Oct. 20, 1942. A. H. RINEY ET AL 2,299,254

COMBINED PIPELINE CLEANER AND FLUID SEPARATOR

Filed June 26, 1939 2 Sheets-Sheet 1

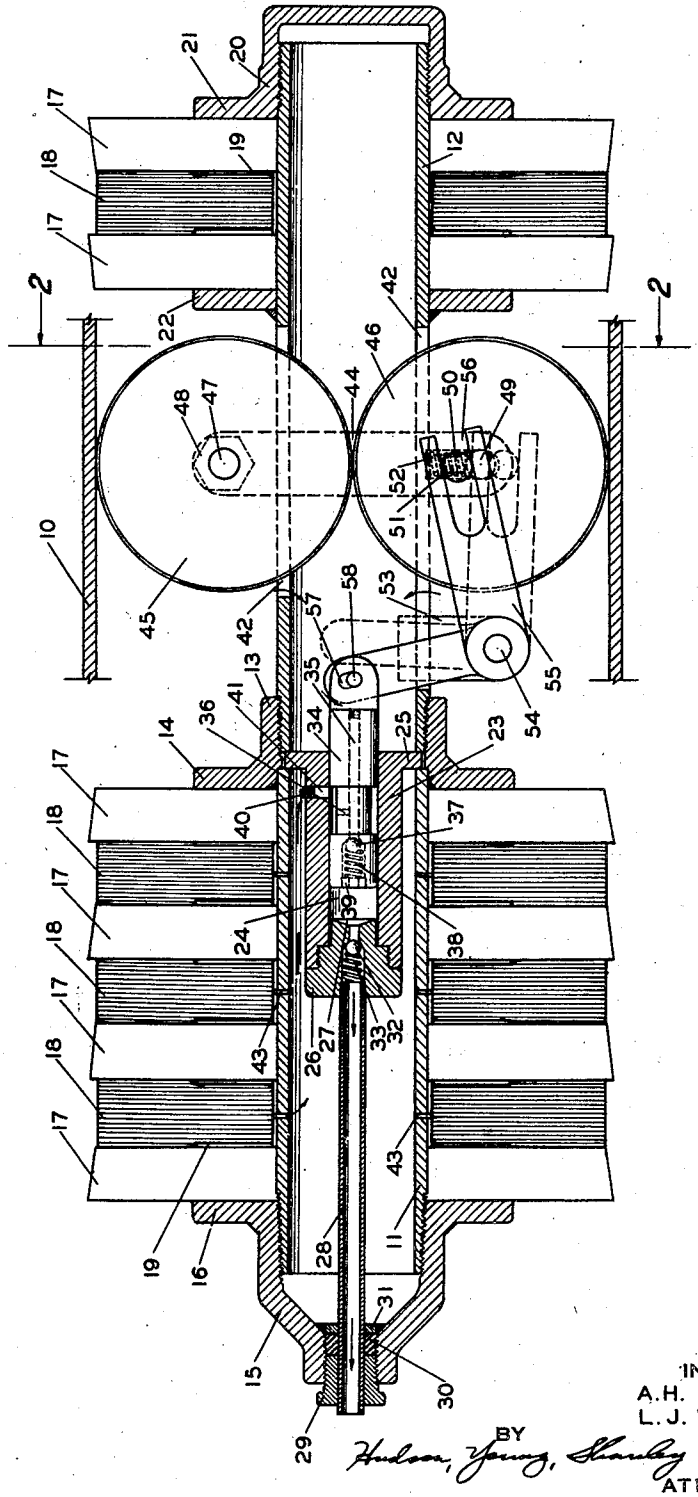

FIG. 1

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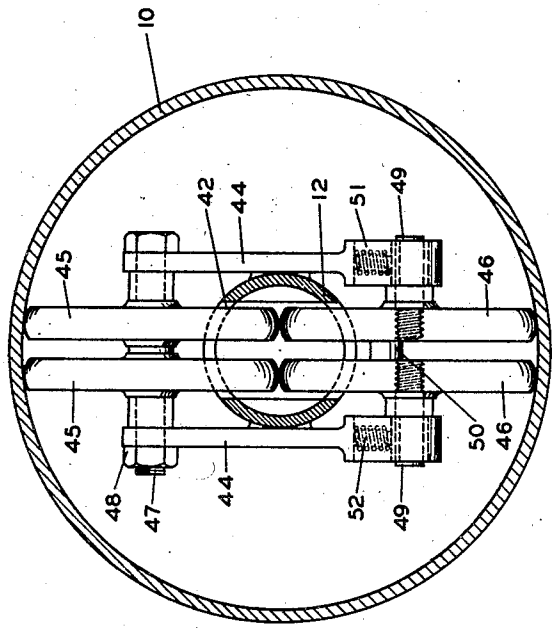

FIG. 2

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2,299,254

UNITED STATES PATENT OFFICE

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COMBINED PIPE-LINE CLEANER AND FLUID SEPARATOR

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4 Claims. (Cl. 15—104.06)

This invention relates to a combined pipe cleaner and fluid separator. It is particularly adapted to remove films from the inside surface of a pipe line and to separate one fluid from another during the transportation of two fluids through the line. While our device is especially suitable for use in pipe lines for transporting different grades of crude and treated petroleum it may be employed with equally satisfactory results in conveying various other fluids through pipe lines or similar conduits.

Present day practice in transporting fluids for great distances, contemplates pumping the fluids through suitable conduits or pipe lines. The usual pipe line, such as a petroleum pipe line, may serve termini that are many miles apart and has a large fluid capacity. Since the installation of these lines involves the expenditure of large sums of money, it is not economically feasible to construct a separate line for conveying each fluid. It is therefore customary to transmit the desired amounts of various liquids successively through an individual line. The usual procedure is to pump the predetermined amount of one fluid into the line; the second fluid is then introduced into the line and transported therethrough under pressure. In some cases the two fluids are in direct contact with each other, and, as a consequence, may intermix more or less freely, depending upon the composition of the fluids. This intermixing is generally objectionable. For example, if a quantity of "slug" or crude petroleum is immediately followed by a "slug" of refined gasoline and passed through a pipe line, there will be a mixing of a portion of each of the fluids with the other. The extent to which this intermixing occurs depends to a great extent on the character of the fluids, the length of the pipe line, and the conditions under which the materials are transported. A gasoline which has become contaminated by a crude petroleum in this manner is generally not fit for consumption upon arrival at the receiving end of the line, but must first be reprocessed in order to remove the adulterating components.

A number of mechanical plugs have been devised for insertion in the line between different fluids. These plugs are adapted to travel through the line with the fluids and, broadly speaking, act as a partition between the fluids. While these plugs afford varying degrees of protection against intermixing, experience has proven that none of them is fully suited to perform its intended functions in a satisfactory manner. The main objection to their use is due to the fact that a certain amount of fluid is permitted to pass through and/or around these devices, and in that way, comes in direct contact with the other fluid, contaminating the same.

The practice of our instant invention eliminates the objectionable intermixing experienced heretofore during the transportation of successive slugs of different fluids through a pipe line. Our device in its preferred form includes a hollow central body on which is located a plurality of flexible wiping discs and wire brushes alternately arranged. The wiping discs and brushes are employed to remove films of the fluid preceding our device that may have become deposited on the inner surface of the piping, and thereby reduce contamination of the fluid which follows the device. A reciprocating pump is positioned within the central body and communicates with one end thereof. This pump ejects removed film and any fluid that may seep into our device between the disc and brush assemblies and the inside wall of the piping. Suitable rotary means in contact with the pipe wall are coupled to the pump to actuate the same. Our device may be inserted in the line so that the materials discharged by the pump will be directed either upstream or downstream of the direction of flow.

It is the primary object of this invention to substantially eliminate contamination and intermixture of one fluid by and with another when two fluids differing in composition are transported through the same pipe line or similar conduit in succession.

This invention has for another object the provision of means for mechanically separating two fluids in a dependable and efficient manner while they are being conveyed under pressure through a pipe line.

A further object of this invention is to provide a combined pipe cleaner and fluid separator which is simple and compact in construction; inexpensive to manufacture and maintain; and positive and dependable in operation.

These and other objects and advantages will be apparent to those skilled in the art by reference to the following detailed description and annexed drawings which respectively describe and illustrate a preferred embodiment of the invention, and wherein,

Figure 1 is a longitudinal view, partly in cross section, through the center of our device; and

Figure 2 is a transverse section taken through line 2—2' in Figure 1.

Referring to the drawings and more particularly to Figure 1, we have denoted therein a por-

tion of a pipe line 10 within which is a central body consisting of tubular members 11 and 12, rigidly united by an internally threaded ring 13 that is flanged at 14 and is affixed to tubular member 11 by welding or some other convenient method. The front end of the central body is provided with a reducing nipple 15 which has a flange 16. A plurality of alternately arranged flexible wiping discs or sealing members 17 and circular wire brushes 18 on spools 19 are maintained in position on tubular member 11 through the cooperation of flange 16 on nipple 15 and flange 14 on ring 13. A closure 20, having a flange 21, is in threaded engagement with the rear end of the central body and coacts with a fixed back-up plate 22 to support a second assembly of flexible discs 17 and a wire brush 18 therebetween.

A pump cylinder 23 having a bore 24, has a flanged back end 25 disposed and sustained between the ends of tubular members 11 and 12. A removable cylinder head 26 is provided with a fluid outlet 27 that communicates with a discharge conduit 28, this conduit extending beyond reducing nipple 15 and being supported therein through the coaction of an externally threaded nut 29, a sealing gasket 30 and a fixed partition 31. Back flow of fluid from conduit 28 to cylinder bore 24 is prevented by a check valve which consists of a ball 32 and a compression spring 33. A piston 34 is adapted to reciprocate in the cylinder bore and is provided with a pair of communicating fluid passages 35 and 36. The forward end of passage 35 is equipped with valve means including a ball check valve 37, a compression spring 38 and a nut 39. Fluid and film which are handled by our pump may be admitted to the cylinder by either of two methods shown in the drawings. With a plug 40 in passage 41, fluid flows into passage 35 through a slot 42 in tubular member 12, past the check valve arrangement in the forward end of the piston, and then into the cylinder bore. The other method is by removing plug 40 from its illustrated position and placing the same in the back end of passage 35. The path of the fluid and film in this case is through ports 43, passages 41, 36, and 35, in the order indicated, and finally past the piston check valve and into the forward portion of the cylinder bore.

While our pump may be operated by any one of a number of actuating means, we find that excellent results may be obtained by employing the operating means illustrated in the drawings. This includes a pair of parallel spaced brackets 44 which are rigidly mounted on tubular member 12 and support rollers 45 and 46 on a shaft 47, having an end nut 48, and threaded pins 49, respectively. Rollers 46 are coupled by a crankshaft 50 which is eccentrically disposed with respect to the axis of the rollers. All the rollers are preferably made of natural or synthetic rubber or some composition material which will produce the desired traction when the peripheries of the rollers are in contact with each other and with the inner wall of the pipe. It will be noted that a slot 51 in the lower portion of each bracket contains a coil spring 52 for urging rollers 46 against the pipe wall. A post 53, mounted on the central body and having a pivot 54, carries a rocker arm 55 which has a forked end 56 in engagement with crankshaft 50 and a slot 57 at its other end to receive a pin 58 on piston 34.

In describing the operation of our device, let us assume that it is desired to transmit a quantity of crude petroleum and then a quantity of refined gasoline through a pipe line designated by a section of pipe 10 in the drawings. After the "slug" of crude petroleum has been pumped into the line, our device is inserted therein so that discharge conduit 28 communicates with the crude petroleum. The "slug" of refined gasoline is then pumped into the line and both fluids are transmitted therethrough, with our device serving as a plug or partition between the two fluids. As our device passes through the line, wiping discs 17 and wire brushes 18 will remove films of the crude petroleum that may have adhered to the inner wall of the piping. A portion of each fluid will enter the region between the extreme end wiping discs by seepage between the peripheries of these discs and the inside of the piping. Under normal working conditions, some of the removed film will also seep past the front discs. It is therefore essential that the fluid and film that has thus been admitted between the end discs be removed, otherwise, some of the crude petroleum and film will seep past our device and contaminate the refined gasoline. This is prevented by the utilization of the pumping means. With the construction illustrated in the drawings, fluid and film enters tubular member 12 by way of slot 42, passes through passage 35, and due to the pressure of the fluid, the check valve means in the front end of piston 34 will be opened on the back stroke of the piston, permitting the fluid to flow into the front portion of cylinder bore 24. The check valve means in the piston will close on the forward or compression stroke of the piston and and the fluid in the front end of the cylinder will be forced past the check valve means in cylinder head member 26 and thence discharged from our device through conduit 28. As was indicated earlier in this specification, our pump is operated by means of rollers 45 and 46. The rotation of rollers 46 will, through the coaction of eccentrically disposed crankshaft 50 and forked end 56 in rocker arm 55, impart an oscillatory motion to the rocker arm about its pivot 54. The slotted end of the rocker arm cooperates with pin 58 to translate this oscillatory motion into reciprocating motion of the piston.

We may also operate our pump by removing plug 40 from its illustrated position in passage 41 and placing it in the back end of passage 35. The fluid and film instead of being admitted to the pump through the back end of the piston is now admitted through ports 43 and passages 41, 36, and 35, in the order mentioned. Our pump will in all other respects operate in the manner previously described.

The above described modes of operating our combined pipe cleaner and fluid separator contemplate positioning the device in the pipe line so that the pump will discharge into the fluid preceding the device. This is recommended in cases where it is desirable to prevent the fluid ahead of the device from tainting the fluid following it. When it is essential that the downstream fluid be protected against contamination by the upstream fluid, our device should be placed in the line so that the pump will discharge into the upstream fluid. For example, if a "slug" of refined gasoline is pumped into the line and then followed by a "slug" of crude oil, our separator should be inserted between the fluids with the discharge conduit emptying upstream or into the crude oil.

From the foregoing it is believed that the construction, operation and advantages of our present invention will be readily comprehended by

persons skilled in the art. It is to be clearly understood, however, that the form of our invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention, as defined by the appended claims.

We claim:

1. A device of the character described comprising a pair of spaced sealing members, a pump having an intake passage in fluid communication with the space between the sealing members and an exhaust passage in fluid communication with a point outside the space between the sealing members, and means responsive to axial movement of the sealing members in a pipe to actuate the pump.

2. A device of the character described comprising a pair of spaced means for forming a seal with and for removing accumulations from the inner surface of a pipe, each of said means including a pair of wiping discs and a brush positioned therebetween, a pump having an intake passage in fluid communication with the space between the extreme wiping discs and an exhaust passage in fluid communication with a point outside the space between the extreme wiping discs, and means responsive to axial movement of the above mentioned means to actuate the pump.

3. A device of the character described comprising a hollow central body, a pair of spaced sealing members connected to the central body, a pump in the central body, said pump having an intake passage in fluid communication with the space between the sealing members and an exhaust passage in fluid communication with a point outside the space between the sealing members, and means responsive to axial movement of the central body in a pipe to actuate the pump.

4. A device of the character described comprising a hollow central body, a pair of spaced means connected to the central body for forming a seal with and for removing accumulations from the inner surface of a pipe, each of said means including a pair of wiping discs and a brush positioned therebetween, a pump having an intake passage in fluid communication with the space between the extreme wiping discs and an exhaust passage in fluid communication with a point outside the space between the extreme wiping discs, and means responsive to axial movement of the central body in the pipe to actuate the pump.

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