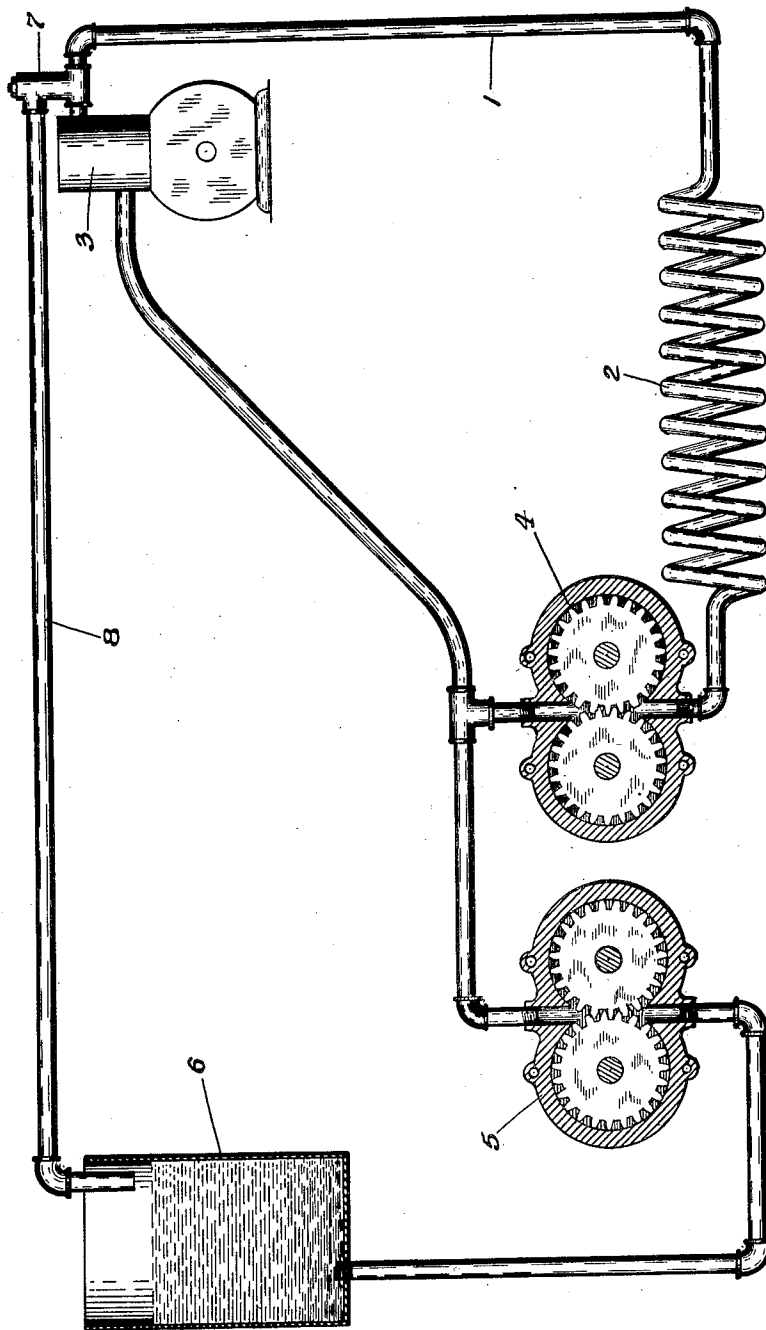


No. 877,903.

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C. R. BUTLER.
ART OF HEAT TRANSFERENCE.
APPLICATION FILED DEC. 4, 1905.



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ART OF HEAT TRANSFERENCE.

No. 877,903.

Specification of Letters Patent.

Patented Feb. 4, 1908.

Application filed December 4, 1905. Serial No. 290,097.

To all whom it may concern:

Be it known that I, CHARLEY R. BUTLER, a citizen of the United States, residing at Carthage, in the county of Rush and State of Indiana, have discovered certain new and useful Improvements in the Art of Heat Transference, of which the following is a specification.

In the operation of gas engines, transformers, furnaces and other apparatus generating heat it is desirable that means be provided to transfer the generated heat to another point and some radiating means is, therefore, provided. Heretofore this radiating means has generally consisted of a radiator coil or conduit through which water can be circulated, the conduit being connected with a jacket surrounding the machine heater. In such an apparatus, however, a very large radiating surface must be provided in order that the temperature of the circulating water may be sufficiently reduced before again coming into contact with the heater.

I have discovered that, by providing a cooling liquid preferably an oil, and circulating this cooling liquid through the conduit, under material pressure, and providing a relief or waste valve by means of which the gases, generated in the cooling fluid by reason of contact with the heated body, may escape, I am enabled to very materially reduce the area of radiating surface necessary for a required drop in temperature of the circulating liquid, the required area of radiating surface varying inversely with the pressure under which the cooling fluid is circulated.

In order to illustrate my discovery, the accompanying drawings illustrate diagrammatically an apparatus for carrying same into effect.

In this drawing, 1 indicates a conduit provided with a radiator portion 2. The conduit consists in part of a portion 3 which either surrounds or is intimately associated with the body to be cooled or the body furnishing the heat to be radiated by portion 2. The conduit 1 is connected with the induction and eduction passages of a suitable circulating means 4 which, in the present case, is illustrated as an ordinary rotary pump by means of which the liquid may be positively circulated through the conduit. Any desired means may be obtained for maintaining the

cooling liquid under pressure in conduit 1—2—3 but I prefer a second pump 5 which, in the present case, is shown as of the same type as the pump 4. The pump 5 has its eduction passage connected with the eduction passage of pump 4 but obtains its supply of cooling liquid from a reservoir 6 so that pump 5 serves to maintain any desired pressure of liquid within the conduit in excess of what is produced by the pump 4.

In order to control the pressure of liquid within the conduit I provide, preferably close to the point of emergence from the heater, a relief valve 7 which discharges through a conduit 8 into reservoir 6, said relief valve being of an ordinary type which may be adjusted to yield at any desired pressure produced in the conduit.

The operation is as follows: Suppose a cooling liquid, as a lubricating oil, be used to fill the conduit and reservoir. The pump 4 will produce a positive circulation of the liquid through the heating chamber 3, the radiator 2 and conduit 1 and this liquid will become heated in the chamber 3, the heat of the chamber being sufficient to partially volatilize the liquid. This volatilization (because of the latent heat of the gas) absorbs a large number of heat units from the chamber 3 but the formation of gas bubbles would prevent the necessary intimate association of the liquid with the object to be cooled. It is for this purpose that the liquid is circulated under decided pressure, this pressure serving to compress the gas bubbles. Upon emergence from the heater, by reason of the pressure, a portion of the stream passes through the valve 7 and conduit 8 into the reservoir 6 this portion being principally the frothy portion of the stream, consisting largely of volatilized liquid. When it reaches the reservoir 6 the gas is free to condense or to pass off.

I have found in actual experiment that when the oil is circulated through the radiator 2 by a single pump, therefore under practically no pressure, the temperature of the radiator does not become very high and the temperature of the liquid as it passes from the radiator is not materially greater than the temperature of the liquid as it passes from the radiator, but that if the pressure within the conduit be increased by the supplemental pump, the temperature of

the radiator increases while the difference in temperature between the liquid as it passes from the heater and the liquid as it passes from the radiator is also materially increased, thus showing that the number of heat units radiated from the radiator when the liquid is under material pressure is much greater than when the liquid is under the merely nominal pressure of circulation by a single pump. As a consequence I am able, by increasing the pressure of the liquid within the conduit to several atmospheres, to very materially reduce the area of the radiator 2.

While I have described my invention particularly as applied to a gas engine it is to be understood that the discovery may be applied as readily to any other apparatus for heat transference. For instance, an electric transformer of the ordinary type may be cooled by circulating the oil under pressure within the casing or, what would be better, a portion of the conduit might be formed of small copper tubing which could be wound with the windings of the transformer so as to be distributed therethrough, thus providing means by which there could be complete circulation of the liquid. As another instance of the application of my discovery it will be apparent that it might be utilized in a heating system, the heating chamber 3 being an ordinary furnace.

It will be readily understood that the particular mechanical construction of the various portions of the described apparatus may be varied without departing from my discovery, and it will also be readily understood that a single circulating pressure device may be used if the induction pipe of the pump be connected with the reservoir and the conduit discharge through a pressure controlling valve into the reservoir.

I claim as my discovery:

1. That improvement in the art of heat transference, which consists in providing a conduit circuit comprising a heater and radiator, positively circulating an oil through said conduit, heating the heater, permitting a portion of the oil to escape from the conduit after leaving the heater to permit escape of gases resulting from the heat, and driving an additional supply of oil into the system so as to maintain such material pressure of oil within the heater portion of the conduit as to substantially prevent the generation of gases within the conduit.

2. That improvement in the art of heat transference, which consists in providing a conduit circuit comprising a heater and radiator, positively circulating an oil through said conduit, heating the heater, permitting a portion of the oil to escape from the conduit after leaving the heater to permit escape of gases resulting from the heat and driving

an additional supply of oil into the system in front of the heater, so as to maintain such material pressure of oil within the heater portion of the conduit as to substantially prevent the generation of gases within the conduit.

3. That improvement in the art of heat transference, which consists in providing a conduit circuit comprising a heater and radiator, positively circulating a liquid through said conduit, heating the heater, permitting a portion of the liquid to escape from the conduit after leaving the heater to permit escape of gases resulting from the heat, and driving an additional supply of the liquid into the system so as to maintain such material pressure of liquid within the heater portion of the conduit as to substantially prevent the generation of gases within the conduit.

4. That improvement in the art of heat transference, which consists in providing a conduit circuit comprising a heater and radiator, positively circulating a liquid through said conduit, heating the heater, permitting a portion of the liquid to escape from the conduit after leaving the heater to permit escape of gases resulting from the heat and driving an additional supply of liquid into the system in front of the heater, so as to maintain such material pressure of liquid within the heater portion of the conduit as to substantially prevent the generation of gases within the conduit.

5. That improvement in the art of heat transference, which consists in circulating a liquid through a closed circuit of a heater and radiator by means of a pump, permitting an escape of a portion of the liquid in the line to permit escape of gases due to the heat, and introducing into said circuit an additional supply of liquid by a second pump to produce a pressure within the circuit such as to prevent the generation of gases in the circuit.

6. That improvement in the art of heat transference, which consists in circulating a liquid through a closed circuit of a heater and radiator by means of a pump, permitting an escape of a portion of the liquid in the line between the radiator and heater, to permit escape of gases due to the heat, and introducing into said circuit an additional supply of liquid by a second pump to produce a pressure within the circuit such as to prevent the generation of gases in the circuit.

7. That improvement in the art of heat transference, which consists in circulating an oil through a closed circuit comprising a heater and a radiator by means of a pump, permitting an escape of a portion of the oil from the circuit through a pressure controlling valve and introducing into said circuit by a second pump an additional sup-

ply of oil to maintain such pressure within the circuit as to substantially prevent the formation of gases therein.

8. That improvement in the art of heat transference, which consists in circulating an oil through a closed circuit comprising a heater and a radiator by means of a pump, permitting an escape of a portion of the oil from the circuit through a pressure controlling valve between the radiator and heater, and introducing into said circuit by a second pump an additional supply of oil

to maintain such pressure within the circuit as to substantially prevent the formation of gases therein. 15

In witness whereof, I, have hereunto set my hand and seal at Indianapolis, Indiana, this 25th day of November, A. D. one thousand nine hundred and five.

CHARLEY R. BUTLER. [L. s.]

Witnesses:

ARTHUR M. HOOD,
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