

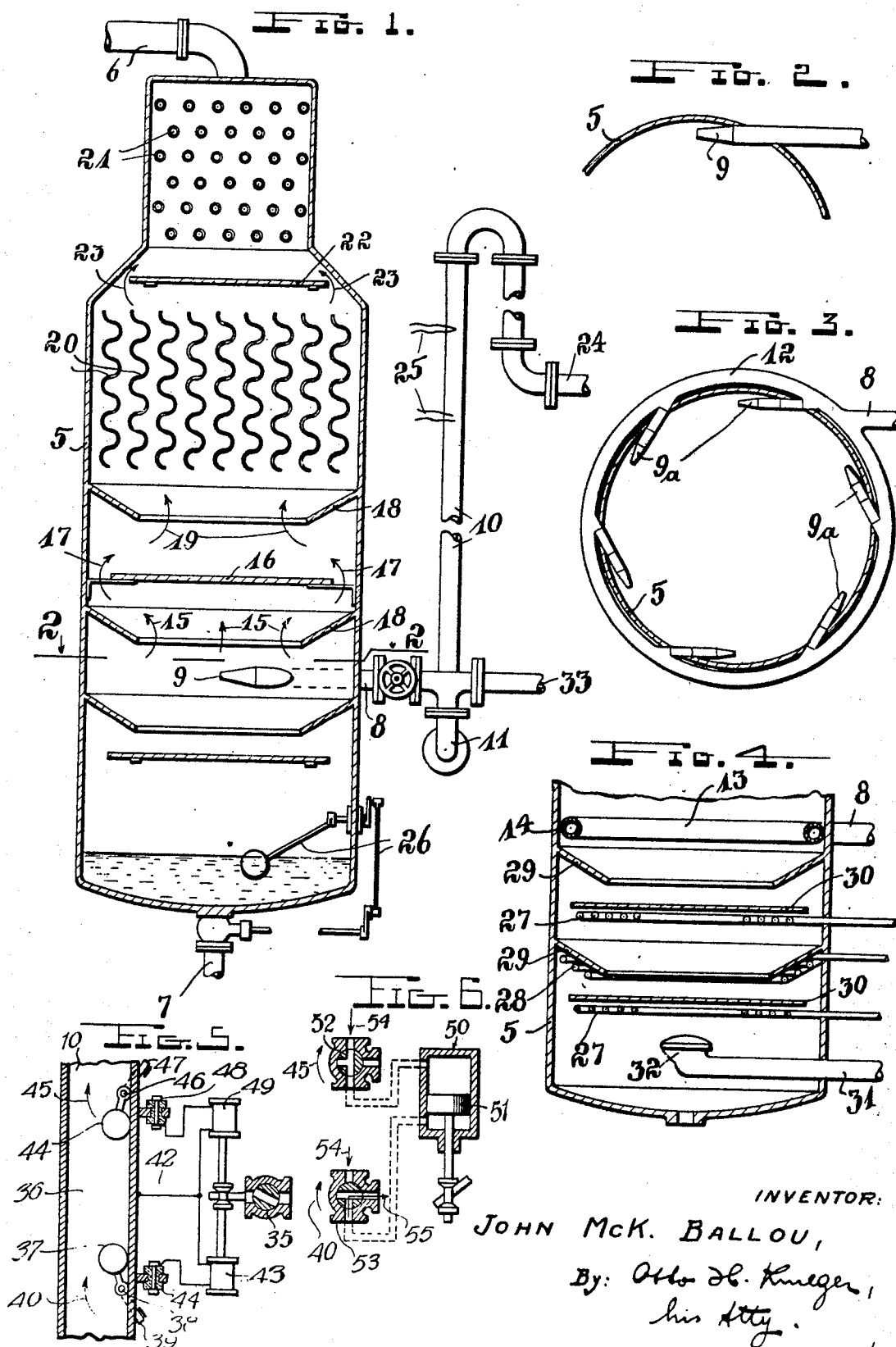
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J. McK. BALLOU

PROCESS FOR OIL REFINING

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UNITED STATES PATENT OFFICE.

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PROCESS FOR OIL REFINING.

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To all whom it may concern:

Be it known that I, JOHN MCK. BALLOU, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Process for Oil Refining, of which the following is a specification.

This invention relates to the separation of certain matter from crude oil.

One of the objects of this invention is to provide a pressure head of a form to prevent foaming.

Another object is to provide cooperating heating and condensing means to assure accurate control in desired cuts.

Another object is to provide for control during evaporation.

Another object is to provide for control of the residuum to include matter not desirable in further cuts.

Another object is to provide for a continuous separation and conversion of liquids into vapor form.

Another object is to provide a pressure head close to the injecting point past which the matter is injected, so that the pressure head can be used to keep the inpassing matter in liquid form under the influence of the pressure head.

Other objects will appear from the following description and appended claims as well as from the accompanying drawing, in which—

Fig. 1 is a vertical midsectional view of a separating apparatus of a simple form by which the objects of this invention may be accomplished, though this or any other particular form is not absolutely necessary for the process.

Fig. 2 is a fragmentary horizontal section through the casing of the apparatus on line 2—2 of Fig. 1, illustrating an inlet nozzle to discharge tangentially into the casing.

Fig. 3 is a horizontal section through the casing, similar to the section of Fig. 2, illustrating a number of nozzles provided on a common inlet manifold.

Fig. 4 is a fragmentary vertical midsectional view of a separating apparatus, illustrating a slightly modified form, having heating means for heating the slowly inpassing liquids.

Fig. 5 is a diagrammatical illustration of a simple form of an arrangement of electric contacts, a main control-valve, coils, and

electric source, in connection with a portion of the pipe 10, such portion of the pipe representing that part of the pressure-head at which the liquid level is to be maintained in the pipe, as indicated by the points 25.

Fig. 6 is a diagrammatical illustration of a simple form of an arrangement of air-valves, connections, and an air-actuated piston in a cylinder, by which a main-control valve can be actuated through floats in the pipe or pressure-head in a similar manner as illustrated in the electrically functioning form of Fig. 5.

The drawing merely illustrates devices and apparatus by which a separation of desired matter may be accomplished, though modified forms may be used with the same result.

In treating liquids and especially crude oil for the purpose of separating desired matter from the whole mass of such liquids, it is a common occurrence that a foaming will be produced by such treatments.

Foaming, however, impedes or obstructs a separation to a great extent, so that efficient separation requires the elimination or avoiding of foaming as far as possible.

To avoid or control foaming tendencies, a pressure head is preferably provided at a point close to the evaporating discharge.

In Fig. 1, a simple device is illustrated by which desired matter can be separated from crude oil. The tank 5 is provided with an outlet at 6, for discharging separated matter, while the residuum can be discharged at 7. An inlet is provided at 8, by which fresh stock or matter to be treated may be allowed to enter.

The tank, container, or housing 5 is not necessarily of any specific form as long as the treated matter can be caused to evaporate and separate in a desired manner.

The inlet is designed to discharge into the housing in such a manner that the incoming matter will not interfere with or counteract the evaporating process within the housing. One preferred form of termination for the inlet is a tangentially disposed nozzle, as indicated at 9 in Figs. 1 and 2. This tangentially disposed nozzle tends to discharge matter against the walls of the housing 5, at the same time producing a circulating and centrifugal force and movement.

Crude oil is commonly heated preparatory

to separating treatments to such an extent as to evaporate readily on being discharged into space.

The pressure head is therefore provided close to the discharging point to maintain a high pressure against such preheated mass, thereby facilitating a maintaining of the mass in liquid form. A heat-trap 11 is provided between the pressure head 10 and the inlet 8.

Such a heat trap can be made of a very simple form, as, for instance, of a plain return pipe, or double elbow. The branch projecting downward practically eliminates heat or foam from the pressure-head 10. Heat and foam have a tendency to rise, and foam is practically always developed in an upright pipe if heated crude oil is allowed to pass upwardly through such a pipe.

The principal idea of the combination of the heat-trap with the upright pressure head is for that reason to maintain a comparatively cool pressure maintaining means in the discharging pipe line close to the discharging point.

Any desired or required number of nozzles can, of course, be provided, as indicated at 9^a in Fig. 3. The common supply pipe or manifold 12 is illustrated on the outside of the tank or container 5, but may as well be inside of the tank, so that only one passage is required for the main supply connection or inlet 8 instead of the several openings for the several nozzles 9^a.

Such and other slight modifications of minor details can easily be provided within the scope of this invention, and I do not limit myself to any specific details illustrated in the drawing as long as modified forms of such details are within the scope of the appended claims. Another slightly modified form is illustrated in Fig. 4. The inlet 8 terminates in a manifold 13 within the container 5. The manifold 13 is provided with a suitable number of apertures 14, to discharge close to or towards the walls of the container.

The tangential discharge into the container 5 through a single nozzle, as at 9 in Figs. 1 and 2; or through several nozzles, as at 9^a in Fig. 3; or through apertures close to the walls of the container, whether tangential or discharging in other directions as long as the fluid is allowed to come close to the walls, tends to distribute the liquid so as to spread in an even sheet over the walls of the container.

Being preheated, all matter subject to evaporation at a certain temperature rises upwardly within the container 5, while the remaining matter passes downwardly as residuum to be drained off at 7.

In Fig. 1, the evaporated matter rises in the direction of the arrow 15 towards the baffle 16, being deflected thereby to pass

around the baffle 16 as indicated at 17. While the baffle 16 forces the evaporated matter outwardly towards the walls of the container, other baffles 18 are interposed to deflect the rising stream centrally, as indicated by the arrows 15 and 19.

Corrugated baffles 20 are provided above the baffles 16 and 18, so that the rising evaporated matter is compelled to strike along the corrugations of the baffles 20.

The deflecting and striking of the rising matter serves to further and more completely separate heavier mists and entrained particles that should not be passed on to other apparatus in the refining process.

Such secondary residue passes downwardly over the baffles 16 and 18 thereby helping to clear the rising evaporated matter of undesired products.

Whether tangentially discharged or otherwise, the important point is to impart suitable acceleration to the particles or drops in order to force them to stick to the shell or in such a manner as to release evaporated gases to the center or otherwise free to rise as described above.

A planer or condenser is provided as indicated at 21, by means of which a certain temperature can be maintained at which certain desired matter can be separated to be discharged at 6 to and through a dephlegmator or other similar suitable apparatus, not shown in the drawing, for further treatment.

Any reconverted fluid from the condenser 21 is caused to pass downwardly over the baffle 22 in the direction of the arrows 23, and further downwardly through the spaces between the corrugated baffles 20 and past the baffles 16 and 18 in the manner described above, serving to further help in clearing the rising matter of products undesirable in further cuts, by causing the rising matter to pass through the reconverted fluid.

An overflow to a sump is provided from the pressure head 10, as indicated at 24.

The level in the pressure head 10 may be controlled by suitable instruments, electric or others, not shown in the drawing, applied at points indicated at 25. The flow through the inlet 8 can thereby be regulated and controlled, as will easily be understood without further illustration or description.

There are so many well-known instruments, by which a control-valve can be actuated from such points as indicated at 25, whenever the level of fluid or other matter in such a pipe as this pipe 10 changes beyond predetermined points, that it is an easy matter to apply any of such well-known instruments so as to give the desired results in this particular case. Having stated above, that electric or other instruments can be used, a simple diagrammatical arrangement of an electrically functioning mecha-

nism is illustrated in Fig. 5, while a diagrammatical illustration of a simple air-control is given in Fig. 6, to indicate the co-operation of parts normally mounted or

located at very different points of the whole apparatus.

The electrically functioning form, as illustrated in Fig. 5, shows a control-valve 35 in a partially open position. Such a control-valve, or any other similar suitable valve can easily be provided in the pipe line 33, or in connection with a pump for bringing matter through the pipe line 33.

At 36, a liquid level is indicated within a portion of the standard pipe 10. If the level descends to a point below the float 37, the float is caused to drop with the liquid level. A shaft 38 is mounted so as to pass through the pipe 10 for supporting the float inside of the pipe 10 and also for supporting a contact arm 39 outside of the pipe 10. The float may thus descend with the level of the matter in the pipe 10, by swinging around the axis at 38, until the contact arm 39 contacts with an insulated contact, indicated at 41. The electric source, indicated at 42 is through such a contact-making put into a closed circuit together with the coil. A vitalizing of the coil 43 tends to actuate the valve 35 for further opening so that more liquid or pressure can be transmitted to the pipe 10.

As the liquid level rises within the pipe 10, the float 37 moves upwardly in the direction of the arrow 40 to its uppermost position, thereby breaking the contact between 39 and 41. The contact-breaking neutralizes the coil 43 and thereby frees the valve 35 to move to normal position, in which it is shown in Fig. 5.

If the valve is not designed that it will automatically move to normal operating position, the liquid level within the pipe 10 may rise until it comes to a point at which it is able to actuate the float 44. This float 44 may swing upwardly in the direction of the arrow 45, around the shaft 46, until the contact-arm 47 comes into contact with the insulated contact 48. A contacting at this point closes a circuit through the electric source at 42 and through the coil 49. An actuating of the coil 49 results in a full closing of the valve 35, so that the liquid level and thereby the pressure in pipe 10 can be suitably reduced.

Under normal conditions, that is, as long as the contacts, coils, and electric source are effective, the liquid level in the pipe 10 is maintained between points such as indicated at 25 in Fig. 1.

However, inasmuch as such automatic mechanisms are liable to get out of working order, an overflow 24 is provided for such an emergency, but it must be understood that this overflow is not normally expected

to have any influence upon the operation of the whole apparatus and upon the pressure-head as such, represented by and embodied in the pipe 10, in relation to the supply through the pipe 33 into the tank 5.

An air-control, for actuating a valve 35 or any other similar suitable valve or means in a similar manner as described above in connection with the electric control illustrated in Fig. 5, is illustrated in Fig. 6.

A cylinder 50 with a piston or plunger 51 is shown in a simple form to which air may be supplied through the three-way valves 52 and 53, to actuate a valve 35 in a similar manner as described above. The valve 52 can be connected to the float 44, and the valve 53 can be connected to the float 37, to cause a passing of air, either, in a direct direction to the cylinder as indicated by the arrow 54, or in a releasing direction from the cylinder as indicated by the arrow 55.

The float-mechanism indicated at 26 serves to control the discharge of the residuum through the valve 7.

In Fig. 4, the slightly modified form is designed to further heat the matter within the container 5 during the separating process within the container 5. A suitable number of heating coils 27 and 28 are provided below or in suitable relation to the baffles 29 and 30, by which steam-heat or heat in other form may be applied. Such a heating serves to release entrained particles of the residuum that may well be used for further cuts, and can thereby be caused to rise past the baffles 29 and 30, to mix with the gases directly released from the incoming liquid as described above.

Another connection is indicated at 31, by which live steam may be discharged through the head 32 into the container 5.

Such additional heating means assist greatly in the evaporation within the container 5.

A more accurate control of the separation is possible by reason of the fact that the matter within the container can always be heated above the point within the power of the operator by means of the planer or condenser 21 before the separated matter is allowed to escape into dephlegmator through the outlet 6.

In admitting steam, the boiling point of the oil is lowered to a suitable degree.

After heating crude oil in a furnace, not shown in the drawing, the heated matter is injected into the tank or housing through the connection 33, discharging from the nozzle or inlet distributors.

Heated crude oil has the tendency to foam, especially on being discharged from the furnace. If such heated crude oil is discharged through a pressure head so as to escape from the head or top of the pressure head, it tends to promote or even develop foaming.

Any foaming, however, is detrimental to volatilization, since desired matter is easily prevented from rising when entrained in heavier foam. On the other hand, lighter suspended matter, that is not at all desired for further cuts, is easily carried upwardly with the foam instead of being allowed to settle with other undesired residuum. The whole process of separation is therefore retarded by the action of foam.

It is therefore one of the main principles of this invention to provide a pressure head by which foaming can be prevented or avoided as far as possible. The pressure head is preferably arranged and disposed as close as possible to the point of discharging matter into the separating compartment. The pressure under which matter is discharged into the separating compartment can in this manner be nearly equal to the pressure maintained in the pressure head and by the pressure head. The pressure under which matter is discharged can, therefore, practically be controlled by the pressure head. The discharging into the separating compartment can in this manner be accomplished under a desired pressure, determinable by the pressure head.

In the drawing, the pressure head is represented by an upright pipe or standard 10, broken to indicate that a suitable length of standard can be provided to assure a desired pressure by the pressure head.

The end 24 is open so that liquids will easily rise within the standard 10. Liquids maintained in a certain level normally represent or indicate the pressure of the liquids in a standard of this type.

By applying suitable instruments, not shown in the drawing, electric or others, such as are well known in the art, a supply valve can easily be controlled by such instruments so as to discharge more or less liquids into the separating compartment whenever the liquids in the standard rise or fall, thereby maintaining an even pressure and level of the liquids in the standard 10. On the other hand, at an increase of the pressure, the instruments can easily be provided to reduce the discharge into the separating compartment in the tank 5, so as to assure an equal amount of matter to pass through the separating compartment. Surplus matter can easily be caused to pass through the waste pipe at 24, to be returned to the furnace.

The standard 10 in the drawing appears at some distance from the tank 5, but it will easily be understood that this can be overcome in practice, and that the standard can easily be directly close to the discharging points inside of the separating compartment, as long as the discharge is not passing through the standard.

The next important point is that the dis-

charge is directed toward the walls of the tank 5, surrounding the separating compartment, or at least that the discharge is directed close to the walls so that the stream passes along the walls of the separating compartment.

If one nozzle is used, it is preferred that the nozzle discharges tangentially so that the incoming stream is spread and extended over the whole circumference of the tank or separating compartment.

More than one nozzle, or a suitable number of orifices in a manifold extending over the whole circumference of the separating compartment serve easily to distribute the incoming matter over the whole circumference of the separating compartment.

After having been confined in the pipe line, on being discharged in this manner, volatilization is easily produced within the separating compartment within the tank 5. The incoming matter, being thus distributed over the walls and further over the baffles, has little tendency of foaming.

Certain matter liable to evaporate at a certain temperature easily rises through the separating compartment, to escape through the outlet at 6 for further treatment to a dephlegmator or other apparatus, not shown in the drawing.

Having thus described my invention, I claim:

1. The herein described process of separating matter from crude oil consisting in injecting heated crude oil into a separating compartment, and maintaining the crude oil under pressure by means of a pressure head close to the point of injection into the separating compartment but not in line with the injected stream, so as to prevent foaming.

2. The herein described process of separating matter from oil consisting in facilitating a separation by keeping the oil from foaming by maintaining the oil under controllable pressure close to the point of discharging the oil into a separating compartment.

3. The herein described process of separating matter from crude oil consisting in facilitating a separation by keeping the crude oil from foaming by means of a pressure head close to the point of discharging the crude oil into a separating compartment.

4. The herein described process of separating matter from crude oil consisting in heating the crude oil, and keeping the heated crude oil under pressure by means of a pressure head close to the point of discharging the crude oil into a separating compartment.

5. The herein described process of separating matter from crude oil consisting in heating the crude oil, discharging the heated crude oil into a separating compartment, keeping the heated crude oil under pressure

up to the point of being discharged into the separating compartment, and directing and deflecting the discharged crude oil upwardly so that the heavier and liquid particles will return to form the screen through which the rising gases will be freed of suspended matter not desired in the rising separated matter.

6. The herein described process of separating matter from crude oil consisting in heating the crude oil, discharging the heated crude oil into a separating compartment, keeping the heated crude oil under pressure up to the point of being discharged into the separating compartment, directing the

evaporating and separating matter upwardly, condensing the evaporated matter to a temperature at which only the desired matter will remain in vapor form while other matter will condense, and directing and deflecting the condensed matter downwardly against the freshly evaporated rising matter to facilitate the separating by causing the freshly rising matter to pass through the downwardly passing condensed matter so as to separate lighter undesired and suspended matter from the rising matter.

In testimony that I claim the foregoing as my invention I have signed my name.

JOHN McK. BALLOU.