the boiler 11 is contained in the exhaust pipe 12 of an internal combustion engine. The system includes the steam pipe 44 for superheated steam leading from the boiler 11 to the annular part of a casing 45 surrounding the intake pipe 46. The return pipe for condensed water 47 leads back to 11 and has its

lower end therein pointing in an upper direction as at 48 for the reason that water returning from 45 through 47 into 11 when it becomes turned into steam in 11 and rises directly upwardly from 48 and will not impede the return of condensed water through 47.

I claim:

1. In a fuel system for automobiles, a casing, an expansible member in said casing, a fuel pipe leading into said member, a pipe leading from said member, means for preventing the return flow of a liquid through said pipes, a boiler, an expansible fluid in said boiler, and a pipe connecting said boiler and casing.

2. In a fuel feeding system for an internal combustion engine, a fuel tank, a carburetor, an expansible and contractable member, means including conduits for connecting said member to said tank and carburetor for conducting fuel to said carburetor, and means independent of said fuel and operated by the heat of the exhaust of said engine for operating said member for transferring fuel from said tank to said carburetor.

3. In a fuel pumping system, for an internal combustion engine, a pumping member for transferring fuel to said engine, and means independent of said fuel and controlled by heat generated in said engine for intermittently operating said member.

4. A fuel pump comprising a chamber, a flexible member in the chamber, an inlet and an outlet pipe leading into and from said chamber, a boiler for containing a liquid, in communication with said chamber, said liquid being permanently confined in said boiler and chamber, means for heating the liquid in said boiler for intermittently vaporizing the same comparatively rapidly for operating said member for pumping a fluid through said pipes, and valve means for preventing the return flow of said fluid through said pipes.

5. In a fuel feeding system for an internal combustion engine, means including a collapsible bellows for supplying fuel to said engine, and means including a permanently confined fluid for utilizing a portion of the heat generated by said engine for heating said bellows.

6. In a fuel feeding system for an internal combustion engine, a casing, an expansible and contractable member in said casing, a fuel passage leading to and from said casing, a boiler for generating a vapor under pressure, for operating said member and for heating the same for supplying fuel to said engine and for heating said fuel in transit.

7. In a pumping system, a casing, an expansible and contractable member in the casing forming a chamber of variable size therein, a vaporizable liquid within the casing, inlet and outlet passages connecting with the

chamber, valves in said passages, means causing the liquid intermittently to be converted to a vapor stage and to cause a collapse of the chamber by the pressure of the vapor, and means causing the expansion of the chamber when the vapor pressure falls.

8. In a fuel feeding system for an internal combustion engine, a reciprocating pump mechanism for supplying fuel to said engine, a source of heat, and means utilizing a portion of the heat to cause the pump to reciprocate and to cause the fuel to be heated in its transit through the pump.

9. In an internal combustion engine having an exhaust passage, in combination, a boiler within the exhaust passage, a casing exterior of said passage, a connection between the casing and the boiler forming together a permanently confined space, a vaporizable liquid in the space, a chamber within the casing with walls adapted for the rapid transfer of heat therethrough, means for admitting fuel to the chamber, means for withdrawing the warmed fuel therefrom, and means for returning the condensate to the boiler after the vapor has delivered its heat to the fuel.

Signed at Wilmington, in the County of Los Angeles, and State of California, this 28th day of November, A. D. 1924.

CHARLES LAWRENCE STOKES.