

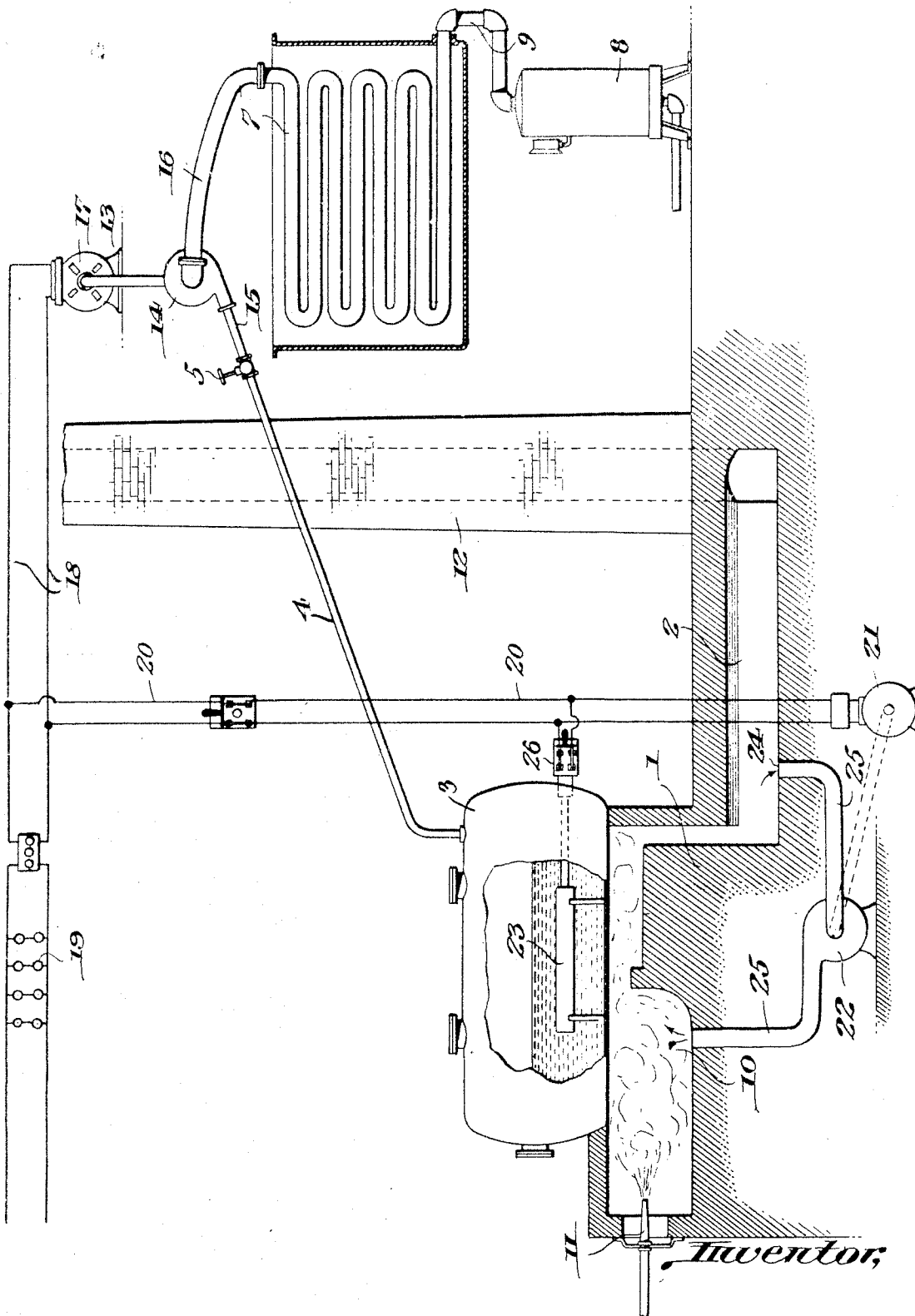
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METHOD OF AND APPARATUS FOR TREATING HYDROCARBONS

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METHOD OF AND APPARATUS FOR TREATING HYDROCARBONS

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My invention relates to methods of and apparatus for treatment of hydrocarbon oils, and has for its object to recover the expansive energy which is now employed in such methods and apparatus, and then lost.

In systems for the refining of hydrocarbon oils in cracking plants, and elsewhere, it is common to heat the oil to produce vapors which are passed through a suitable pipe line from the still or retort to a dephlegmator or bubble tower or other apparatus, according to the treatment being carried on. The temperatures and pressures employed in these systems are frequently very high, a pressure of 600 lbs. to the square inch being not uncommon. These temperatures and pressures, after they have performed their useful functions, in point of energy dissipated are very wasteful. Thus, in large plants of a certain type, the power which goes to waste probably amounts to 100 horsepower. In many plants, heat energy is recovered to a certain extent, usually by the use of heat exchangers, counter-current circulators, or bubble towers. So far as I am aware, however, nothing of effort has been made to recover the energy represented by the expansive forces due to the pressure imposed upon the gases and liquids in the course of their treatment, and especially in the initial or primary distillation and cracking thereof.

In every such system there are numerous applications of power, including pumps for the make-up, pressure pumps and pieces of retreatment apparatus, pumps for forcing reflux back into the header of a cracking retort or pressure still, fans or blowers for recirculating flue gases, and electric lighting apparatus. Power is usually supplied for these from outside sources.

Specifically stated, my invention has for its object to recover the energy represented by the expansive force due to pressure in any part of a system of the class mentioned and return it in the form of useful work into the system, or otherwise usefully employ it. For example, in a system such as that shown in U. S. Letters Patent No. 1,119,700, granted December 1, 1914, to R. E. Humphreys, the vapor line 4 carries a super-atmospheric pres-

sure which drops in the condenser 7 and only a relatively low pressure is carried through and beyond the condenser. The expansive force represented by the pressure in pipe 4 in this case is lost.

Examples might be multiplied indefinitely, as apparently no such effort has been made to conserve the pressure energy as there has been to conserve heat energy, although, as already pointed out, it represents a serious loss.

According to my present invention, and in order to attain my object, I connect a motor in the vapor line or other portion of the system carrying pressure and preceding a pressure drop, so that there can be no interference with the normal operation. According to what I now consider the best method of utilizing this power, I couple this motor, which may conveniently be a turbine, to a generator, and transmit power electrically to points of utilization in the plant. Such turbo-generator units have been developed to a point of high efficiency, and are well known in the art. Of course, as a modification, it is possible to transmit the power mechanically and utilize it mechanically, but I have found electrical transmission better for my purposes because it is more flexible and is in line with modern standard practice.

Another very important use which is included within the scope of my invention is that of supplying supplemental heat either to a cracking still or to a preheater. By employing an electric generator unit, it is my purpose to produce current which may be supplied to all the needs of the plant, including pumps, recirculation of flue gases, lighting and the like, and thereafter if there be any margin of power left, to add the same in the form of heat to raise the temperature of stills, preheaters and the like.

My invention is illustrated in the accompanying drawing, in which the figure is a diagram showing a system for the treatment of hydrocarbon oils, including a cracking still and reflux line operated under high pressure, with my invention applied thereto.

Referring to the drawing, 1 is a substructure or base, containing flue 2 leading to a stack and supporting a cracking still 3, from

which a reflux line 4 extends obliquely upward to an elevated point where it is fitted with a pressure control valve 5, from which pipe 16 drops to a condenser 7, from which the outlet pipe 9 extends to a receiver 8. In the upper part of the substructure is a furnace 10, fitted with the usual oil burner 11 and flue 2, already mentioned, extending to a stack 12.

In operation, the still 3 is charged with a heavy hydrocarbon liquid, heat is applied thereto, and vapors pass up through the line 4, wherein the heavier fractions are condensed and reflux back into the still for re-treatment. The valve 5 is kept closed until the desired operating pressure is obtained, after which it serves to control the pressure and to permit the passage of the lighter fractions suitable for condensation and storage. The drop in pressure outside of the valve 5 is produced by expanding the vapors and condensing them in the condenser 7, and the energy represented by the expansive force due to pressure controlled by the valve 5 is in prior practice dissipated largely as heat in the cooling water, and is thereby lost.

According to my present invention I install a turbo-generator unit 13 with a turbine 14 whose intake 15 is connected to the reflux line 4 through the valve 5, and whose exhaust 16 is connected to the condenser 7. The generator 17 may conveniently be an alternator of standard construction, indicated as furnishing current at 220 volts to the mains 18, which may supply feeders leading to various points in the plant. I have shown an electric lighting circuit 19 thus supplied with current, and a power circuit 20 extending to a motor 21 driving a blower 22 for circulating flue gases, to be presently described, and an electric heater 23 installed in the still 3 for the purpose of returning a portion of the energy in the form of heat to the oil itself.

The circulation of flue gases in the present case is accomplished as follows: The furnace 10 has a flue 2 extending to the stack 12. At an indifferent point, such as 24, in the flue 2, a breeching 25 is taken off to the blower 22 and continues therefrom to the furnace 10. In operation, the heated gases and products of combustion pass from the furnace through the flue 2 to the stack 12, but the blower 22 draws off a certain portion of them through the breeching 25 and conveys them back to the furnace 10 to be mingled therein with the hot gases and products of combustion from the burner 11 and thereby to soften the heat applied to the still. The relation between the total volume of gases passing through the flue 2 and the volume that is withdrawn at the point 24 may be varied, and is a matter of design, depending upon the capacity of the blower. These blowers are usually operated by motors under energy

supplied from outside the system. According to my invention I connect the motor 21 through circuit 20 to the mains 18, to derive power from the generator 17.

Usually the amount of energy derivable from the drop in pressure between the reflux pipe and the condenser is sufficient for the circulation of the flue gases, but in case a larger amount of energy is available I employ it in supplemental heating of the oil in the still 3. For this purpose an enclosed heating unit 23 is mounted in the still and its circuit connected through the insulating bushing 26 to the circuit 20. By this means the energy represented in expansive force in the vapors leaving the still under pressure is restored to the oil in the form of heat.

By a modification of this electric heating method, the heating unit 23 or its equivalent may be applied to the reflux line 4 so as to superheat the vapors therein, with the result of increased cracking in the vapor phase. I have not illustrated this species of the invention, because it will be clearly understood from the illustration given. It is to be noted, however, that the form of the heater may be changed in various ways, as for example by applying heating coils to the pipe 4, and the like.

It is unnecessary for the purposes of this specification to describe the pieces of apparatus in detail, as standard units are available in each case, and the structure and arrangement may be varied and modified without departing from the scope and purview of the invention, provided they are adapted to my use and suitable for my purpose, as herein set forth.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In treating hydrocarbon oils, the method of conserving energy which consists in heating said oils in a closed vessel to produce cracking temperature and pressure therein conducting the vapors from said still while under pressure through a vapor line, expanding said vapors and gases through a suitable motor so as to produce mechanical power, and causing said power to resupply the energy so recovered in the form of heat to the oil being treated.

2. The method described in claim 1, in which the vapors and gases are caused to pass from the high pressure vapor line and be expanded through a suitable motor into a condensing zone, and the energy developed in the motor thereby is caused to produce heat, which is continuously resupplied to the oil under treatment.

3. The method described in claim 1, which includes the step of expanding the vapors and gases from a high pressure vapor line through a suitable motor, causing the power developed in said motor to generate an elec-

tric current, and applying the energy in said electric current to produce heat in the oil under treatment.

4. The method of conserving energy represented by the expansive force due to compression in a system for treating hydrocarbon oils as described in claim 1, which consists in expanding the vapors and gases through a suitable motor at a point of natural pressure drop in the system so as to generate mechanical power, and then causing said power to restore to the oil under treatment in the form of heat the energy lost in expansion.

5. In a system for the treatment of hydrocarbon oils, a still, a high pressure vapor line and a low pressure condenser adapted to receive vapors from said vapor line and forming an expansion chamber therefor, a motor connected so as to utilize the drop in pressure from said vapor line into said condenser, an electric generator connected to be driven by said motor, and translating devices connected to receive electrical energy from said generator and to transform the same into heat in the oil under treatment.

In testimony whereof I hereunto affix my signature.

FRANK E. WELLMAN.

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