PUBLISHED

APRIL 27, 1943.

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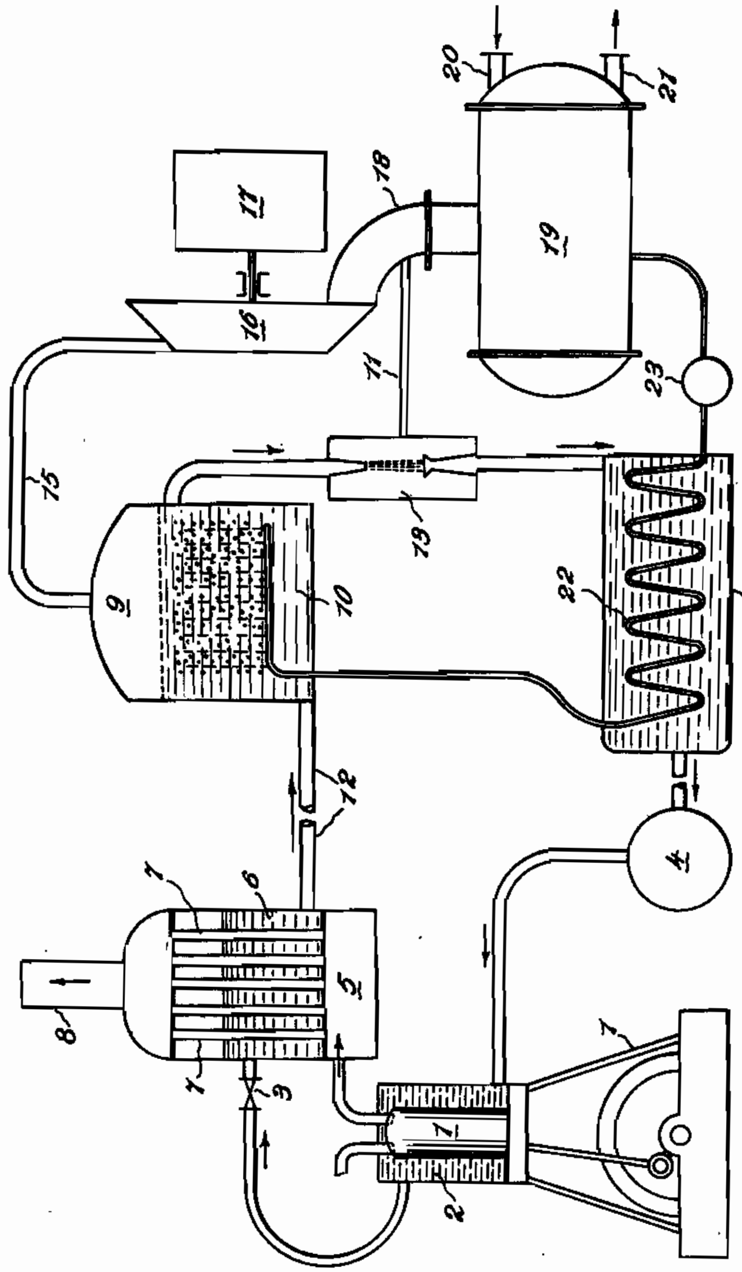
HEAT EXCHANGER

Filed March 29, 1940

Serial No. 326,817



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Published Apr. 27, 1943 Serial No. 326,817

ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR THE UTILISATION OF THE HEAT LOST BY INTERNAL COMBUSTION ENGINES

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Application filed March 29, 1940

The present invention relates to a process for the utilisation of the heat lost by internal combustion engines. Object of the invention is equally a device allowing the realisation of said process.

The invention aims at the rational utilisation of the heat abandoned by internal combustion engines as well in the circulating water as in the discharging gases by employing said heat for actioning a turbine installation fed by the vapours of a fluid with a high molecular weight and peculiar thermodynamic characteristics.

A form of realisation of the invention is illustrated in the accompanying drawing in which the only figure schematically shows an installation where the heat is utilised for actioning a turbine.

With reference to the drawing the internal combustion engine 1 is cooled by circulating distilled water conveyed to the usual cool water jackets 2.

The water possesses at the admission a temperature generally higher than 50° C, for instance 65° C, but the temperature may also descend below said limit. The circulation of the water is actively produced by a pump 4. At the outlet the water is introduced, through a laminating valve 3 into a further heater 8 while the discharge gases of the motor are conveyed to a chamber 5 of the same heater and heated through the smoke tubes 7 where they also heat the warm water admitted from the jackets into the same boiler 8. At the outlet of the boiler 8 the water may have a temperature below 100° C.

As well within the jackets 2 as in the boiler 6 the water is kept under a pressure higher than the one of ebollition. From the boiler 6 the water after separating the heat transmitted by the jackets as well as by the discharge gases, flows into a receptacle 10, where it is stationary for a certain time though in continuous active circulation; from said receptacle the water flowing through a gas expeller 13 passes to a preheater 14. From this pre-heater 14 by means of a circulating pump 4 the water is sent back to the jackets 2 of the motor. In the receptacle 10, constituting the evaporator of the fluid with a high molecular weight, the water yields a part of the heat absorbed by the motor to evaporate the weighty fluid. This fluid is injected within the warm water minutely fractioned and since it has been selected among those not mixable with water, a species of emulsion is formed with water. In the receptacle 10, then the weighty fluid evaporates within warm water and in consideration of the pressure of the saturated vapours of the fluid, the partial pressure of the water steam in the receptacle 10 may be regarded as neglectable with respect to the pressure of the fluid. The vapours of the fluid produced by the generator 10 operate through the tubing 15 a steam turbine 16 which drags an alternator or another operating machine 17 or the same driving shaft of the internal combustion engine. The steam discharged by the turbine through the tube 18 is admitted into a condenser 19 fed by refrigerating spring water, sea water or the like which is admitted for instance at 15° C and discharged at 20° C. From the condenser 19 the fluid condensed crosses the coil pipe 22 of the pre-heater 14 and is sent back again minutely fractioned into the boiler 10 by the pump 23.

The warm water of the evaporator 10, being cooled after yielding heat to the fluid evaporating therein, passes, as mentioned, into the gas expeller 13, where it is brought under a pressure lower than the one reigning in the chamber 10 and consequently loses a part of the gases the same water had dissolved. These gases are directly conveyed into the condenser 19. The water after the expulsion of the gases acquires again at the expense of the kinetic energy a part of the original pressure after flowing through the pre-heater 14, the pump 4 restores the original pressure and is sent back into the jackets 2. Nevertheless in the jackets 2 as well as in the boiler 6 and in the evaporator 10 there reigns an only pressure that is the one of the weighty fluid much higher than the partial pressure of the water.

The characteristic feature of the system described is the following.

The heat carried away from the cool water jackets of the internal combustion engine as well as the one carried away through walls by the outlet gases of the motor are collected by an only circulating water current. This heat collected serves to directly evaporate, within the water and in a convenient receptacle 6 a fluid capable of driving a pure action turbine. This fluid selected among those not mixable with water has a high molecular weight according to the principle that a saturated vapour when adiabatically expanding between two temperatures acquires discharge speeds inversely proportional to the square root of the molecular weight and consequently acquires speeds remarkably lower than the speed of steam between the same end temperatures allowing the use of an action turbine with one wheel and a simple crown of blades in the conditions of the highest efficiency that is with a peripheric speed about the half of the discharge speed of the vapour.

Among the different fluids the butane or isobutane are chosen having the characteristic thermodynamic propriety to possess in the entropy-temperature diagram the upper limit curve in the range of temperature comprised between 10° C and 100° C with entropy increasing with the temperature, consequently possessing the characteristic that in an adiabatic expansion starting from a saturated and dry vapour or with a high tritation there is obtained after the expansion an overheated or dry vapour, all the inconveniences owing to the humidity of the steam in a turbine being removed. Finally, this fluid, selected by way of example, possesses at the temperature approaching the one of the cold source a pressure of saturated vapour a little higher than the atmospheric pressure so that an easy tightness of the members is allowed as to prevent returns of air into the fluid. As a clearing example the butane has been considered presenting between the end temperatures of 90 and 15° C the thermodynamic proprieties above mentioned. The molecular weight of this fluid is 58, the one of water being 18. The discharge speed in an only adiabatic expansion between the temperatures mentioned is about 400 metres the second, the one of water steam being 1000, easily allowing the use of one-wheeled action turbine with a simple crown of blades and peripheric speed allowable of only 200 metres the second while in the same case with water steam peripheric speeds would be necessary of about 500 metres the second not allowable according to the present state of technology. The pressure of the butane at 15° C is about 0,8 Kg/cm^2 higher than the atmospheric pressure while for water steam the absolute pressure is about 0,02 absolute atmosphere. At the end of the expansion the vapours of butane also starting from saturated and damp vapour, but at a high tritation, are in overheated conditions while for the water steam the titration would be rather lower.

The present invention has been illustrated and described in a preferred form of realisation, but it is understood that constructive changes may be practically introduced therein without surpassing the limits of protection of the present industrial patent.

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