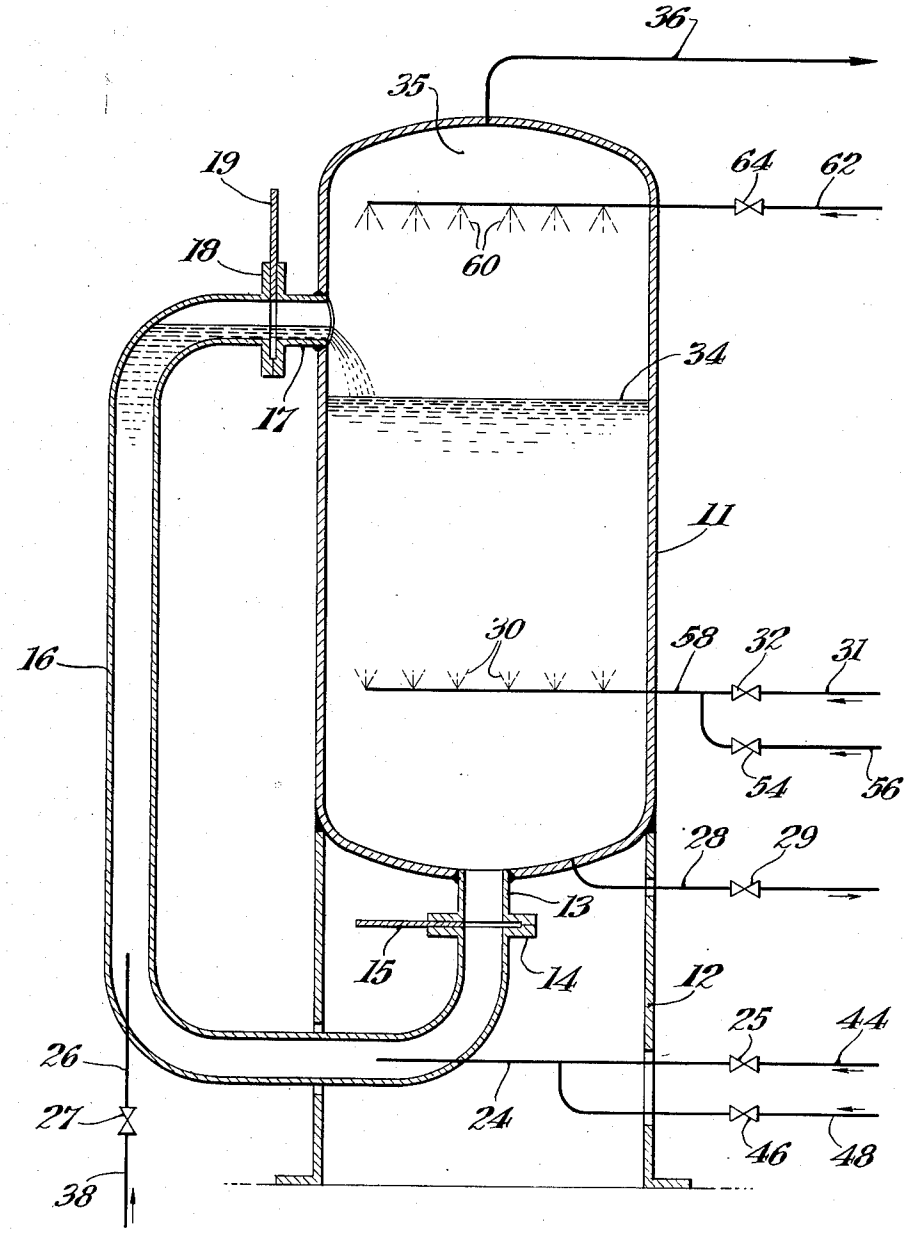
Dec. 1, 1953 W. W. KRAFT 2,661,323

ASPHALT BLOWING

Filed Nov. 18, 1949



INVENTOR.
Wheaton W. Kraft
BY Nathaniel Cly
ATTORNEY

Patented Dec. 1, 1953

2,661,323

UNITED STATES PATENT OFFICE

2,661,323

ASPHALT BLOWING

Wheaton W. Kraft, Scarsdale, N. Y., assignor to The Lummus Company, New York, N. Y., a corporation of Delaware

Application November 18, 1949, Serial No. 128,118

2 Claims. (Cl. 196—74)

1

This invention relates to a method of obtaining efficient and economical contacting of asphalt with air.

In accordance with present practice, the operation of blowing asphalt with air involves (1) filling a blowing tank with charge stock, (2) directing air into the bottom of the tank through a sparger, (3) withdrawing air and vapors from the top of the tank, and (4) withdrawing the oxidized asphalt from the lower part of the tank.

Although batch processes, such as this, are simple and easy to operate they are generally undesirable because they are wasteful of labor, material, and fuel. Due to the inefficient circulation of air and asphalt in a standard blowing tank, a quantity of air is required which is very large.

According to my present invention, the operation of oxidizing asphalt is rendered efficient and economical by the use of air in a closed circuit, so that the air can be utilized not only for a gas lift effect, but also for a jet effect that tends to establish the necessary velocity of the flowing mixture and thereby provide for a positive circulation. Water or steam may also be injected to insure better control and more efficient operation.

Objects and advantages of this invention will become apparent to one skilled in the art when taken in connection with the accompanying drawing in which the figure is a diagrammatic vertical sectional view of a preferred form of apparatus embodying my invention.

The blowing tank 11 is preferably cylindrical throughout most of its length and may have a dished bottom portion with an enlarged outlet nozzle 13. A valve 15 may be provided in the nozzle 13. In communication with the nozzle 13 is an attenuated external return conduit 16, the upper end of which is connected to the tank 11 through nozzle 17. This nozzle may also have a suitable valve 19. If desired, the valves 15 and 19 may be flanges of the "figure eight" variety whereby the flow may be completely stopped.

At the lower end of return conduit 16, there is provided a pipe 26 extending upwardly through the bottom of the tube and suitable for the introduction of air, steam, or water. Valve 27 controls the quantity of air admitted from pipe 38 to pipe 26 and conduit 16. Suitable means, not shown, may be employed to cover the end of pipe 26 to serve as a distributing outlet.

Asphalt inlet 24 is provided, preferably at a point in the conduit 16 below the air pipe 26. The flow of asphalt from pipe 44 to pipe 24 is controlled by valve 25. The flow of water from pipe 48 to pipe 24 is controlled by the valve 46. Pipe

2

28 is a drawoff pipe through which oxidized asphalt may be removed as desired from tank 11, preferably in the lower part of the tank 11. Valve 29 controls the flow in line 28.

A sparger 30 is located in the lower part of tank 11 below the liquid level 34. Air may be admitted to this sparger through pipe 31 and valve 32. Valve 54 controls the steam which may pass to sparger 30 from line 56 and through line 58. A second sparger 60 is located near the top of tank 11. Steam may be passed to sparger 60 through line 62 and control valve 64.

Nozzle 17 which is near the top of tank 11 is sufficiently high to be above the highest desired operating level 34. Above liquid level 34 is a vapor space 35 from which vapors may be removed through vapor outlet 36.

In operation, asphalt at a temperature of from about 400° F. to 450° F. is admitted to a lower point in external return conduit 16 through pipes 44 and 24. Valve 25 controls the flow of asphalt.

Simultaneously air is admitted to conduit 16 at a higher point as through lines 38 and 26 under the control of valve 27. The relatively large amount of air in conduit 16 insures a high mixing velocity in the conduit. This produces a desirable mixing effect which insures efficient contact and reaction of the air with the asphalt and the liberation of lighter gaseous material.

From nozzle 17, the mixture is discharged laterally and downwardly into vapor space 35. This further produces an efficient contacting action and added turbulence which enables the asphalt and air to become completely mixed. It also permits any light gases or vapors present to be ejected from the bulk of the liquid. This effect may be aided by means of a baffle, not shown, placed in the path of the fluid as it emerges from the nozzle 17.

Simultaneously with the admission of the asphalt to tank 11, air is passed to sparger 30 from line 31 under the control of valve 32. Thus the liquid in tank 11 will be continually contacted with air. Stripping steam may be admitted as desired to sparger 30 through line 56 under the control of valve 54. Asphalt is passed into tank 11 until a liquid level 34 is reached and then valve 25 is closed stopping the flow of asphalt.

Due to the excellent oxidation conditions in tank 11, it is necessary to have a positive control. Steam is passed into tank 11 through pipe 62 and sparger 60 thus diluting the oxygen content of the vapor space and thereby minimizing the possibility of fire hazards or explosion.

When tank 11 has been filled to level 34, a

run is started which may continue for a period of time of from 3 to 48 hours. Six hours is about average. During this run, a level of asphalt is maintained at 34, air is admitted through pipes 38 and 31, and steam through pipe 62. Stripping steam is admitted from line 56. Vapors are removed through pipe 36. Thus a continuous circulation of asphalt is maintained from tank 11, through nozzle 13, valve 15, conduit 16, valve 19, and nozzle 17. In this manner a very efficient contacting of air and asphalt may be had.

The oxidation of asphalt is an exothermic reaction and accordingly the temperature rises during the blowing. It is permitted to rise to a maximum which is generally not less than 518° F. nor more than 572° F. If there is a tendency to exceed this maximum, the supply of air may be temporarily decreased or stopped altogether.

The vapors leave tank 11 through pipe 36. When the run is complete, the blown asphalt may be removed through line 28.

Whereas it is contemplated that this process will normally be a batch operation, it is possible to effect a continuous operation by the simple expedient of continuously feeding fresh asphalt in through line 44 and withdrawing the blown product through line 28.

The vigorous mixing and contacting makes it possible to obtain a very high contact efficiency and accordingly a minimum amount of air will have to be used. This insures that the oxidation will occur in the shortest possible time and at the lowest cost.

As will be seen, my method of blowing asphalt has several advantages. It is efficient and economical with reference to both initial and operating costs, and repairs and maintenance expenses. There is a minimum of internal parts. The method, further, is equally useful for a batch, semi-continuous, or continuous operation. It has the advantage of utilizing the air present for two distinct functions, rendering both more efficient.

In operation of this system it has been found desirable to blow the asphalt at a temperature of about 518° F. to about 572° F. The temperature and duration of the blowing process depend on the desired quality of asphalt product. The higher the temperature and the longer the duration of the blowing process, the higher the liquification point and the hardness, and the lower the penetration. These are due to the chemical changes occurring in the asphalt during blowing and include cracking, polymerization, and condensation.

When asphalt is blown under conditions as hereinbefore described, the time of blowing will range from 3 hours to about 48 hours depending on the charge stock and the product desired. Average time is about six hours. It is found that an asphalt can be produced in this manner having a penetration of 10–100 as determined by ASTM test D5–25, a softening point of from 200° F. to 125° F., as determined by the ball and ring test, ASTM test D36–26, and a minimum specific gravity of from 1.01 to 1.05 as determined by ASTM tests D70–27 or D71–27.

It will be appreciated that there is practically no uniformity of materials which are ordinarily available for the manufacture of asphalt. Not only do the crude oils in different localities differ markedly in their composition and properties, but also refining practices in the removal of the lighter fractions of gasoline, naphtha, kerosene, etc. differ to a great extent, so that the residues available for conversion into asphalts differ widely in composition. It is a feature of this invention that it is adapted to meet substantially all of these varying conditions in a simple and economical manner to produce uniformly satisfactory products.

It will be understood that the word "oxidize" is herein used to cover those changes in the asphalt which occur under the conditions described. It will include cracking, polymerization, condensation and distillation, as well as oxidation in the strict sense of the word.

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

1. The method of oxidizing a hydrocarbon residue to produce a blown asphalt of a predetermined degree of oxidation in a closed vertical vessel having an external attenuated circulation conduit including a substantially vertical portion, which comprises, introducing a hydrocarbon residue into the external conduit at a point near the bottom of the vertical vessel in a direction of flow away from the bottom of the vessel, introducing steam and oxidizing gas into the lower part of the vertical vessel to oxidize the major portion of the hydrocarbon residue therein and drive off volatile components therefrom, introducing an oxidizing gas into the hydrocarbon residue in the lower part of said vertical portion of the external conduit downstream of the point of introduction of the hydrocarbon residue and in a direction of flow away from the bottom of the vessel so as to simultaneously create a density difference between the hydrocarbon residue in the vertical vessel and in the external conduit by reducing the density of the residue in the vertical portion of the external conduit, oxidizing the hydrocarbon residue in the external conduit at its reduced density, establishing circulation of the residue in the vessel and in the conduit by the density difference created, spray discharging the oxidized hydrocarbon residue from the external conduit into the vertical vessel above the liquid level therein to facilitate removal of light components from the discharge, withdrawing said light components from the top of said vessel and separately withdrawing blown asphalt product.

2. The method of oxidizing a hydrocarbon residue to produce a blown asphalt of a predetermined degree of oxidation in a closed vertical vessel having an external attenuated circulation conduit including a substantially vertical portion, which comprises, introducing a hydrocarbon residue into the external conduit at a point near the bottom of the vertical vessel in a direction of flow away from the bottom of the vessel, introducing steam and oxidizing gas into the lower part of the vertical vessel to oxidize the major portion of the hydrocarbon residue therein and drive off volatile components therefrom, maintaining the hydrocarbon residue in the vessel at a temperature of between 518° F. and 572° F., introducing an oxidizing gas into the hydrocarbon residue in the lower part of said vertical portion of the external conduit downstream of the point of introduction of the hydrocarbon residue and in a direction of flow away from the bottom of the vessel so as to simultaneously create a density difference between the hydrocarbon residue in the vessel and the hydrocarbon residue in the external conduit by reducing the density of the residue in the external conduit, oxidizing the hydrocarbon residue in the external conduit at its reduced density, establishing cir-

culation of the residue in the vessel and in the conduit by the density difference created, spray discharging the oxidized hydrocarbon residue from the external conduit into the vertical vessel above the liquid level therein to facilitate removal of light components from the discharge, diluting with steam the free oxygen content of the vapors present in the upper part of the vertical vessel, withdrawing said light components from the top of said vessel and separately withdrawing blown asphalt product.

WHEATON W. KRAFT.

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