June 18, 1940. E. W. GARD ET AL 2,205,089

APPARATUS FOR MIXING FLUIDS

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Fig. 1.

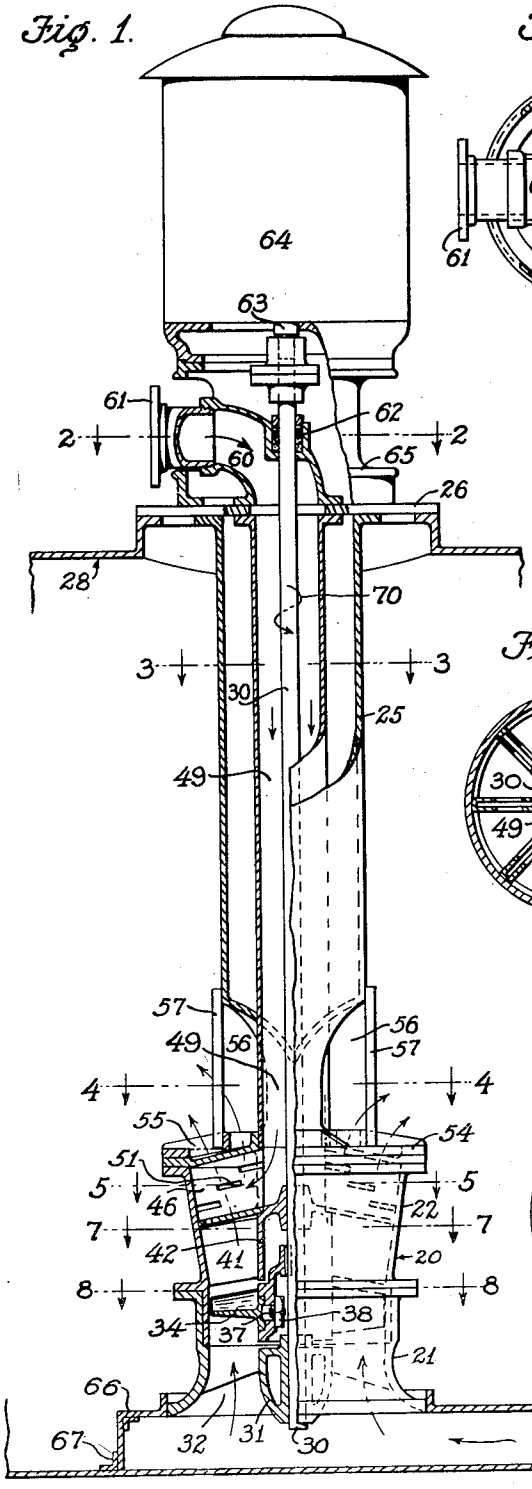


Fig. 2.

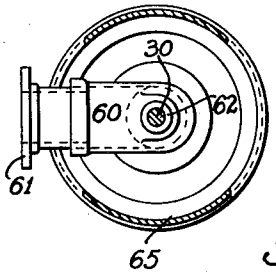


Fig. 3.

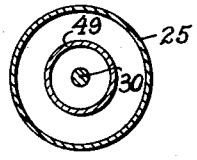


Fig. 4.

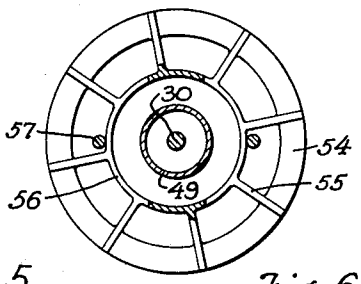


Fig. 5.

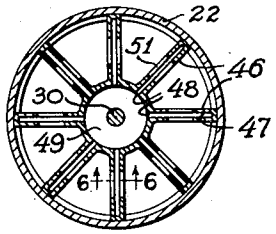


Fig. 6.

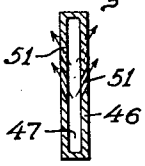


Fig. 7.

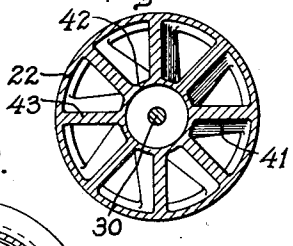
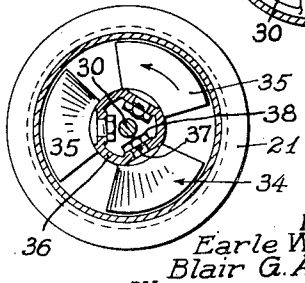


Fig. 8.



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Fig. 9.

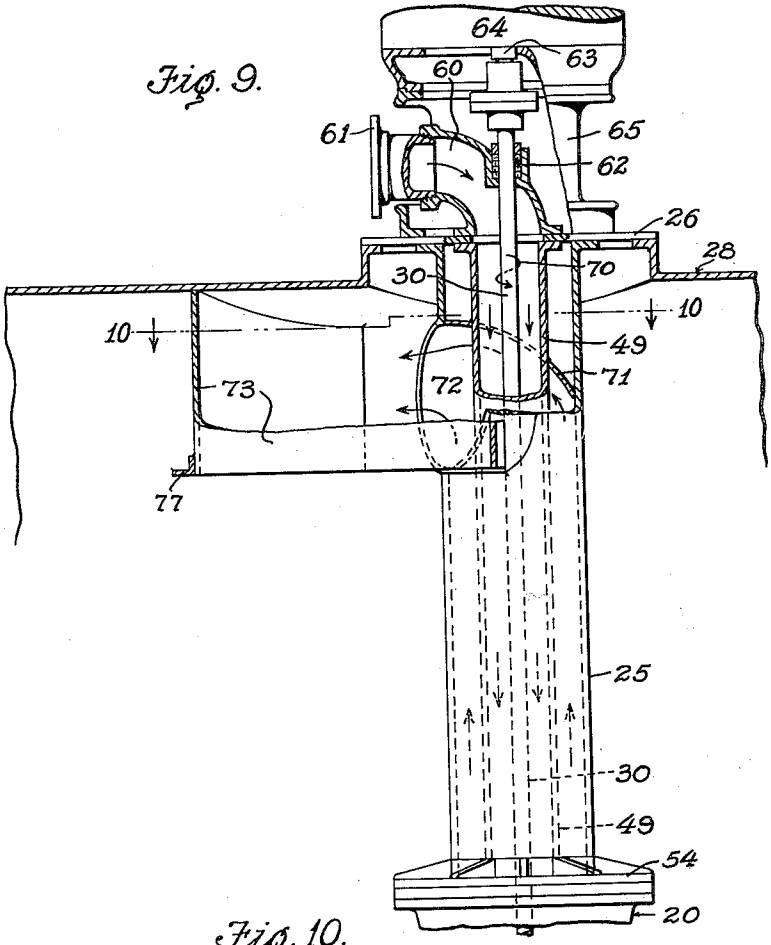
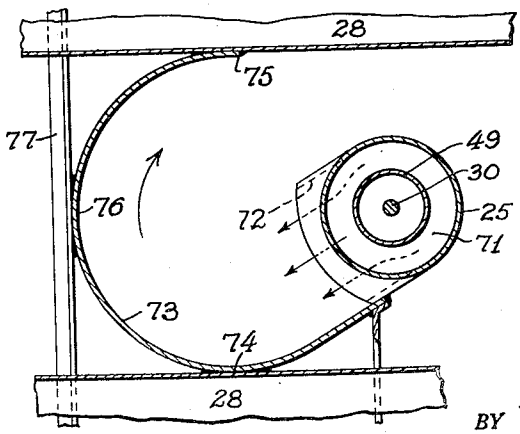


Fig. 10.



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APPARATUS FOR MIXING FLUIDS

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Fig. 11.

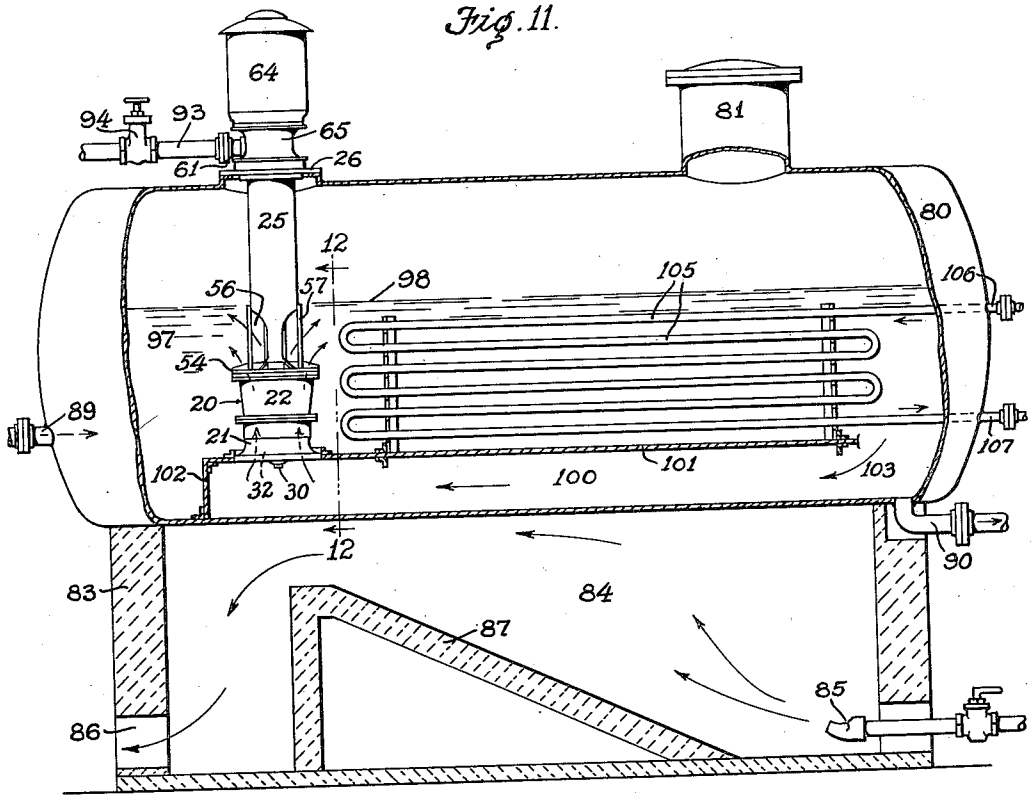
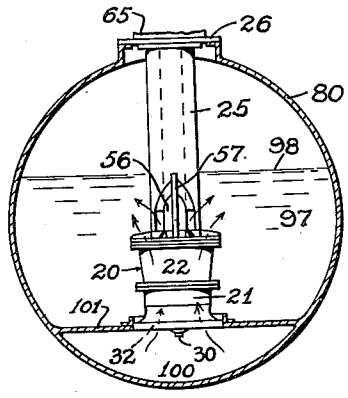


Fig. 12.



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UNITED STATES PATENT OFFICE

2,205,089

APPARATUS FOR MIXING FLUIDS

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Application July 5, 1938, Serial No. 217,452

4 Claims. (Cl. 261—93)

The present invention relates to the treatment of petroleum products, and has particular reference to the production of high grade asphalt products suitable for any of the various uses in the art. More specifically, the invention pertains to certain improvements in a process and apparatus to be employed in the preparation of high grade asphaltic products.

The use of air, gas and/or steam in varying proportions to oxidize petroleum fractions has been used for many years. By varying these proportions of air or steam, the yield of the oxidized asphalt thus produced may be controlled to a limited degree. However, in order to obtain asphalts of a high melting point and having a high ductility and a desired penetration, it is necessary to produce an intimate mixture of the oil to be oxidized and of the oxygen containing gas, such as air or steam, so that all parts of the oil are uniformily exposed to the action of the gas. Such intimate contact of the gas with the oil to be oxidized is also essential because it permits sufficient use of the oxygen-content of the gas and because such intimate contact permits the oxidation of the more refractory components of the oil.

The oxidation reaction, being exothermic in nature, an increase in temperature occurs during the reaction. It has therefore been found essential to provide heat-abstracting means to control the temperature and to prevent over-oxidation. These heat-abstracting means are necessary since the effect of oxidation, being exothermic, actually heats the oil, this increase in temperature occurring even when the air is injected in the cold or unheated state, for in the majority of cases the heat of oxidation of oil more than offsets the cooling effect of the injected cold air.

In an attempt to control the desired oxidation it has been previously proposed: to maintain the oil to be oxidized in a heated still optionally provided with agitators; to main the air, steam or other oxygen-containing gases in the still above the oil therein; to control the temperature of the oil being oxidized by means of cooling coils disposed within said oil; and to withdraw continuously a portion of said oil to be oxidized, commingle it with air to other oxygen-containing gases, and return the thus obtained mixture, preferably maintained at the optimum or incipient temperature of oxidation, into the mass of oil being oxidized. Such a procedure brings the oil into intimate contact with the air, this step being followed by the return of the mixture into the oil mass wherein the air is separated from the oil. The repeated and continuous recycling of the oil from the still, into the mixing or commingling zone, and back into the still (wherein optimum temperatures are controllably maintained as by heat-abstracting means) gradually oxidizes the oil until the desired degree of oxidation has been attained.

We have previously described and patented processes for oil oxidation, and particularly for the production of oxidized asphalts, in which the intimacy and duration of contact of the asphaltic oil and oxygen have been controlled, and in which the temperature of the mixture is also regulable. These patents are: No. 1,953,345, No. 1,953,346, No. 1,999,018. We have also described an improved process and apparatus or structure in which the rates of introduction of asphaltic oil and of air into the agitating zone, and the degree of agitation therein have been controlled to produce optimum oxidation, and in which the excess velocity head over and above that necessary for the intimate agitation, is extracted from the mixture prior to the return of the mixture into the still. For this purpose this excess velocity head is transformed into energy which is used for the recirculation of the asphaltic oil being oxidized. This has been described and claimed in our co-pending application Serial No. 74,264, filed April 14, 1936, (Patent 2,170,496, dated August 22, 1939) the present application being a continuation-in-part of the aforementioned co-pending application.

It is an object of the present invention to provide a structure which will comprise improvements on the processes and apparatuses of the above application and patents, as well as on all other processes of oxidation, reduction or chemical or physical interaction of oil, whether petroleum, animal or vegetable, or of other organic liquids in which it is desired to produce an intimate commingling of the liquid and of the reacting gases.

It is a further object of this invention to provide a structure adapted to withdraw continuously a measured quantity of oil or other liquid from a bulk supply such as a still, to admit continuously a measured stream of air or other gases into the oil thus withdrawn, to commingle intimately the particles of such liquid and gas, and to return or discharge said mixture back into the still wherein the gases are separated from the liquid. It is a still further object of this invention to provide an improved structure to perform all of the above enumerated functions

without the necessity of imparting to either the liquid or to the gas, or to both, any excessive velocities. It is a still further object of this invention to provide a structure wherein the aforementioned commingling of the liquid and gas is realized at relatively low velocities and/or pressure heads, and without excessive agitation.

It is a still further object of the invention to provide a structure adapted to continuously withdraw a measured quantity of oil or other liquid from a bulk supply, such as a still, to impart to the liquid thus withdrawn a relatively low velocity and/or pressure head, to admit continuously and at a relatively low pressure a measured stream of air or other gases into the oil thus withdrawn, to commingle intimately and continuously the particles of such oil and gas without imparting thereto any excessive degree of agitation, and to return said mixture into the still or bulk supply wherein the gases are separated from the liquid. Another object includes the provision of means adapted to prevent or greatly decrease the vibration of the described structure, this vibration being ordinarily caused by the velocity, pressure head and/or surging of the discharging mixture.

The above and other objects may be obtained by providing a structure comprising a housing provided with oil and gas inlets, means in said housing adapted to suck a stream of oil continuously into said housing, means within the said housing adapted to intimately commingle said oil with the gas introduced through the gas inlet, and discharge means for the thus produced mixture. More specifically, the invention comprises a pumping and agitating structure including a housing, means adapted to introduce a stream of oil into said housing, means within said housing adapted to introduce a stream of air into said housing, means within said housing adapted to intimately commingle said fluids without imparting thereto any excessive degree of agitation, and means for the discharge of the thus obtained mixture out of said housing.

The invention still further includes a structure wherein the above mentioned means for introducing the oil into the structure are adjusted to regulate and control the velocity and/or pressure head imparted to such oil.

The invention still further includes a structure of the character hereinabove in combination with means for preventing any vibration of the structure which may be caused by the velocity, pressure and/or surging of the discharging mixture, said means including arcuated means adapted to receive the discharging mixture and to return said mixture to the bulk supply in the still.

In one of its specific embodiments, the invention resides in a fluid mixing structure including a motor, a rotary shaft driven by said motor, a rotary fluid pump or propeller mounted on said shaft adapted to receive and discharge a fluid at a relatively low velocity head, a housing around said propeller said housing being provided with a fluid inlet through which the fluid may be conveyed to the propeller, means within said housing and adjoining the discharge phase of said propeller adapted to cause the fluid to flow in a direction substantially parallel to the axis of the pump, means communicating with said housing and adapted to convey thereto a gas, means within said housing and substantially adjacent to the discharge end of the last mentioned means adapted to intimately commingle said fluid and gas thus introduced into the housing and means adapted to discharge said mixture.

Additional objects, as well as the various particulars of the present invention will become apparent from a discription of the accompanying drawings, in which:

Fig. 1 illustrates a vertical sectional view, partly in elevation, of a circulating pump and mixing structure built and assembled according to the present invention;

Fig. 2 is a section taken along line 2—2 of Fig. 1;

Fig. 3 is a section taken along line 3—3 of Fig. 1;

Fig. 4 is a section taken along line 4—4 of Fig. 1;

Fig. 5 is a section taken along line 5—5 of Fig. 1;

Fig. 6 is a section taken along line 6—6 of Fig. 5;

Fig. 7 is a section taken along line 7—7 of Fig. 1;

Fig. 8 is a section taken along line 8—8 of Fig. 1;

Fig. 9 illustrates a fragmentary vertical sectional view, partly in elevation, of a modified embodiment of the invention, this embodiment providing means for discharging the mixture back into the still and simultaneously preventing or decreasing any vibration of the pump structure which may be caused by the velocity and pressure of the discharge mixture.

Fig. 10 is a section taken along line 10—10 of Fig. 9;

Fig. 11 is a diagrammatic view, partly in elevation and partly in longitudinal section through a still equipped with a vertically disposed pumping and mixing structure of the type shown in Fig. 1; and

Fig. 12 is a section taken along line 12—12 of Fig. 11.

Referring now to the drawings and more particularly to Fig. 1 and the sections shown in Figs. 2 to 8, inclusive, the circulating and commingling means are inclosed in a housing generally indicated by numeral 20. This housing consists of two sections 21 and 22 which are bolted or otherwise united as at 23. These sections are generally annular in shape but have various constructions described in greater detail herein below. The housing 20 is suspended from a supporting pipe 25, the upper end of which is attached to a plate 26, bolted or otherwise united to the upper end of a still 28 in which the assembly is disposed.

A shaft 30 extends vertically through the diametric center of supporting pipe 25 and of the housing 20. The lower end of said shaft 30 is supported at the lower end of section 21 by means of a bearing 31. Section 21 is also provided with an annular opening 32 adapted to communicate the interior of section 21 with the outside. Within section 21 and substantially in its upper portion, shaft 30 is provided with a pumping device 34. As shown in Figs. 1 and 8, said pumping device may be of the impeller type consisting of a plurality of blades 35 attached to a hub 36 which is actuated by the rotation of shaft 30. For the purpose of attachment of blades 35, as well as to provide an impeller pump of a variable pitch type, the inner edges of blades 35 are equipped with bolts 37, these bolts passing through a hub 36 and being rigidly attached thereto as by means of nuts 38. It is thus clear that blades 35 may be rotated on their bolts 37,

thereby regulating the pitch of the impeller pump 34.

The lower portion of section 22, immediately above the pumping device 34 in section 21, comprises a stator section more particularly shown in Fig. 7, and adapted to force the upwardly moving liquid to flow in a direction substantially parallel to the axis of the pump. For this purpose, this lower portion of section 22 is provided with a plurality of radially disposed ribs 43 which extend between and are connected or otherwise attached to the inner walls of said section 22 and to a stationary hub 42 arranged substantially adjacent to the shaft 30. A plurality of vanes 41 are attached to said ribs 43. As stated, the purpose of vanes 41 is to deflect the stream of liquid pumped upwardly by impelled plates 35, and to cause said liquid to pass substantially vertically and axially with respect to the axis of the structure. For this purpose vanes 41 are curved or actuated as shown more specifically in Fig. 7, the upper portions or ends of said vanes 41, near their junction with ribs 43, being substantially vertical in configuration.

The upper part of section 22 is also provided with a plurality of ribs 46. These ribs also extend radially, as this is shown in Fig. 5, and they align with the upper edges of the aforementioned ribs 43. Ribs 46 are however hollowed, providing a space 47 therein. This space 47 communicates at 48 with an air-introducing pipe 49 extending axially within supporting pipe 25 and around shaft 30. Ribs 46 are also provided with a plurality of slots 51 communicating the interior 47 of said ribs with the space surrounding each of said ribs. Preferably, as shown more particularly in Fig. 6, these openings or slots 51 are drilled at an angle so that the air or other oxygen-containing gases, passing from space 47 outwardly, is ejected in an upwardly direction.

The upper end of section 22 is enclosed by a webbed plate 54, webs 55 of which are connected to the supporting pipe 25. To facilitate the discharge of the air-liquid mixture, the lower portion of said pipe is provided with ports or openings 56. Optionally and only for the purpose of strengthening the structure supporting elements 57 connect with web 55 to pipe 25 on the two sides wherein pipe 25 is provided with the aforementioned ports 56.

As indicated in Fig. 1, the upper end of air-pipe 49 passes through plate 26 and communicates with a curved pipe or elbow 60 which terminates in a flange 61. Shaft 30 passes through said curved pipe 60 and through a packing gland 62, the upper end of shaft 30 being attached directly or otherwise to shaft 63 of an actuating motor 64 supported by means 65 to the plate 26.

As shown in the drawings, the pumping, circulating and commingling structure described hereinabove is disposed in still 28, the lower end of the structure being supported substantially at the lower end of the still as by means 66 which are rigidly attached as at 67 to the bottom of still 28. This support is for the purpose of preventing the swinging of the structure during the actuation of the pump.

In operation, shaft 30 is rotated by motor 64 in the direction shown by the arrow (see Fig. 1). The pumping device of impeller 34 actuated by the rotation of shaft 30 causes the upward flow of the oil or other liquid entering section 21 through opening 32. By varying the pitch or angle of blades 35 it is possible to regulate the rate of inflow of the liquid into housing 20. The liquid thus pumped upwardly by the impeller 34 enters the lower portion of section 22, wherein it is forced to pass along the arcuated surfaces of blades or vanes 41. Due to the curvature of these vanes 41, the upwardly moving liquid is gradually forced to move in a path which is parallel to the axis of the pumping structure. Therefore, when the structure is disposed vertically, as shown in Fig. 1, the liquid being lifted by the pump or impeller 34, will be flowing in a substantially vertical direction when it enters the upper part of section 22. During such passage through said upper part of section 22, the oil moves upwardly between the hollow ribs 46. Simultaneously, air or a similar oxygen-containing gas is conveyed downwardly through pipes 60 and 49, this air passing through the openings 48 into the interior 47 of the hollow ribs 46. This air then passes from 47 through ports 51 into this space between the ribs 46, thus coming into contact and commingling with the upwardly moving stream of liquid. Because of the slanting or angular position of ports 51, the air is caused to move upwardly and substantially in the direction of the flow of the liquid, thus aiding in the lifting of said liquid. The liquid-air mixture thus formed then passes through webbed plate 54 (between the webs 55) and, after passing through openings or ports 56 in the lower portion of pipe 25, overflows into the still from which the liquid was originally withdrawn through opening 32.

It is thus seen that the liquid, such as for example an asphaltic oil to be oxidized, may be continuously recirculated or recycled through the above described structure, each particle of this oil coming into contact with air introduced through ports 51, and the mixture thus formed overflowing back into the still wherein the oil separates from the air. The provision of the straightening vanes 41 and the introduction of the air through ports 51 in ribs 46 eliminates any excessive agitation. It has been found, however, that there is sufficient commingling between the oil and the air to cause the necessary interaction or oxidation if an asphaltic oil is to be oxidized. Since no excessive agitation is necessary and because of the relatively short lift to which the oil is to be subjected, there is a considerable saving in energy, the impeller pump imparting to the oil entering through opening 32 only sufficient energy and/or velocity to cause its upward movement through the structure 20 and to a point just above the webbed plate 54. Another advantage resides in the fact that the air can be introduced at a very low pressure. Thus, the angular arrangement or disposition of ports 51 in ribs 46 permits the upwardly moving stream of oil to create a partial vacuum within the hollow ribs 46, thus aiding in the injection of the air into the oil to be oxidized. Obviously, the velocity and pitch of the impeller blades 35 can thus be regulated for each individual case, the liquid receiving only enough energy for its travel through the structure. A further advantage of the present structure resides in the fact that the air inlet line is constructed and arranged so that it is not necessary to work within the still when it is desired to remove the structure, as for example when it is necessary to repair same. The axial disposition of air conduit 49, as well as the provision of the bent pipe or elbow 60 and of flange 61, permits the removal or withdrawal of the whole structure by a simple disconnecting of the air-pipe at flange 61. Obviously, plate 26, supporting the hollow structure

must also be released from still 28 when such a withdrawal is contemplated.

Figs. 9 and 10 disclose a modified embodiment of the structure. The pumping and agitating structure employed in this apparatus is identical to the one shown in Figs. 1 to 8 and described hereinabove. The only main difference between the two structures resides in the provision of certain discharge means which prevent or at least greatly inhibit the vibration of the apparatus, this vibration being caused by the surging and the force of the mixture discharging from the mixing agitating apparatus.

As shown more specifically in Fig. 9, the mixing and pumping apparatus is the same as that shown in Figs. 1 to 8. Thus, actuating motor 64 is supported by means 65 on plate 26 which is bolted or otherwise united to the upper end of still 28. Shaft 30 is directly attached to shaft 63 of the motor and passes downwardly and into still 28 through packing gland 62. At its lower end shaft 30 extends into housing 20 containing the pumping and agitating stretcher more fully described hereinabove. The housing 20 is suspended on pipe 25 the upper end of which is attached to the aforementioned plate 26. The air or similar gas is introduced through the concentric pipe 49 the upper end of which passes through plate 26 and communicates with a curved pipe or elbow 60 terminating in a connecting flange 61.

Instead of providing the discharge openings 56 in pipe 25 substantially immediately above housing 20, the modified embodiment discloses that said discharge opening from pipe 25 is provided near the upper end of pipe 25. For this purpose a curved or arcuated travel plate 71 is disposed within said pipe 25 and around the air introducing pipe 49. On one side pipe 25 is provided with a discharge opening 72, baffle 71 being preferably curved so as to permit a gradual change in direction of flow of the discharging mixture. For the purpose of dissipating the energy or velocity of the mixture thus discharged through opening 72 and for the purpose of facilitating the separation of the liquid from the gas, an arcuated plate 73 is attached to the side of the discharge opening 72. Preferably the plate is arcuated in the form of a spiral so that the discharging fluid is gradually caused to reverse its direction of flow, as more fully shown in Fig. 10. For purposes of stability and support, plate 73 is attached at 74 and 75 to the sides of still 28 and 76 to a supporting beam 77.

The advantage of the embodiment shown in Figs. 9 and 10 resides in the fact that the mixture discharged upwardly through pipe 25 is returned into the still above the oil level therein. Also the provision of the arcuated plate 73 prevents any excessive vibration of the mixing and agitating structure.

Figs. 10 and 11 disclose an embodiment in which a pumping and commingling structure of the type shown in Figs. 1 to 8 is employed for oxidizing an asphaltic oil. In these figures a still 80, provided with the usual man-hole 81, is disposed horizontally on a brickwork 83 of a furnace 84. This furnace, equipped with a burner 85 connected to a source of fuel not shown in the drawings. The flue gases from the furnace 84 are discharged through opening 86. To cause the products of combustion to flow along the lower and side walls or still 80, the furnace may be provided with a baffle wall 87. At one of its ends, still 80 is provided with oil inlet 89, while asphalt discharge pipe 90 may be provided at the other end of said still and preferably at its lower side. If desired, the still may be equipped with steam inlets as well as with vapor discharge openings.

A commingling and pumping structure of the type described hereinabove is disposed vertically within still 80 in such a manner that its actuating motor 64 is located outside of said still. As previously described, this motor is supported on a base-plate 26 by means 65, said base-plate being bolted or otherwise attached to the upper wall of still 80. Pipe 93, equipped with valve 94 is attached to flange 61 of the air-introducing pipe more fully described hereinabove in connection with the description of Figure 1. Regulation of valve 94 thus controls the rate of input of air or other oxygen-containing gases. Pipe 25, supporting the housing 20, extends downwardly from plate 26 so that said housing 20 (enclosing the housing and commingling units of this structure) is located within the oil 97 being oxidized. Although ports 56 adapted to discharge the air-oil mixture back into the still are shown to be below level 98 of the oil being oxidized, it is obvious the structure may be located so that the oil-air mixture may be discharged above said level. The oil inlet 32 opens into a space 100 formed by a baffle 101 extending horizontally across the lower portion of the still and substantially, but not quite, the length thereof. This space 100 is closed at one end by baffle 102, the other end 103 being open and communicating with the rest of the interior of still 80. This still is also provided with heating or cooling coils 105 adapted to control the temperature of the oil being oxidized. This heating or cooling medium enters coils 105 through pipe 106 and leaves said coil through 107.

In operation, the oil to be oxidized and maintained at a proper temperature by means of the coil 105 and of the furnace 84, is drawn into the pumping and commingling structure through opening 32. This is caused by the impeller pump in section 21, said pump being actuated by motor 64. Simultaneously, air or a similar oxygen-containing gas is introduced at a predetermined rate through pipe 93. The two fluids commingle (as described hereinabove) in section 22 of the structure 20, the mixture returning back into the still 80 through the aforementioned openings 56. If desired, the vapors and the spent gases may be withdrawn from still 80, as for example, through a vent line which may be attached to or provided on the man-hole or dome 81. The provision of baffle means 101 and 102 prevents the oil from entering the recirculating structure 20 except by first passing through space 100 separated from the rest of the still by said baffling means. It is thus obvious that a current is created in the still, the oil to be oxidized being forced across the whole length of the still prior to the time when said oil enters through 103 into the space 100 and then through opening 32 into the pumping and commingling structure described herein. The provision of these baffling means (as well as of the current thereby) aids a thorough separation of the gas or air from the mixture thereof with the oil coming out from the commingling zone through opening 56. The provision of these means also aids a thorough commingling of the oil being oxidized thus permitting a uniform oxidation of all of the oil in still 80.

It is obvious that the oil in said still 80 should

be initially heated to the oxidation temperature, after which the above described oxidation process could be started. Thereafter, coil 105 may be used to control the temperature of the oil in the still during the oxidation thereof. In most cases, due to the fact that the oxidation reaction is exothermic in nature, a cooling means will have to be circulated through coil 105 to abstract the excess heat generated in still 80 during this oxidation of the oil.

Although the drawings and the operation of the structures shown therein are described as used for the oxidation of petroleum or asphaltic oils, it is obvious that said structures may also be employed for commingling and agitating any other liquids with gases.

While the invention has been herein disclosed in what is now considered to be the preferred form, it is to be understood that the invention is not limited to the specific details thereof, but covers all changes, modifications and adaptations within the scope of the appended claims.

We claim:

1. A fluid mixing apparatus including a motor, a rotary shaft driven by said motor, a casing around said shaft, a rotary fluid propeller mounted on the end of said shaft and within said casing and adapted to receive a fluid and to discharge it into said casing at a relatively low velocity head, arcuated vanes within said casing and adjacent the discharge side of said propeller adapted to cause the fluid to flow in a direction substantially parallel to the axis of said shaft and casing, and a plurality of hollow ribs disposed radially with respect to the axis of the shaft, said ribs being provided with openings communicating the interior of said hollow ribs with the exterior thereof.

2. A fluid mixing apparatus including a motor, a rotary shaft driven by said motor, a casing around said shaft, a rotary fluid propeller mounted on the end of said shaft and within said casing and adapted to receive a fluid and to discharge it into said casing at a relatively low velocity head, arcuated vanes within said casing and adjacent the discharge side of said propeller adapted to cause the fluid to flow in a direction substantially parallel to the axis of said shaft and casing, and a plurality of hollow ribs disposed radially with respect to the axis of the shaft, and openings in the sides of said ribs communicating the interior of said hollow ribs with the exterior thereof, said openings being disposed at an angle with respect to the sides of said ribs, whereby the second fluid is introduced from the interior of said ribs through said openings and into the first fluid substantially parallel to the axis of the shaft, thereby aiding in the moving of the first fluid and also causing said fluids to be intimately commingled.

3. A fluid mixing apparatus including a tank adapted to receive a mixture of fluids, a motor mounted on said tank, a rotary shaft driven by said motor and extending into said tank, a rotary fluid propeller mounted on said shaft near the lower end thereof and adapted to receive a fluid and to discharge it at a relatively low velocity head, a stationary casing adapted to receive said fluid, arcuated vanes within said casing and disposed radially with respect to the pump shaft and adapted to receive said fluid and to cause it to move substantially vertically and parallel to the axis of said shaft, a fluid inlet pipe axially disposed around the pump shaft, a plurality of radially arranged hollow ribs communicating with said pipe, and openings in the sides of said ribs communicating the interior of said hollow ribs with the exterior thereof, said openings being disposed at an angle with respect to the sides of said ribs whereby the second fluid is introduced from said pipe and the interior of said ribs through said openings and into the first fluid substantially parallel to the axis of the shaft, and discharge means adapted to discharge the mixed fluids into said tank for recirculation.

4. A fluid mixing apparatus including a tank adapted to receive a mixture of fluids, a motor mounted on said tank, a rotary shaft driven by said motor and extending into said tank, a rotary fluid propeller mounted on said shaft near the lower end thereof and adapted to receive a fluid and to discharge it at a relatively low velocity head, a stationary casing adapted to receive said fluid, arcuated vanes within said casing and disposed radially with respect to the pump shaft and adapted to receive said fluid and to cause it to move substantially vertically and parallel to the axis of said shaft, a fluid inlet pipe axially disposed around the pump shaft, a plurality of radially arranged hollow ribs communicating with said pipe, and openings in the sides of said ribs communicating the interior of said hollow ribs with the exterior thereof, said openings being disposed at an angle with respect to the sides of said ribs whereby the second fluid is introduced from said pipe and the interior of said ribs through said openings and into the first fluid substantially parallel to the axis of the shaft, and wherein the discharge openings communicate with an arcuated baffle within the tank, said baffle being adapted to receive the discharged fluids and to return said fluids into the tank without substantial vibration of the mixing apparatus, and discharge means adapted to discharge the mixed fluids into said tank for recirculation.

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