Aug. 26, 1958 C. E. McMICHAEL ET AL 2,849,120

OIL BLEACHING EQUIPMENT

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Fig. 2.

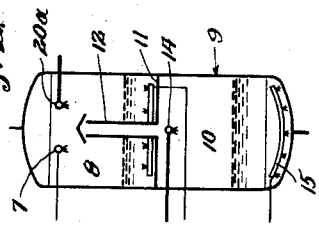
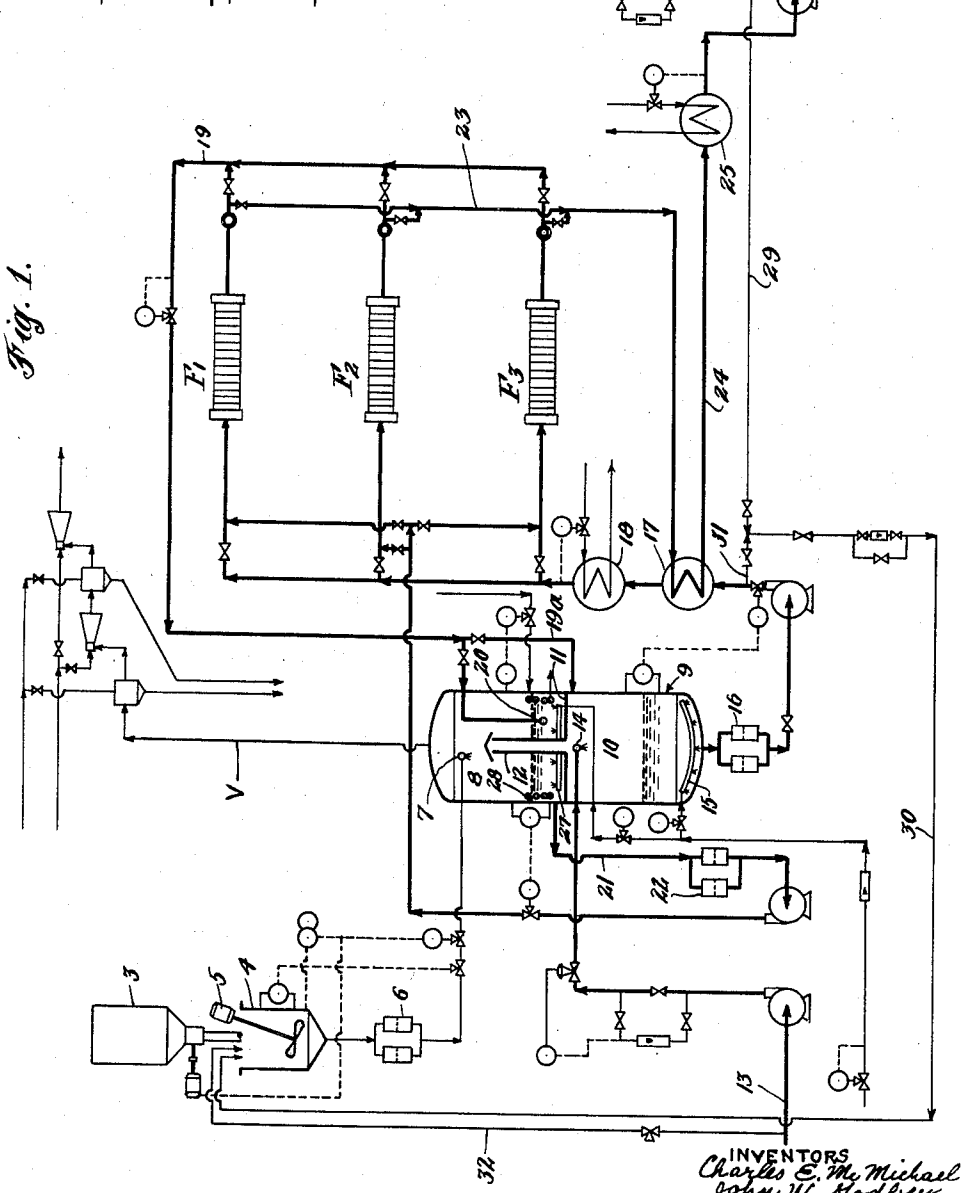


Fig. 1.



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OIL BLEACHING EQUIPMENT

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Original application August 28, 1951, Serial No. 244,016, now Patent No. 2,717,256, dated September 6, 1955. Divided and this application November 16, 1954, Serial No. 478,213

7 Claims. (Cl. 210—193)

This invention relates to the bleaching of oils, especially fatty oils and fats, for instance cotton seed oil, soya bean oil and the like intended for use in various ways, such as in food products.

The invention is concerned with equipment adapted to utilize a bleaching adsorbent, for instance carbon black or bleaching clays such as Fuller's earth.

In the bleaching of oils with a bleaching adsorbent it is of course necessary to effect intimate contact between the oil and the adsorbent, and this usually involves dispersing the adsorbent in the oil, at least at one stage of the bleaching operation. The physical intermixing of adsorbent, ordinarily consisting of a finely powdered material, with the oil presents problems from the standpoint of handling and ensuring the desired degree of intimacy of admixture or uniform dispersion of the adsorbent in the oil. One of the important objects of the present invention is concerned with providing equipment which facilitates the handling of the adsorbent and the obtaining of intimacy of contact thereof with the oil.

The invention is also of special utility when used in a bleaching system where the adsorbent and the oil are brought together in counterflow in which respect the invention is in the nature of an improvement on the method disclosed in the copending application of Alton E. Bailey, Serial No. 58,327, filed November 4, 1948, now Patent No. 2,618,644 issued November 18, 1952. In said Bailey application, the oil is first subjected to a bleaching treatment with partially spent adsorbent, and thereafter subjected to treatment with fresh adsorbent, which latter is then separated from the oil and used for the first stage of bleaching of additional unbleached oil. The invention facilitates the multistage use of the adsorbent.

Another problem encountered in bleaching systems using an adsorbent arises because of the desirability of deaerating and dehydrating both the oil and the adsorbent prior to the intercontact thereof at an elevated temperature, since the subjection of oils of the kind here involved to high temperatures in the presence of substantial quantities of air or of moisture is undesirable, usually having a deleterious effect upon the oil itself. With these general problems in mind, the invention also contemplates certain improvements which not only facilitate the handling of the adsorbent but which provide at the same time for subjecting the adsorbent to deaeration and dehydration prior to contact with the oil at a high temperature. Thus, in using the equipment of the invention the fresh adsorbent is initially mixed with a small quantity of oil which has been previously subjected at least to deaeration and dehydration and preferably also to at least some bleaching treatment. In this way a slurry is formed in which the oil is substantially free of air and moisture, and this slurry is dispersed in space and treated with stripping steam prior to admixture with the oil to be bleached. This facilitates the handling of the dry, powder adsorbent material in the deaeration of the adsorbent itself and also facilitates the admixture of the adsorbent with the oil to be bleached.

How the foregoing objects and advantages are attained will appear more fully from the following description referring to the accompanying drawing, in which—

Figure 1 is a somewhat schematic view of an oil bleaching system using the equipment of the invention; and

Figure 2 is a view illustrating a modification of one portion of the equipment shown in Figure 1.

As appears in Figure 1, an adsorbent supply bin or the like is indicated at 3. The adsorbent is delivered from this bin into a vessel 4 equipped with a mixer 5, and in the vessel 4 the adsorbent is mixed with a small amount of oil in order to produce a slurry. This slurry may then be strained as at 6 and delivered through a dispersing or spray-type nozzle 7 located in the upper portion of the upper chamber 8 of a treatment vessel generally indicated at 9.

The vessel 9 further has a lower chamber 10, the upper and lower chambers being divided by a partition 11. A stand pipe 12 extends upwardly from the partition 11 and serves to interconnect the upper region of the lower chamber 10 with the mid or upper region of the upper chamber 8, for a purpose to be described more fully hereinafter.

The oil to be bleached is introduced into the system through the supply connection 13 from which it is pumped to a spray inlet nozzle 14 arranged in the upper portion of the lower chamber 10. The oil is preferably introduced into this chamber at a somewhat elevated temperature, for instance from 130° F. to 160° F. and during the falling of the oil particles to the body of oil in the bottom of chamber 10, the oil particles are subjected to the action of stripping steam which is introduced through the perforated pipe or the like 15 located in the bottom of this chamber. Stripping also occurs during the residence of the oil in the bottom of the chamber.

At the top of the vessel 9, communicating with the upper portion of the upper chamber 8, is a vacuum offtake V. Because of the provision of the stand pipe 12 the vacuum is drawn not only in the upper chamber 8 but also in the lower chamber 10, and the result of this arrangement is to effect steam stripping under vacuum of the oil discharged from the nozzle 14, thereby effecting deaeration and dehydration of the incoming oil in the lower chamber. The oil is withdrawn from chamber 10 at the bottom thereof through a strainer 16 and is then pumped through a heat exchanger 17 and a heater 18, and from there is delivered to one or another of the filters F^1, F^2 and F^3.

Assuming flow through filter F^1, it should be noted that this filter contains a cake or mass of partially spent bleaching adsorbent through which the oil is passed. As the heated, unbleached oil passes in contact with the partially spent, massed adsorbent, it gives up a substantial amount of its color to the adsorbent, and thereby is subjected to a first stage of bleaching. From the filter, the partially bleached oil passes to the connection 19 which extends through branches and valves to an oil inlet 20 located below the surface of the body of oil in the bottom of the upper chamber 8 of the treatment vessel 9. Here the partially bleached oil is mixed with the slurry of oil and fresh adsorbent introduced through the inlet 7, and the second or final bleaching stage is accomplished.

The oil is withdrawn from the lower portion of upper chamber 8 through the connection 21, and is strained as at 22, after which it is pumped to the inlet side of the filter system, being delivered, for example, to the inlet side of filter F^2 in which the now partially spent adsor-

bent is separated from the oil. The bleached oil is discharged from the filter F^2 through line **23** to heat exchanger **17**, where it passes in heat exchange with the cooler oil being pumped from the lower chamber **10** to the filter F^1. The connection **24** from the outlet side of the exchanger **17** extends to a cooler **25**, from which the completely bleached oil may be pumped to storage through the storage line **26**.

It should be understood that after the build up of a filter cake in the press F^2, the oil flow from the upper chamber **8** of the treatment vessel **9** may be diverted to one of the other filters, for instance filter F^3, and at this time the oil flow from the lower chamber **10** may also be diverted from the filter press F^1 to the filter press F^2. With a system of filter presses and connections as described above, the individual filters may be "rotated," so to speak, in their use and when one is out of service it will of course be cleaned and then initially re-used to separate adsorbent from the oil withdrawn from the upper chamber **8**, and thereafter used for the passage therethrough and treatment of oil withdrawn from the lower chamber **10** of the vessel **9**.

Returning to the arrangement in the upper chamber **8**, it is now noted that the steam which is introduced into the lower chamber and flows upwardly through the stand pipe **12** is withdrawn upwardly through the vacuum connection V, and in passing upwardly through the free space in the upper chamber **8** this steam is used in assisting the separation of air and moisture from the incoming and dispersed slurry of adsorbent and oil admitted through the inlet **7**. Additional stripping steam may be introduced into the lower portion of the upper chamber **8** as by the perforated pipe **27**. This latter steam also serves to agitate the mixture of oil and adsorbent during its residence in the bottom of chamber **8**. The oil may also be heated in the upper chamber **8** by means of the steam heater coil **28**.

By arranging the flow of oil through the upper and lower chambers of the vessel **9** in the manner described above, i. e., initial flow through the lower chamber, in the event of any overflow of oil from the upper to the lower chamber, no contamination of bleached oil will occur, as the oil from the lower chamber is not yet bleached and will be delivered to one or another of the filter presses and ultimately to the upper chamber.

It may be noted that the temperature of the oil leaving the lower chamber is preferably raised in the heat exchanger **17** and the heater **18** to an effective bleaching temperature, for instance in the neighborhood of 250° F. Some loss in temperature may occur in passage through the filter in which the first stage of bleaching takes place, but the oil delivered from the filter system to the upper chamber **8** (through the inlet **20**) will still have a fairly high temperature, effective for bleaching as this oil is admixed with the fresh bleaching adsorbent.

A branch line **19***a* is provided in cases where it is desired to recirculate all or a portion of the oil after the initial bleaching in the filter press system, this connection **19***a* delivering into the lower chamber **10**.

As hereinabove indicated it is preferred to utilize oil which has at least been deaerated and dehydrated in preparing the slurry in vessel **4**. For this purpose completely treated oil, for example about 10% of the total flow through the system may be diverted from the storage line **26** through the connections **29** and **30** and thereby delivered to the mixing vessel **4**. If desired some or all of the oil used in preparation of the slurry may be derived from the lower chamber **10** of the treatment vessel **9**, a connection **31** being provided for this purpose, which connection **31** communicates with the connection **30**.

Still further, particularly after shutdowns, the initial slurry to be used may be prepared by using completely untreated oil derived from the supply line **13** and delivered to the mixing vessel **4** through the connection **32**. Under some circumstances, it is contemplated that in preparing the slurry it may even be desirable to use untreated oil in the initial slurry in normal operation of the system.

In Figure 2 a modified arrangement is illustrated in which the inlet **20***a* for oil delivered from the filter press system to the upper chamber takes the form of a spray-type of nozzle arranged above the level of the oil in the bottom of the upper chamber **8**. By this arrangement the oil introduced into the upper chamber **8** may also be subjected to some steam stripping in space.

It will be understood that level and other controls are of course provided in the system in a manner which need not be described in detail herein.

From the foregoing it will be seen that a novel and improved mode of handling and of deaerating and dehydrating the adsorbent is provided according to the invention, and that the equipment utilized for the handling, deaerating and dehydrating of the adsorbent are integrated into a system of the counterflow type wherein the oil is subjected to a plurality of steps of bleaching, the same bleaching adsorbent being used in counterflow.

This application is a division of application Serial No. 244,016 filed August 28, 1951, now Patent No. 2,717,256 issued September 6, 1955.

We claim:

1. Equipment for use in bleaching oils with a bleaching adsorbent comprising, in combination with a filter having an oil inlet and an oil outlet, an oil treatment vessel having upper and lower treatment chambers therein, an oil spray inlet in the upper region of the lower chamber, an oil outlet from the lower chamber connected with the filter inlet, a connection for delivering oil from the filter outlet to the upper chamber of said vessel, an inlet for introducing adsorbent in dispersed form into the upper portion of the upper chamber, an oil outlet from the upper chamber connected with the filter inlet, the oil outlets from the lower and upper chambers being alternately connectible and disconnectible with respect to the filter inlet, a vacuum connection in the upper chamber, a stripping steam inlet in the lower chamber, and a connection between the upper portions of the upper and lower chambers providing for serial flow of the stripping steam from the lower chamber to the upper chamber to the vacuum outlet, and providing for sequential stripping by said steam of the oil sprayed into the lower chamber and then contact of said steam with the adsorbent in the upper chamber.

2. Equipment according to claim 1 and further including mechanism for preparing a slurry of adsorbent with a portion of the oil which has been subjected to steam stripping in the lower chamber of said vessel and for introducing such slurry into the upper portion of the upper chamber through the adsorbent inlet.

3. Equipment in accordance with claim 1 in which the oil inlet to the upper chamber of the vessel is disposed in the upper portion thereof and arranged to spray the oil into the said upper chamber.

4. Equipment for use in bleaching oils with a bleaching adsorbent comprising an oil treatment vessel having upper and lower treatment chambers therein, an inlet for spraying untreated oil into the upper region of the lower chamber, an inlet for introducing partially bleached oil into the upper chamber, an inlet for introducing adsorbent in dispersed form into the upper portion of the upper chamber, an inlet for stripping steam in the lower portion of the lower chamber, a vacuum connection in the upper portion of the upper chamber, and a connection between the upper portions of the upper and lower chambers providing for sequential flow of the stripping steam from the lower chamber after contact with the untreated oil therein into the upper chamber for contact with the adsorbent.

5. Equipment according to claim 4 and further including an inlet for stripping steam in a lower portion of the

upper chamber providing for agitation of oil and adsorbent in the upper chamber.

6. Equipment for use in bleaching oils with a bleaching adsorbent comprising a first treatment chamber and a second treatment chamber, an inlet for spraying untreated oil into the upper region of the first chamber, an inlet for stripping steam in the lower portion of the first chamber, an inlet for introducing partially bleached oil into the second chamber, an inlet for introducing adsorbent in dispersed form into the upper portion of the second chamber, a vacuum connection in the upper portion of the second chamber and a connection between the upper portion of the first chamber and the second chamber providing for the sequential flow of the stripping steam from the first chamber after contact with the untreated oil therein into the second chamber for contact with the dispersed adsorbent.

7. Equipment for use in bleaching oil with a bleaching adsorbent comprising in combination with a filter having an oil inlet and an oil outlet, a first treatment chamber and a second treatment chamber, an oil spray inlet in the upper region of the first chamber, an oil outlet from the first chamber connected with the filter inlet,

a connection for delivering oil from the filter outlet to the second chamber, an inlet for introducing adsorbent in dispersed form into the upper portion of the second chamber, an oil outlet from the second chamber connected with the filter inlet, the oil outlets from the first and second chambers being alternately connectible and disconnectible with respect to the filter inlet, a vacuum outlet in the second chamber, a stripping steam inlet in the first chamber, and a connection between the upper portion of the first chamber and the second chamber providing for serial flow of stripping steam from the first chamber to the second chamber to the vacuum outlet, and providing for sequential stripping by said steam of the oil sprayed into the first chamber and then contact of said steam with the adsorbent in the second chamber.

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