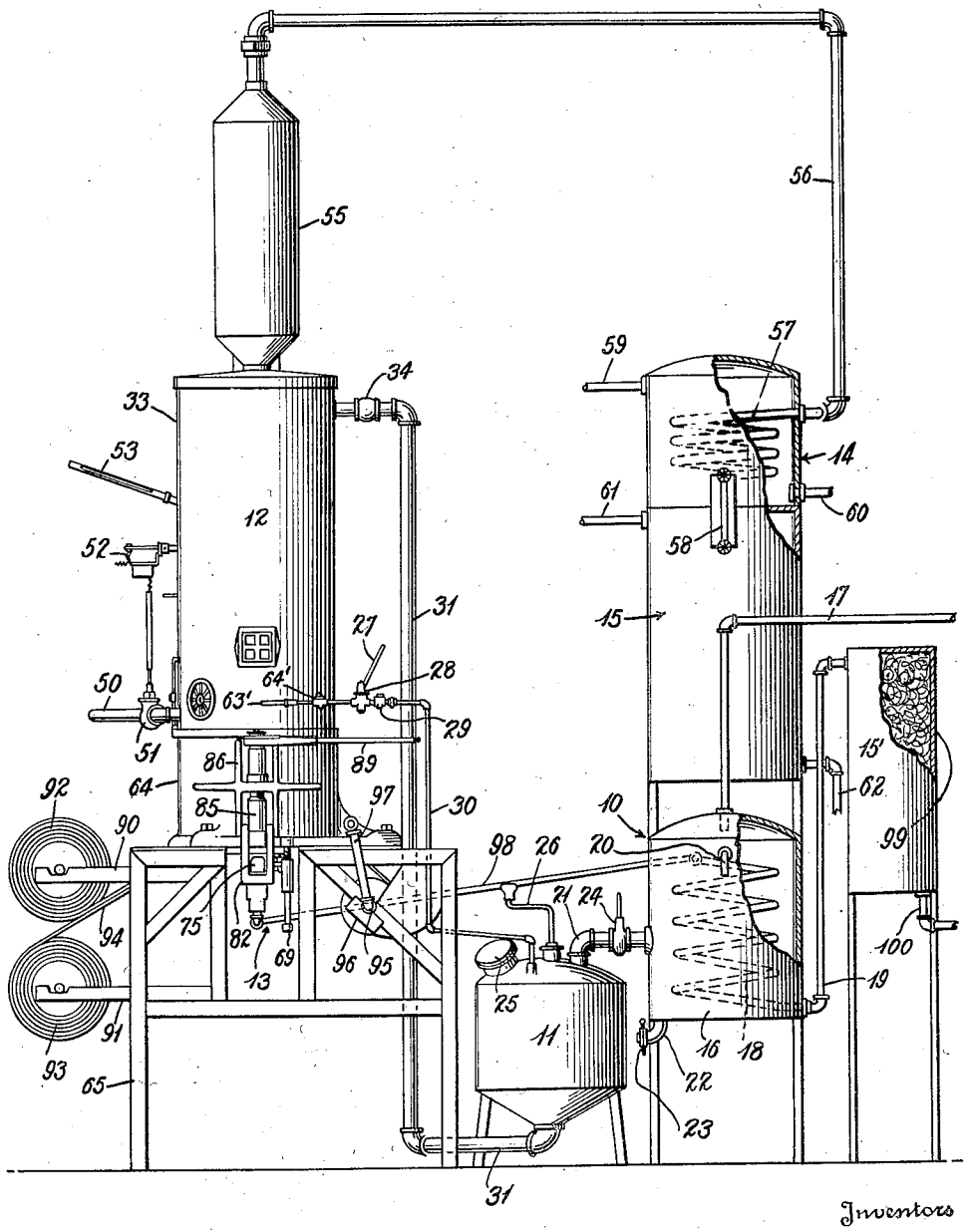
June 23, 1936. H. G. CROWLEY ET AL 2,045,216

METHOD OF RECLAIMING USED LUBRICATING OIL

Filed Feb. 6, 1933 3 Sheets-Sheet 1

Fig. 1.



Inventors
H.G. Crowley and
E.W. Riemenschneider

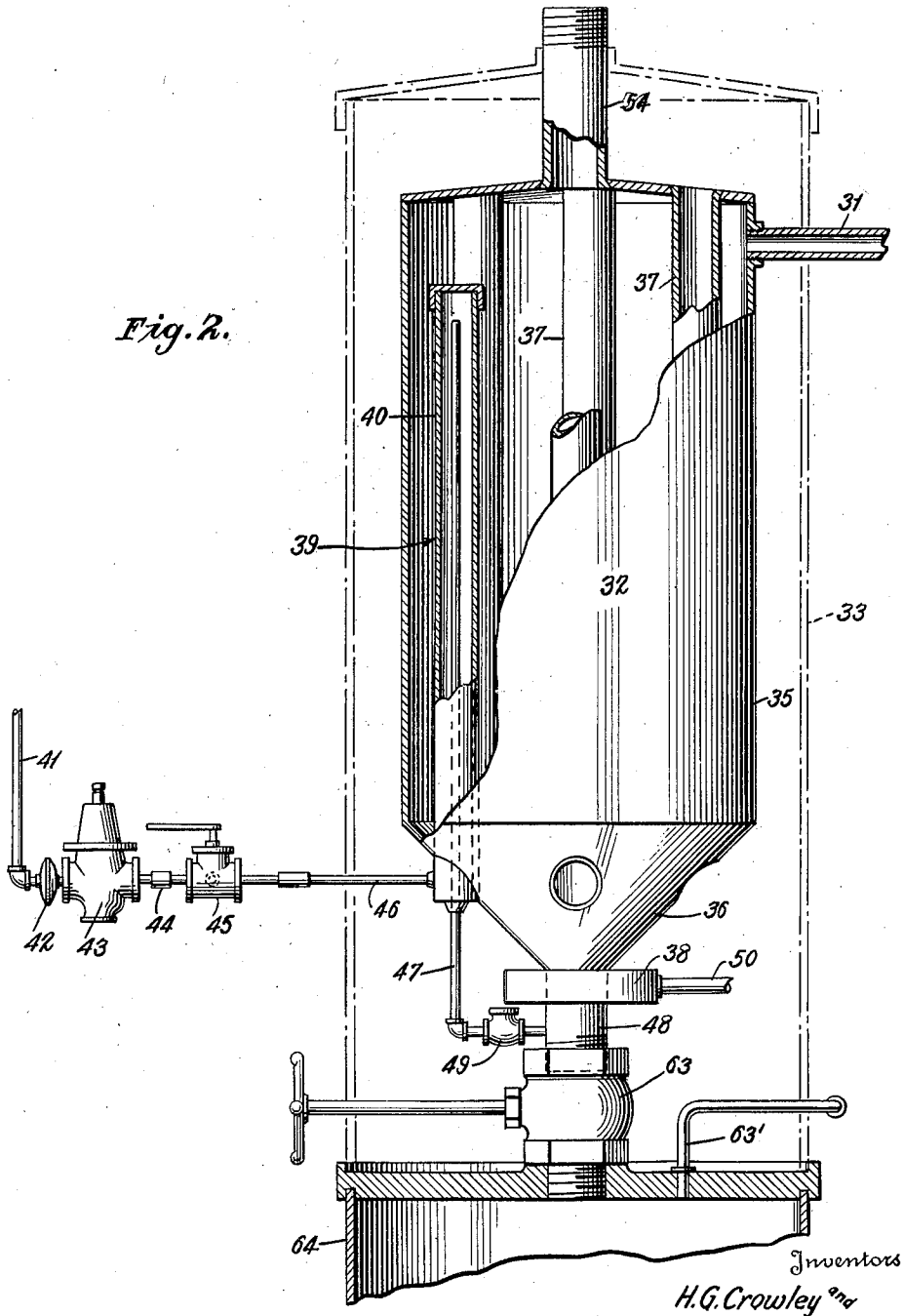
By Fraser Stevens
Attorneys

June 23, 1936. H. G. CROWLEY ET AL 2,045,216

METHOD OF RECLAIMING USED LUBRICATING OIL

Filed Feb. 6, 1933 3 Sheets-Sheet 2

Fig. 2.



Inventors
H. G. Crowley and
E. W. Riemenschneider

By Bacon & Thomas

Attorneys

June 23, 1936. H. G. CROWLEY ET AL 2,045,216

METHOD OF RECLAIMING USED LUBRICATING OIL

Filed Feb. 6, 1933 3 Sheets-Sheet 3

Fig. 3.

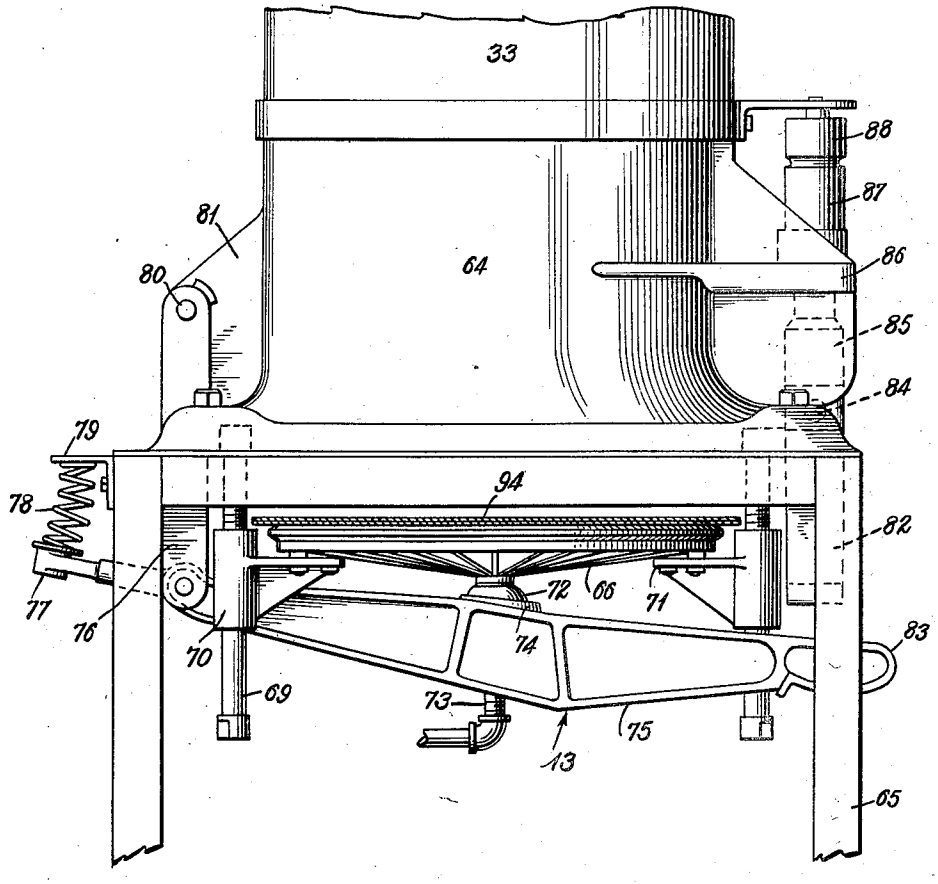
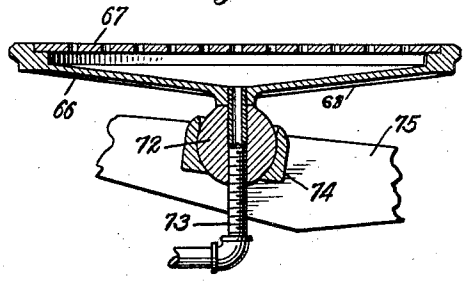


Fig. 4.



Inventors
H. G. Crowley and
E. W. Riemenschneider

By Macon Thomas

Attorneys

Patented June 23, 1936 2,045,216

UNITED STATES PATENT OFFICE

2,045,216

METHOD OF RECLAIMING USED LUBRICATING OIL

Henry G. Crowley, Fort Worth, Tex., and Edmund W. Riemenschneider, Canton, Ohio, assignors to Triploil Manufacturing Company, Incorporated, Dallas County, Tex.

Application February 6, 1933, Serial No. 655,504

4 Claims. (Cl. 196—16)

This invention relates to a method and apparatus for reclaiming or reconditioning used lubricating oils and particularly to the reclaiming of crank case oils, which have become so diluted with lighter hydrocarbons and so contaminated with foreign substances such as dust, particles of metal, carbon, or the like, so as to render them useless as a lubricant.

In prior process for reclaiming used lubricating oil steam or air employed for agitating the oil in the heating chamber was introduced while the oil was being heated. We have discovered, however, that it is advantageous to first subject the used lubricating oil to heat treatment and discontinue the heating thereof before the steam is introduced into the body of the heated oil. Among the advantages incident to our improved method are the cooling of the oil to a desirable temperature whereby the same will not injure the filter paper when introduced to the filtration zone, minimizing the tendency of "cracking" of the oils, preventing the tendency of the heated oils to "flash" when led to the filtration zone and avoiding the tendency of slowing down the heating operation as would be the case if the steam were introduced during the heating step.

We have also discovered that a portion of the heavier impurities can be removed from the used crank case oils before subjecting them to the heating and steaming steps above mentioned by the utilization of a portion of the waste heat from the oil from a prior heating and filtering step to effect a separation of heavy greases and sludge from the lubricating and lighter oils contained in the used oils such that the oil charged to the heating and steaming step can be more efficaciously treated. As a result of this improvement the temperature of the filered oil is lowered, while producing the important advantage above described, so as to leave the oil at a desirable temperature for a further purification step and at a temperature at which oxidization after discharge from the process is inhibited. We have also discovered that the oil after heat treatment and filtering still contains a quantity of very finely divided carbon and have further discovered that if this oil, after it has had its temperature somewhat reduced by causing it to give up some of its heat to the oil entering the process for the purpose above stated, is caused to come into intimate contact with a metal contact surface, the finely divided carbon is precipitated and removed from the oil.

We have also provided an improved apparatus in which our process may be carried out although it is to be understood that the process may be carried out in an apparatus other than that illustrated.

One object of the invention is, therefore, to provide a method whereby used crank case oil may be subjected to controlled heating and filtering to separate it from contained impurities such as lighter hydrocarbons from the cylinders of an internal combustion engine, water, motor cuttings, dust and carbon.

Another object of the invention is to provide a process for reclaiming used lubricating oils in which the oil is subjected to heating and steaming, wherein the heating of the oil is discontinued before the steam is introduced into the body of the heated oil, to produce the improved results above pointed out.

Another object of the invention resides in the provision of a method of reclaiming used crank case oil wherein the waste heat from the heat treating portion of the process is used to effect a preliminary separation of the heavier impurities from the contaminated oil.

Another object of the invention is to provide a process of reclaiming used oil wherein very finely divided carbon, which remains in the oil after treatment by usual filtration processes, may be removed therefrom.

Another object of the invention resides in an improved apparatus providing a combination of elements for carrying out our process of reclaiming used lubricating oils herein disclosed.

A further object of the invention is to provide, in a device for treating used lubricating oils, an improved filtering aparatus which cooperates with the other elements of the combination to produce a more complete purification of the oil and which lends itself to safety in the operation of the device and eliminates the danger of serious burns to the operator due to the handling of heated residues and the dripping of heated oils from the filtering aparatus.

A still further object of the invention resides in the provision of an improved device for utilizing the heat of the oil being treated, to provide and admit to the oil, steam of the desired temperature and pressure and in the correct amount for satisfactory treatment.

Other objects and advantages of the invention will appear in the following description of the preferred embodiment of the apparatus shown in the attached drawings and in the description of the preferred process of treating used crank case oil. In the attached drawings

Fig. 1 is an elevation of the complete oil treating device;

Fig. 2 is an elevation, partly in section, of the treating chamber;

Fig. 3 is a fragmentary elevation of the lower portion of the treating chamber with parts removed;

Fig. 4 is a sectional view of the filter door.

Referring more particularly to the drawings, 10 indicates a heat exchanger in which treated oil is made to give up part of its heat to the oil to be treated; 11 indicates a mixing chamber in which oil and filter material is mixed prior to charging into treating chamber; 12 indicates generally an oil treating chamber assembly; 13 indicates generally the filter door and filter paper supplying assembly; 14 indicates the condenser for condensing vapors from the oil treating chamber; 15 indicates the receiving tank for the distillate from the condenser; and 15' indicates a metal contact filtration device for the treated oil after it is passed through the heat exchanger.

The heat exchanger 10 comprises a tank 16 provided with an inlet 17 through which used crank case oil may be pumped or drained into the heat exchanger tank. A pipe coil 18 is positioned within the heat exchanger tank and connected to the outlet of the filter door, as hereinafter explained. The other end of the coil 18 is connected to an outlet pipe 19 which leads to the contact filter 15'. The heat exchanger tank is provided with an overflow pipe 20 and with an outlet pipe 21. It is to be noted that the outlet pipe 21 is connected to the heat exchanger tank at a point spaced from the bottom of the heat exchanger tank to provide a settling chamber below the outlet and that a drain 22 having a valve 23 is provided to empty the lower portion of the heat exchanger tank. The outlet pipe 21 is provided with a manually operable quick action valve 24 and this outlet pipe empties into the top of the mixing chamber 11.

The mixing tank 11 has an enlarged opening which can be closed by the cap 25, the opening being provided for the purpose of allowing a measured amount of oil treating material, for example, acid treated clay to be poured into the mixing chamber 11. An agitating device operated by the agitating lever 26 is provided for securing an intimate mixture between the oil to be treated and the mixing material. A source of compressed air 27 connected to the mixing chamber 11 through air pressure regulator 28, valve 29 and pipe 30 allows air pressure to be applied to the surface of the mixture in the treating chamber, to force the mixture through the pipe 31 leading from the bottom of the mixing chamber 11 into the oil treating chamber 32 positioned within the outer casing 33 of the oil treating chamber assembly 12. While we have disclosed a means for applying compressed air to the surface of the mixture in the mixing chamber, a source of inert gas, steam, or any other suitable gaseous pressure may be utilized for this purpose. A check valve 34 is provided in the pipe 31 to prevent back pressure from the treating chamber 32 from interfering with the operation of the mixing chamber 11.

The treating chamber 32 which is positioned within the outer casing 33 comprises a cylindrical portion 35 and a conical lower portion 36. Flues 37 extend vertically through the treating chamber 32 to insure that the products of combustion from the burner 38 give up their heat to the oil contained in the treated chamber. A steam generating device 39 is positioned within the treating chamber 32 and has its outer surface in contact with the mixture contained in the treating chamber. This steam generating device comprises an outer casing 40 which is connected with a source of water 41 through a strainer 42, water pressure regulator 43, orifice fitting 44, a three-way valve 45 and the pipe 46. A pipe 47 extends through the bottom of the casing 40 to a point adjacent the top of the casing and is connected to the outlet pipe 48 of the treating chamber 32 through a ball check valve 49. The burner 38 surrounds the outlet pipe 48 and is connected to a fuel supply through a pipe 50 which has interposed therein a fuel regulating valve 51 controlled by a thermostat 52 responsive to the temperature of the mixture in the treating chamber. This thermostat can be utilized to discontinue the heating of the mixture when a predetermined temperature is reached. A thermometer 53 is also provided to give a visual indication of the temperature of the mixture. An outlet 54 for vapor leads from the upper portion of the treating chamber 32, through the outer casing 33 to an expansion chamber 55. The expansion chamber 55 is connected through a pipe 56 to a cooling coil 57 positioned within the condensing chamber 14. The other end of the cooling coil is connected through a sight glass 58 to the receiving tank 15. The condensing chamber 14 is provided with an inlet 59 and an outlet 60 for a cooling medium such as water. The receiving chamber 15 is provided with a vent 61 which may lead to any desired location and an outlet 62 for the distillate.

As shown in Figure 2, a manually operated valve 63 is provided in the lower outlet 48 of the treating chamber and has connected thereto a pipe leading into a filter chamber 64 positioned below the outer casing 33 and forming a support for the treating chamber assembly. A pipe 63' is connected to a source of compressed air through a pipe 27, pressure regulator 28, valve 64' and enters the filtering chamber 64 to provide air pressure for pressure filtration. As indicated above with respect to the mixing chamber any other source of suitable gaseous pressure such as steam or any inert gas may be utilized. As shown in Figure 1 the filter chamber 64 is supported upon a frame work 65 which also forms a support for the filter paper feeding device hereinafter described.

A filter door 66, which is a part of the filter assembly 13, provides a lower wall or floor for the filter chamber 64. The door 66 is provided with a perforated filter plate 67 fitted into an annular recess in a conical plate 68 forming the filter door proper. A plurality of guide pins 69 project downwardly from the casing forming the filter chamber and guide members 70 slidably mounted upon the guide pins and rigidly secured to the door plate 68, by means of bolts 71 permit the filter door 66 to be moved vertically but maintain the door in a horizontal position at all times. The door 66 is supported upon a spherical bearing member 72 which is drilled and internally threaded to receive a threaded discharge pipe 73.

The pipe 73 is also threaded into the door plate 68 to form a rigid connection between the bearing member 72 and plate 68. The bearing member 72 is received in a semi-spherical socket 74 forming part of a door closing beam 75. Beam 75 is pivotally supported at one end by a link 76 and has an extension 77 engaging one end of a counter-balancing spring 78 which has its

other end engaging a bracket 79 mounted upon the frame 65. Link 76 is pivoted at 80 to a bracket 81 mounted upon the filter chamber 64. It will be seen that the link 76 allows the spherical bearing member 72 to move in a truly vertical direction and that the spring 78 is effective to balance at least a portion of the weight of the door 66 and the beam 75.

A mechanism is also provided for forcing the beam upwardly to clamp the filter door tightly against the lower portion of the filter chamber. This mechanism comprises a U-shaped link 82 adapted to be slipped over the end 83 of the beam 75 when the beam approaches its uppermost position. The link 82 is pivoted at 84 to a vertically movable member 85 slidably mounted in a bracket 86 secured to the filter chamber casing 64. The slidable member 85 is provided at its upper end with a screw threaded extension (not shown) upon which is mounted an internally threaded member 87 bearing upon the bracket 86. A double ratchet device 88 provided with a lever 89 is positioned above the member 87 and is effective to turn the internally threaded member 87 in either direction at the will of the operator.

The filtering device 13 is also provided with means for positioning a fresh supply of filter paper or cloth upon perforated plate 67 forming part of the filter door and for removing the residue from the filter chamber. In the embodiment shown, this device includes supports 90 and 91 mounted upon the frame 65 and provided with notches for receiving arbors upon which filter paper rolls 92 and 93 are mounted. Superposed webs of filter paper 94 are threaded across the top of the filter door 66 as shown in Figures 1 and 3 and are re-rolled upon an arbor 95 journaled in a bearing 96 mounted upon the frame 65. The arbor 95 is provided with a crank 97 for manual rotation. The guide pins 67, upon which the filter door is slidably mounted, also serve as guides for the filter paper.

The discharge pipe 73 from the filtering device is connected through flexible connections to the coil 18 of the heat exchanger 10 by a pipe 98. As described above, the coil 18 of the heat exchanger is connected through pipe 19 to the upper portion of the contact filtration device 15'. The contact filtration device 15' comprises an outer casing 99 providing a chamber which may be filled with copper or steel wool, or similar metallic material, having a large contact surface and small interstices for the oil to filter through. A discharge pipe 100 leads from the lower portion of the filter 15' and discharges into any convenient container for the reconditioned oil.

The improved process which we employ to reclaim used crank case oil will be described in connection with the operation, of the apparatus herein shown, but it is to be understood that other forms of apparatus can be used in carrying out our process. In carrying out our process, used crank case oil is pumped or drained through pipe 17 into the heat exchanger chamber 16. Heated oil from a prior treating operation is forced through the coil 18 in the heat exchanger and gives up some of its heat to the oil to be treated. The heat thus made available attacks grease and sludge present in the crank case drainings, the heavy non-filtering substances settle down and the lubricating or lighter oil separates upwardly such that the heavy greases and sludge accumulate on the bottom of the heat exchanger and can be drained through the outlet 22. After this preliminary separation has taken place the quick opening valve 24 is opened to allow the lubricating and lighter oils to drain into the mixing chamber. The overflow 20 in the heat exchanger chamber determines the amount of crank case drainings in the heat exchanger such that it is impossible to overload the mixing chamber and also provides a vent so that the oil will readily flow from the heat exchanger. A calculated charge of acid treated clay or other oil treating substance is introduced into the mixing chamber and agitated so as to thoroughly incorporate the treating substance into the oil. The cover 25 for the mixing chamber is then screwed down tightly and compressed air introduced into the pipe 30 to force the mixture through the pipe 31 and check valve 34 into a treating chamber 32.

Heat is then applied to the treating chamber by means of the burner 38 and the temperature of the oil and treating material raised to substantially 600° F. When the temperature reaches substantially this point, the burner is shut off and the three-way valve 45 actuated to admit a controlled amount of water into the steam generator 40. The amount of water admitted in a given time is determined by the water pressure regulator 43 and the orifice fitting 44 and the water thus admitted is strained through strainer 42 to prevent a deposition of foreign matter in the pressure regulator, orifice 44, valve 45 or steam generator 40. The water admitted to the steam generator 40 absorbs heat from the oil surrounding the steam generator and the resultant steam is collected by the pipe 47 and injected into pipe 48 so as to pass upwardly through the mixture contained in the treating chamber to agitate the same and carry off vapors entrained therein. The formation of steam in the steam generator will abstract heat from the mixture in the treating chamber and the steam admitted to the treating chamber will be at a somewhat lower temperature than the mixture. It will be seen that the effect of the formation of the steam and admission of the steam to the treating chamber will cause a drop in temperature of the mixture as well as an agitation of the mixture.

During the heating of the mixture and the subsequent agitation by steam, the lighter fractions contained in the mixture will be driven off as vapors contained in the condenser 14, and received as a liquid in the condensation tank 15.

When the mixture has been agitated for a sufficient length of time and the temperature lowered to approximately 524° F. the three-way valve 45 may be operated to disconnect the water supply from the steam generator and open the generator to the atmosphere to relieve the pressure therein. The check valve 49 prevents the passage of any of the mixture back to the steam generator 40.

Introducing the steam after the heating operation does not have a tendency to slow down the heating of the oil as would be the case if it were introduced simultaneously with the heating step, nor does the steam, when employed, have a tendency to aid in "cracking" the oil due to the high temperatures employed. Also, by reducing the temperature of the oil the tendency of the oil to "flash" when exposed to compressed air in the filtering step, as hereinafter described, is reduced and the temperature is lowered sufficiently to prevent burning or charring of the filter paper used. Although steam is preferred, it is possible to use other gases or vapors, for example an inert gas, to agitate the mixture and carry off entrained vapors.

During the heating steps a fresh supply of filter paper has been positioned upon the perforated plate 67 of the filter door 66 and the filter door has been closed tightly against the opening in the filter chamber. The manually operated valve 63 is then opened and the mixture allowed to flow into the filter chamber 64, after which the valve 63 is again closed. Compressed air is then admitted into the filter chamber through pipe 63' to force the oil through the filter paper. This pressure is also effective to force the filtered oil through the pipe 98, the heat exchanger coil 18 and the contact filter 15' to the outlet 100.

Upon completion of the filtering operation the ratchet device 88 is operated by a lever 89 to relieve the pressure exerted by the beam 75 against the filter door 66. The link 82 is then removed from the end 83 of the beam 75 and the beam lowered manually carrying the filter door with it. Upon actuation of the crank 97, the used filter paper is withdrawn from the perforated filter plate 67 and wound upon the arbor 95. As a result of the rolling of the filter paper, the collection of clay and carbon deposit on the paper is dumped into any convenient container placed below the arbor 95. Also, a fresh supply of filter paper is positioned upon the filter plate for the next filtering operation. It will be noted that the filter paper, at all times, completely covers the top of the filter door and prevents any accidental accumulation of resfdue upon the door which might prevent the proper closing of the door. Also, it eliminates the necessity of the operator handling the heated residue or in any way coming in contact with the heated portions of the treating apparatus. After a fresh supply of filter paper has been positioned, the beam 75 is again raised, the link 82 slipped over the end thereof and the ratchet device 88 actuated to tighten the door against the bottom of the filter chamber. It is also to be noted that our improved device for closing the filter door eliminates the necessity of the operator's placing any portion of his body below the filter chamber and coming in contact with heated oil dripping therefrom.

It will be noted that in our process the oil is filtered while hot, although the maximum temperature reached is somewhat reduced before filtering in order to prevent flashing and burning of the filter paper. The heat still contained in the oil is used to raise the temperature of the incoming crank case drainings in order, not only to conserve the heat necessary for treating the oil, but also to effect a preliminary separation of lubricating and lighter oils from non-filtering residues. Also, the heat exchanger serves to still further reduce the temperature of the filtered oil such that oxidation of the oil is inhibited.

We have discovered that oil treated, as described above, still contains a considerable amount of very finely divided carbon and have discovered that this carbon can be removed by passing oil, while at an elevated temperature through a device wherein it is brought into intimate contact with the metallic surface. The filtered oil, when it leaves the heat exchanger, is at such a temperature that passing it through a chamber containing copper or steel wool, or a similar substance, the finely divided carbon is deposited thereon and removed from the oil.

While we have described our preferred apparatus for the re-claiming of use crank case oil and have described our preferred method of treating used oil. it will be understood that the apparatus herein disclosed and described is for the purpose of illustration only and that our method may be carried out in other apparatus than that shown. It will also be understood that various changes may be made in the apparatus and method described within the scope of the following claims.

What we claim is:

1. The herein described process of reclaiming used lubricating oils, the steps which comprise, introducing used oils and a colloidal absorbent into a heated zone and heating the same to a high degree of temperature, discontinuing the heat treatment and while the oil remains in a hot condition introducing steam upwardly through the body thereof of a pressure sufficient to completely agitate the mixture and carry off the released volatile constituents thereof, withdrawing the oil from the heating zone and introducing it to a separate filtration zone and forcing the same, under pressure, through a filtration fabric, the said supply of steam tending to reduce the temperature of the oil to an extent such that it will not scorch the filtration fabric during the filtration stage.

2. The herein described process of reclaiming used crank case oils, the steps which consist in introducing used oils and a sufficient amount of acid clay to restore it substantially to its original specification into a heated zone, heating the mixture to a high temperature sufficient to boil off the light constituents, discontinuing the heating operation and introducing an inert gas into the body of the mixture for the purpose of reducing its temperature to a predetermined extent, said inert gas being introduced under a sufficient pressure to completely agitate the mixture, withdrawing the heated oil at its reduced temperature from the heating zone and introducing it into a filtration zone, applying an inert gas to the body of oil within the filtration zone for the purpose of accelerating its filtration therein.

3. The herein described process of reclaiming used oils, the steps which comprise, mixing a quantity of colloidal clay and used oil, thence introducing the mixture into a heated zone, where it is subjected to a heat treatment, discontinuing the heat treatment and reducing the temperature of the heated oil to a predetermined degree by passing a stream of inert gas upwardly which serves also to agitate the mixture, withdrawing the heated oil, at its reduced temperature from the heated zone and subjecting it to a separate filtration zone whereby to separate the clay and other non-lubricating constituents from the oil.

4. The herein described process of reclaiming used oils, the steps which comprise, mixing a quantity of colloidal clay and used oil, thence introducing the mixture into a heated zone, where it is subjected to a heat treatment, discontinuing the heat treatment thereafter reducing the temperature of the oil by bringing water into indirect heat exchanging relation with the oil to reduce the temperature thereof and form steam and further reducing the temperature of the heated oil to a predetermined degree by passing said steam upwardly which serves also to agitate the mixture, withdrawing the heated oil, at its reduced temperature from the heated zone and subjecting it to a separate filtration zone whereby to separate the clay and other non-lubricating constituents from the oil.

HENRY G. CROWLEY.
EDMUND W. RIEMENSCHNEIDER.