March 3, 1936. C. P. McNEIL ET AL 2,032,546

ASPHALT OXIDATION SYSTEM

Filed Jan. 2, 1930

Fig. 1

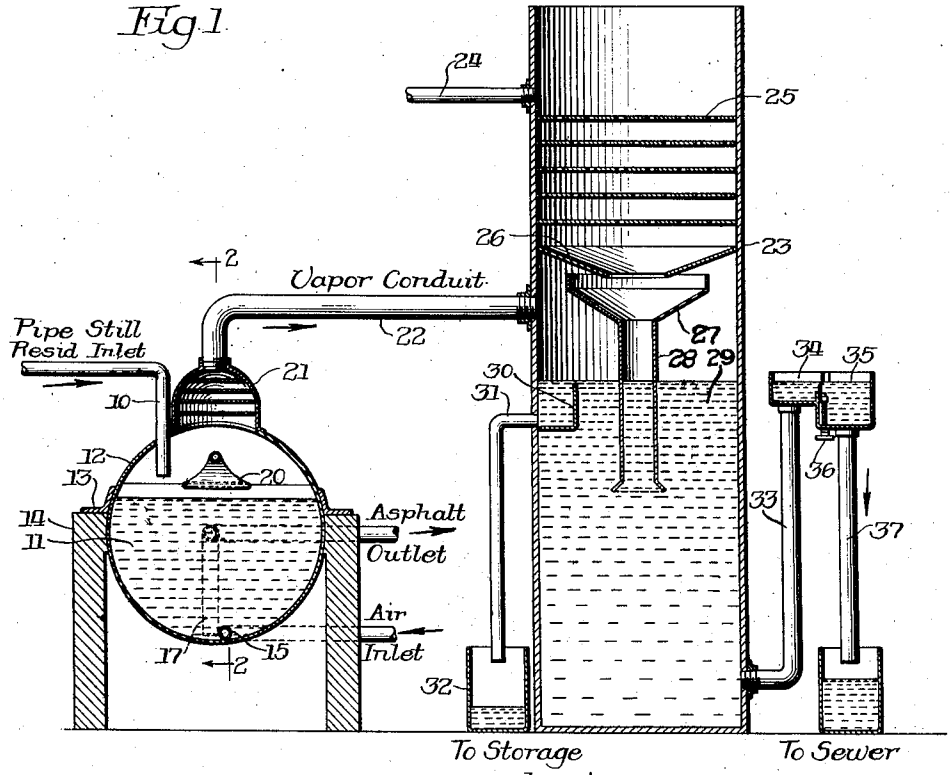


Fig. 2

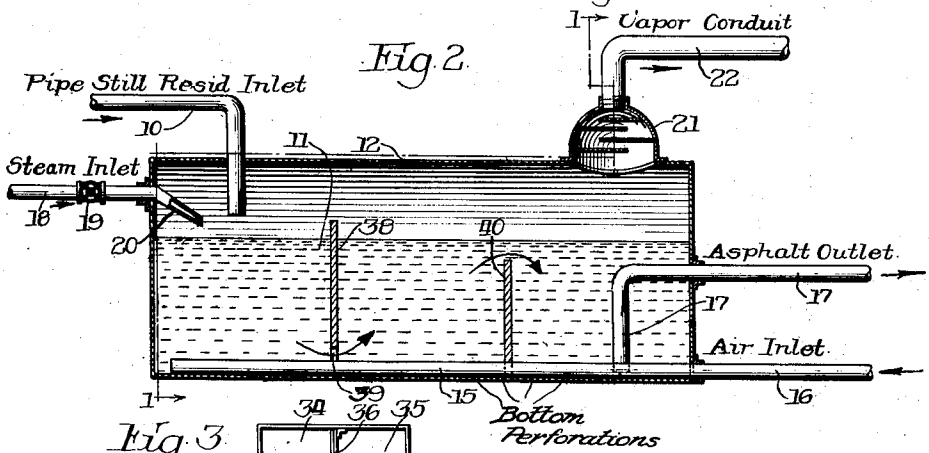
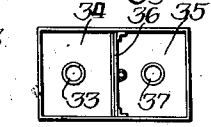
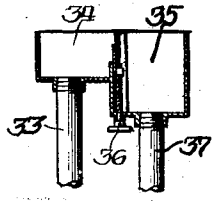


Fig. 3





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Patented Mar. 3, 1936

2,032,546

UNITED STATES PATENT OFFICE

2,032,546

ASPHALT OXIDATION SYSTEM

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Application January 3, 1930, Serial No. 417,350

4 Claims. (Cl. 196—74)

This invention relates to an asphalt oxidation system and it pertains more particularly to a process and apparatus for continuously oxidizing hot petroleum residuums, or in other words for continuously oxidizing asphalt to form "blown" asphalt".

The object of the invention is to provide an efficient and economical process for continuously blowing hot petroleum residuums.

A further object is to provide an asphalt oxidation system which includes a "steam boat" for eliminating the nuisance of disagreeable odors and for recovering oil distillates in a simple effective manner.

A further object is to provide a steady temperature. In batch stills the temperature sometimes shoots up so rapidly that the contents of the still must be run to a cooler. Such practice is economically wasteful in heat, in equipment, and in time and labor. This invention maintains a constant temperature by adding and withdrawing small amounts of residuum and asphalt respectively from a large volume of a reaction mixture held at a given temperature, thereby overcoming all of the disadvantages of the batch still.

A further object is to provide an improved apparatus particularly adapted for the practice of the invention.

Other objects will be apparent as the detailed description of the invention proceeds.

Briefly the invention may be characterized as a continuous system wherein a large body of hot petroleum residuum is blown with regulated quantities of air, supplemented if necessary by steam, the hot residuum being constantly fed in a small stream into the body and the blown asphalt being constantly removed therefrom, gaseous products of the oxidation being treated in a steam boat. The steam boat is a tower whose upper portion is baffled, whose central portion is relatively open, and whose lower portion is a separating chamber for oil and water. A feature of this device is the means for skimming oil from a surface of the mixture in the bottom of the tower by adjusting a weir in the water outlet. The invention will be more clearly understood from the detailed description which follows.

In the accompanying drawing which illustrates a preferred embodiment of the invention—

Figure 1 is an elevation partly in section of the improved apparatus.

Figure 2 is a vertical section through the still, taken along the line 2—2 of Figure 1.

Figure 3 is a plan and elevation of the weir box which regulates the amount of oil skimmed from the oil-water mixture in the steam boat.

Referring to Fig. 1, a small stream of the hot residuum from the flash tower of a pipe still unit or from the last still of a tower still unit is introduced through a pipe 10 to a large body of oil 11 in a shell still 12, which may be supported by suitable brackets 13 of a furnace 14. The hot residuum is preferably at a temperature of 380° to 450° F., and may have a melting point of about 75° F. It is introduced at the rate of about 4500 gallons per hour into a body of about 40,000 gallons, shell still 12 being about 40 feet long and 10 feet in diameter.

The body of hot residuum 11 is constantly agitated and oxidized by air blown through perforated pipe 15 which is connected to a source of compressed air by pipe 16. Pipe 15 is perforated, preferably on its lower side, to provide an even distribution of small bubbles and to prevent clogging or coking. The air is preferably supplied at the rate of about 80,000 cubic feet per hour although this may be varied from 40,000 to 125,000 cubic feet per hour depending upon the temperature, the rate of introducing residuum, the nature of the residuum, and the desired characteristics to be attained. The reaction temperature of the large body of liquid is preferably from 400 to 500° F.

Blown asphalt is continuously removed from a point near the bottom of the still by a pipe 17, which conducts asphalt through suitable heat exchangers to storage tanks or containers (not shown).

Steam may be introduced with the air through pipe 15 in amounts of about 1000 lb. per hour. At high temperatures, a blanket of steam is preferably maintained over the surface of the mixture, such steam being introduced through pipe 18, valve 19, and nozzle 20.

Although the volatile components of petroleum are supposedly removed from the residuum before it enters still 12, gaseous products result from the blowing process. These gaseous products are conducted together with unused air and steam through baffle dome 21 and vapor conduit 22 to steam boat 23.

The steam boat is preferably an open top tower, 6 to 10 feet in diameter and 20 to 30 feet tall. Water is supplied near the top of the tower through a pipe 24 which discharges the water on perforated baffle plates 25. Instead of perforated plates other conventional means, such as disc and doughnut plates, bubble plates, screens, etc., may be used. When perforated plates are used with relatively small amounts of water, it is good practice to provide a distributor above the top plate. The water leaving the lowermost baffle plate is directed by a baffle or feed spout 26 into a hopper or funnel 27, which has a downwardly extending portion 28 terminating under the surface of the oil-water mixture 29 in the base of the tower. By feeding the oil and water through the downwardly extending portion of 28 of funnel 27,

it is introduced into the lower part of the mixture so that the surface thereof is quiescent. This makes it possible to skim oil from the surface without obtaining appreciable amounts of water. Vapors from conduit **22** enter the tower between the oil-water mixture **29** and pouring spout **26**. Some oil particles are collected on the bottom of funnel **27** and fall immediately to the top of the oil-water mixture. The remaining vapors are forced into contact with incoming water by countercurrent scrubbing through baffle plates **25**, so that the gases are stripped of all condensible and soluble constituents. The gases discharged into the air are not noticeable or objectionable and the oil and reaction products are separated from the water as hereinafter described.

As the oil-water mixture gradually separates in the base of the tower, the oil-soluble compounds and materials lighter than water are skimmed from the surface of this mixture over a weir **30** and are removed by a pipe **31** to a gutter **32** which conveys them to a storage tank.

The water is removed from the base of the tower by a pipe **33** which extends upwardly and terminates in an open chamber **34**, which communicates with open chamber **35** by means of an adjustable weir **36**, the open receptacle **35** discharging through pipe **37** into gutter **38** which conveys the water to a sewer.

The normal elevation of weir **36** is slightly below weir **30** and the level of the oil-water mixture in the tower **23** may be regulated by raising or lowering weir **36**. If water is removed through pipe **31**, weir **36** is lowered and if the flow through pipe **31** ceases, weir **36** is raised. By this means the oil is skimmed from the mixture together with oil soluble and other light products resulting from the oxidation.

To insure the complete oxidation of every particle of residuum, we prefer to use baffles as shown in Fig. 2. The residuum must flow under baffle **38** through opening **39** and then over baffle **40**. This effectively prevents "short circuiting" and therefore produces a more uniform product.

The operation of the invention has been described along with the description of the apparatus and no further description is deemed necessary. It should be emphasized, however, that the use of a large body of oil and continuous inflow and outflow of small streams provides a stabilization and efficiency which has been heretofore unknown, and it also results in a uniform product of excellent characteristics.

It is well known, of course, that when the reaction has been initiated, no heat will be ordinarily required from furnace **14**. The temperature may be regulated by varying the rate of feeding residuum and/or air to the still and/or the temperature of the feed. It is understood that conduits, stills and tanks filled with hot liquids should be suitably insulated. The shape of the still is immaterial, and it may be heated by a fire in furnace **14** or by suitable heating coils (not shown) when, for any reason, the temperature gets too low.

Various means may be used to maintain the liquid level in the still; in some cases a gravity overflow has been used and in others a pump controlled by a float.

Many modifications will be apparent to those skilled in the art, and we do not limit ourselves to the details of our preferred embodiment except as defined by the following claims:

We claim:

1. In the process of continuously oxidizing petroleum residuum to form blown asphalt of desired penetration and melting point, the steps comprising maintaining a large body of petroleum residuum in an horizontally elongated oxidation zone, continuously adding liquid residuum at about one end of said zone, blowing said residuum with an oxidizing gas, causing substantially all of said residuum to pass through the lower portion of said body of residuum at an intermediate point in its travel through said zone, causing said residuum to pass near the top of said body of residuum at another intermediate point in its passage through said zone, continuously removing the blown asphalt formed from said residuum from about the opposite end of said zone, whereby short circuiting is minimized, and removing gases and vapors from said zone.

2. In the process of continuously oxidizing petroleum residuum to form blown asphalt of desired penetration and melting point, the steps comprising maintaining a large body of petroleum residuum in an horizontally elongated oxidation zone, continuously adding liquid residuum at about one end of said zone, blowing said residuum with an oxidizing gas introduced near the bottom of said zone, causing substantially all of said residuum to pass through the lower portion of said body of residuum at an intermediate point in its travel through said zone, continuously removing the blown asphalt formed from said residuum from about the opposite end of said zone, whereby short circuiting is minimized, and removing gases and vapors from said zone.

3. Apparatus for continuously oxidizing petroleum residuum to form blown asphalt of desired penetration and melting point, comprising an horizontally elongated chamber, means for continuously adding residuum at about one end of said chamber, means for withdrawing blown asphalt from about the opposite end of said chamber, means for forcing substantially all of said residuum to about the bottom of said chamber at an intermediate point in its travel through said chamber, means for forcing substantially all of said residuum into an elevated portion of said chamber at another intermediate point in its travel through said chamber, means for introducing an oxidizing gas into the lower part of said chamber, and means for removing gases and vapors from said chamber.

4. In the process of continuously oxidizing petroleum residuum to form blown asphalt of desired penetration and melting point, the steps comprising maintaining a large body of petroleum residuum in an elongated oxidation zone, adding liquid residuum at about one end of said zone at a rate of about one-tenth of the volume of residuum per hour, blowing said residuum with an oxidizing gas, causing substantially all of said residuum to pass to the bottom of said body of residuum at an intermediate point in its travel through said zone, causing substantially all of said residuum to pass through the top of said body of residuum at another intermediate point in its travel through said zone, continuously removing blown asphalt from about the opposite end of said zone, whereby short-circuiting is minimized, and removing gases and vapors from said zone.

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