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PROCESS AND APPARATUS FOR THE UTILIZATION OF HEAT IN OIL ENGINES.

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1,382,995. Patented June 28, 1921.

Fig. 2.

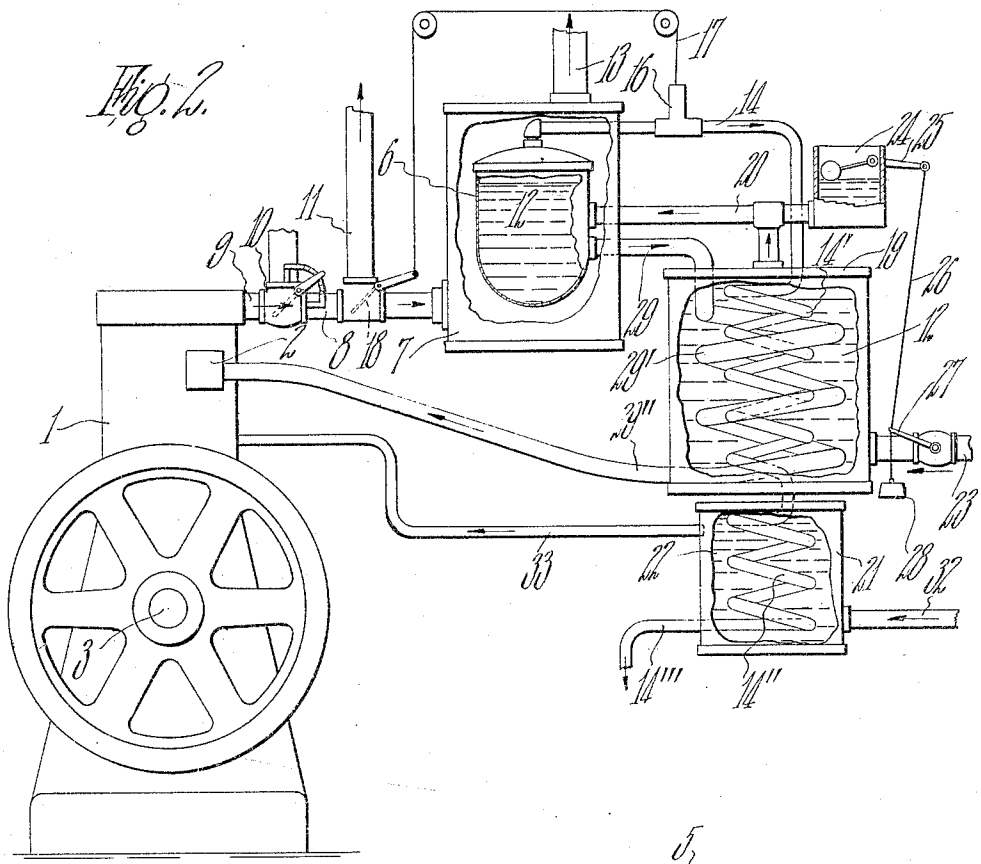
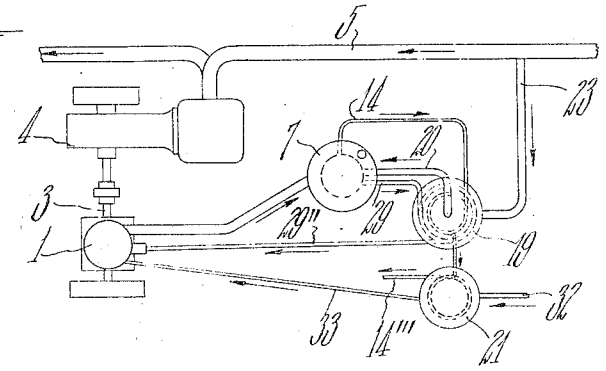


Fig. 1.



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PROCESS AND APPARATUS FOR THE UTILIZATION OF HEAT IN OIL-ENGINES.

1,382,995. Specification of Letters Patent. Patented June 28, 1921.

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To all whom it may concern:

Be it known that I, HERBERT R. LUCKE, a citizen of the United States of America, residing at Dallas, in the county of Dallas and State of Texas, have invented certain new and useful Improvements in Processes and Apparatus for the Utilization of Heat in Oil-Engines, of which the following is a specification.

This invention relates to an improvement in the process and apparatus for the utilization of waste or surplus heat of internal combustion engines, and particularly oil burning engines of the Diesel type.

In many localities, Diesel oil engines are at present operated with crude oil of 40 gravity as fuel, but since the Diesel engine will operate satisfactorily on even lower or heavier grades of fuel, it is proposed by the present invention to separate by distillation the lighter and higher priced fractions of the crude oil and to supply the residue only of such distillation to the engine as fuel.

Furthermore in the present invention, the heat for distillation is obtained from the operation of the engine itself, *i. e.* by efficient use of the exhaust gases thereof so that a sufficient quantity of crude oil can be distilled off to bring at current prices, a sufficient return to substantially pay for the crude oil used, whereby the engine may be operated for power purposes at practically no cost for fuel.

While a power plant of this description has wide application, yet it is particularly adapted for use in pumping stations of crude oil pipe lines and it is in connection with such a use that the present invention will be described.

In the preferred embodiment of the invention illustrated in the drawings,—

Figure 1 is a plan in diagram of the present apparatus installed at a pumping station on an oil pipe line;

Fig. 2 is an elevation of the apparatus also somewhat diagrammatic, and with certain parts in section.

The separate parts of the apparatus are generally of standard or well known form and are therefore illustrated conventionally for the sake of simplicity. The oil engine, preferably of the Diesel type, and water cooled, is indicated as a whole at 1, and has its fuel inlet at 2 and crank shaft or power shaft at 3. Referring to Fig. 1, the crank shaft 3 of the engine 1 is suitably connected to operate an oil pump indicated at 4, located in the oil pipe line, indicated by 5.

An oil still is employed in combination with the oil engine for utilizing the exhaust heat of the engine to vaporize the oil, comprising a retort 6, for containing the oil 12 to be vaporized, and a heating chamber 7 which heating chamber preferably entirely surrounds the retort 6 and is connected by pipe 8 with the exhaust outlet 9 of the engine. The hot exhaust gases entering the chamber 7 through pipe 8 act to heat the retort 6 for vaporizing the oil and said gases are eventually discharged from the chamber 7 through an outlet pipe 13. 10 is a suitable hand valve for controlling the passage of exhaust gases through said pipe 8 and an outlet pipe 11 is provided to carry off any surplus exhaust gases, not needed for heating the retort 6.

The oil vapors from the retort 6 are conducted by pipe 14 and worms 14′, 14″ through one or more condensers, herein preferably shown as two in number and said pipe has a discharge outlet 14‴, from which the condensed distillate is recovered. 16 indicates a thermostatically operated device preferably attached to the pipe 14 adjacent the heating chamber which device by means of a suitable connection 17 operates a damper valve 18 located in the pipe 8 to regulate the admission of exhaust gases into the heating chamber 7 in accordance with the heat of the vapors being distilled. This thermostatically controlled device thus acts to determine the grade of distillate recovered and it is understood that it may be adjusted in the usual manner of such devices to determine the various fractions to be distilled.

A primary condenser indicated at 19 comprises the usual chamber containing the cooling medium 12 therein and through which the worm 14′ of the distillate pipe 14 passes. A secondary condenser 21 is of similar construction and also contains suit-

able cooling medium indicated at 22. The cooling medium for the primary condenser 19 is preferably the crude oil which is to be distilled and which is taken from the pipe line 5 through pipe 23. This crude oil 12 after passing through the chamber of the condenser 19 and coming into heat exchanging relation with the worm 14′ is warmed thereby and passes from said chamber 19 through pipe 20 into the retort 6. A float chamber 24 is preferably connected with the pipe 20 and is provided with the usual float operated lever 25 having a connection 26 to a valve 27 in the crude oil inlet pipe 23 to thereby regulate the supply of crude oil to the still in accordance with the level of oil in said retort 6. 28 indicates a suitable balancing weight for the lever 25 and connections.

The undistilled or unevaporated residue of oil in the retort 6 is conducted by the pipe 29 and worm 29′ preferably through the condenser 19 so as to bring this heated residue into heat exchanging relation with the incoming oil 12 of said condenser and thus warm said incoming oil preparatory to its introduction into the evaporating retort 6. The worm 29′ emerges from the condenser 19 in the pipe 29″ which leads to the fuel inlet 2 of the engine 1.

The secondary condenser 21 is cooled in the ordinary manner by water entering through pipe 32. This cooling water 22 of the secondary condenser is preferably conducted from the upper part of said condenser through pipe 33 to the cooling chamber or water jacket (not specifically shown) of the oil engine 1, thereby assisting in maintaining said oil engine 1 heated to the proper temperature for its best efficiency.

The water after circulating through the water-jacket is preferably directly discharged therefrom through a suitable pipe (not shown) into a drain or sewer, whereby a constant circulation of water is maintained upon a proper quantity being admitted through the supply pipe 32. In this way the cold water admitted to the condenser by the pipe 32 cools the condenser pipe and at the same time the water thus admitted is raised to a sufficient temperature to permit its being admitted to the water-jacket without unduly cooling the engine cylinder, while at the same time this water as admitted to the water-jacket is of such temperature to keep the engine cylinder from becoming overheated. It will readily be understood that by properly regulating the admission of cold water to the condenser the temperature of the water supplied to the water-jacket through the pipe 33 may be maintained substantially constant and at a proper temperature to suitably cool the engine cylinder.

It will be noted, that although the exhaust gases from the oil engine are employed in an efficient manner to heat the oil evaporating retort 6 which heat is sufficient to vaporize a considerable amount of oil nevertheless by preheating the oil before introduction into said retort 6, greater efficiency and a greater amount of distillate is obtained. As shown, this preheating of the crude oil supply is effected by passing it through the primary condenser 19 so as to surround the hot distillate worm 14′ and hot undistilled residue worm 29′, whereby most of the heat ordinarily wasted in a condenser is advantageously utilized in the working of the apparatus. Similarly the heat given to the cooling medium of the secondary condenser 21 is utilized to increase the efficiency of the engine.

The advantages of this invention will be apparent from a specific illustration of its use in connection with a pumping station of a crude oil pipe line. The average pumping station operated with a Diesel oil engine, handling 20,000 barrels of 40 gravity crude oil, requires as fuel for the engine approximately 480 gallons per day, which at present prices of $2.25 per barrel amounts to a fuel expense of about $25.70 per day. It is estimated that the present apparatus will distil 35% of the crude oil supplied thereto and therefore in a plant normally requiring 480 gallons per day, it will be necessary to supply approximately 740 gallons so that the 65% of the undistilled residue thereof will give the 480 gallons necessary to operate the engine. The cost of 740 gallons of crude oil per day at $2.25 per barrel is approximately $39.64. The distillate or lighter fractions distilled off from the 740 gallons namely 35% thereof, amounting to 260 gallons, will bring a price of not less than 15¢ (fifteen cents) per gallon, or $39.00 per day. In other words, the sale of the distilled fraction will bring a price approximately equal to the entire cost of the crude oil handled, enabling the power of the engine to be obtained at little or no cost for fuel.

It is obvious that various changes in the arrangement of the parts and modifications in the several features employed in the present apparatus may be effected without avoiding the substance of the invention as covered in the following claims.

What I claim is—

1. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, and means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

2. In an apparatus for the utilization of heat of internal combustion engines, the

combination with said engine of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, automatically operated means for controlling the heat of said retort, and means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

3. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, a condenser for the oil vapors from said retort and means for conducting oil to be distilled first through said condenser as a cooling medium therefor and then from said condenser to the retort, means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

4. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, a condenser for the oil vapors from said retort and means for conducting oil to be distilled first through said condenser as a cooling medium therefor and then from said condenser to the retort, automatically operated means for controlling the supply of oil, and means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

5. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, a condenser for the oil vapors from said retort, means for conducting oil to be distilled first through said condenser as a cooling medium therefor and then from said condenser to the retort, and means to conduct the undistilled residue from said retort first through said condenser to be cooled therein and then to the fuel inlet of said engine.

6. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine having a water cooled chamber, of an oil still comprising a retort to contain the oil being distilled, means for heating the retort with the heat given off by said engine when in operation, a primary condenser for the oil vapors from said retort and means for conducting said oil to be distilled first through said condenser as a cooling medium therefor and then from said condenser to said retort, a secondary condenser for said oil vapors arranged to be cooled by water and means for conducting water from said secondary condenser to the water cooled chamber of said engine.

7. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled, means for heating the retort from the heat given off from said engine when in operation, and means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

8. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled, means for heating the retort from the heat given off from said engine when in operation, a primary condenser connected with said pipe line to receive a supply of oil therefrom as a cooling medium, a conduit for conducting oil from said primary condenser to said retort, a secondary condenser arranged to be cooled by water and means for conducting water from said secondary condenser to the water cooled chamber of said engine, means for conducting the oil vapors successively through said primary and secondary condensers for obtaining distillate therefrom, and means to conduct the undistilled residue of said oil from the retort first through said primary condenser to be cooled thereby and then to the fuel inlet of said engine.

9. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled, a heating chamber surrounding the retort and means for conducting the exhaust gases of said engine through said heating chamber to heat said retort, and means to conduct the undistilled residue from said retort to the fuel inlet of said engine.

10. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine having a water cooled chamber, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled, a heating chamber surrounding the retort and means for conducting the exhaust gases of said engine through said heating chamber to heat said retort, a primary condenser connected with said pipe line to receive a supply of oil therefrom as a cooling medium, a conduit for conducting

oil from said primary condenser to said retort, a secondary condenser arranged to be cooled by water, means for conducting water from said secondary condenser to the water cooled chamber of said engine, means for conducting the oil vapors from said retort successively through said primary and secondary condensers for obtaining a distillate therefrom, and means to conduct the undistilled residue of said oil from the retort first through said primary condenser and then to the fuel inlet of said engine.

11. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine, having a water cooled chamber, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled, a heating chamber surrounding the retort, and means for conducting the exhaust gases of said engine through said heating chamber to heat said retort, thermostatic means controlled by the heat within said retort for regulating the admission of said exhaust gases to said heating chamber, a primary condenser connected with said pipe line to receive a supply of oil therefrom as a cooling medium, a conduit for conducting oil from said primary condenser to said retort, a secondary condenser arranged to be cooled by water, and a conduit for conducting water from said secondary condenser to the cooling chamber of said engine, means for conducting the oil vapors from said retort successively through said primary and secondary condensers for obtaining a distillate therefrom, and means to conduct the undistilled residue of said oil from the retort first through said primary condenser and then to the fuel inlet of said engine.

12. In an apparatus for the utilization of heat of internal combustion engines, the combination with said engine having a water cooled chamber, a pipe line for conducting oil and a pump operated by said engine for forcing the oil through said pipe line, of an oil still comprising a retort to contain oil being distilled and means for heating the same from the heat given off from said engine when in operation, a primary condenser connected with said pipe line to receive a supply of oil as a cooling medium, a conduit for conducting said oil supply from said primary condenser to said retort, means controlled by the level of liquid in said retort for regulating the admission of oil thereto, a secondary condenser, arranged to be cooled by water, and a conduit for conducting water from said secondary condenser to the cooling chamber of said engine, means for conducting the oil vapors from said retort successively through said primary and secondary condensers for obtaining distillate therefrom, and means to conduct the undistilled residue of said oil from the retort first through said primary condenser and then to the fuel inlet of said engine.

13. In an oil still, in combination with an oil engine used for pumping oil, a retort to contain the oil being distilled, means for heating the retort, a condenser for the oil vapors from said retort, and means for conducting the undistilled residue from the still to the fuel inlet of the oil engine.

14. The combination with an oil pipe line and an oil engine for pumping the oil through said pipe line, of an oil still for distilling oil obtained from said pipe line, said oil still comprising a retort for the oil being distilled, means for heating the retort, a condenser for the oil vapors from said retort, and means for conducting the undistilled residue from the still to the fuel inlet of said oil engine.

15. In combination with a fuel oil pipe line and an engine for pumping oil therethrough, means for drawing a supply of fuel oil from said pipe line, means operated by the exhaust gases from said engine, for producing fractional distillation of the fuel oil thus drawn from the pipe line, and means for utilizing the residue of said oil remaining after distillation for operating the engine.

16. The method of utilizing the waste heat of internal combustion engines which consists in subjecting a supply of fuel oil to the heat from the exhaust gases of said engine to thereby effect vaporization of the lighter fractions of said fuel oil, condensing said lighter fractions as a distillate and conducting only the undistilled residue of said fuel supply to the fuel inlet of said engine.

17. The method of utilizing the waste heat of internal combustion engines which consists in subjecting a supply of fuel oil to the heat from the exhaust gases of said engine to thereby effect vaporization of the lighter fractions of said fuel oil, bringing said vapors into heat exchanging relation with said fuel supply to thereby warm said fuel supply and cool said vapors, condensing said lighter fractions as a distillate and conducting only the undistilled residue of said fuel supply to the fuel inlet of said engine.

18. The method of utilizing the waste heat of internal combustion engines which consists in subjecting a supply of fuel oil to the heat from the exhaust gases of said engine to thereby effect vaporization of the lighter fractions of said fuel oil, condensing said lighter fractions as a distillate and bringing said undistilled residue into heat exchanging relation with said fuel supply to thereby warm said fuel supply and cool said residue, and conducting only the undistilled residue of said fuel supply to the fuel inlet of said engine.

19. The method of utilizing the waste

heat of internal combustion engines which consists in subjecting a supply of fuel oil to the heat from the exhaust gases of said engine to thereby effect vaporization of the lighter fractions of said fuel oil, bringing said vapors into heat exchanging relation with said fuel supply to thereby warm said fuel supply and cool said vapors, condensing said lighter fractions as a distillate and bringing said undistilled residue into heat exchanging relation with said fuel supply to thereby warm said fuel supply and cool said residue and conducting only the undistilled residue of said fuel supply to the fuel inlet of said engine.

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