

Jan. 4, 1927.

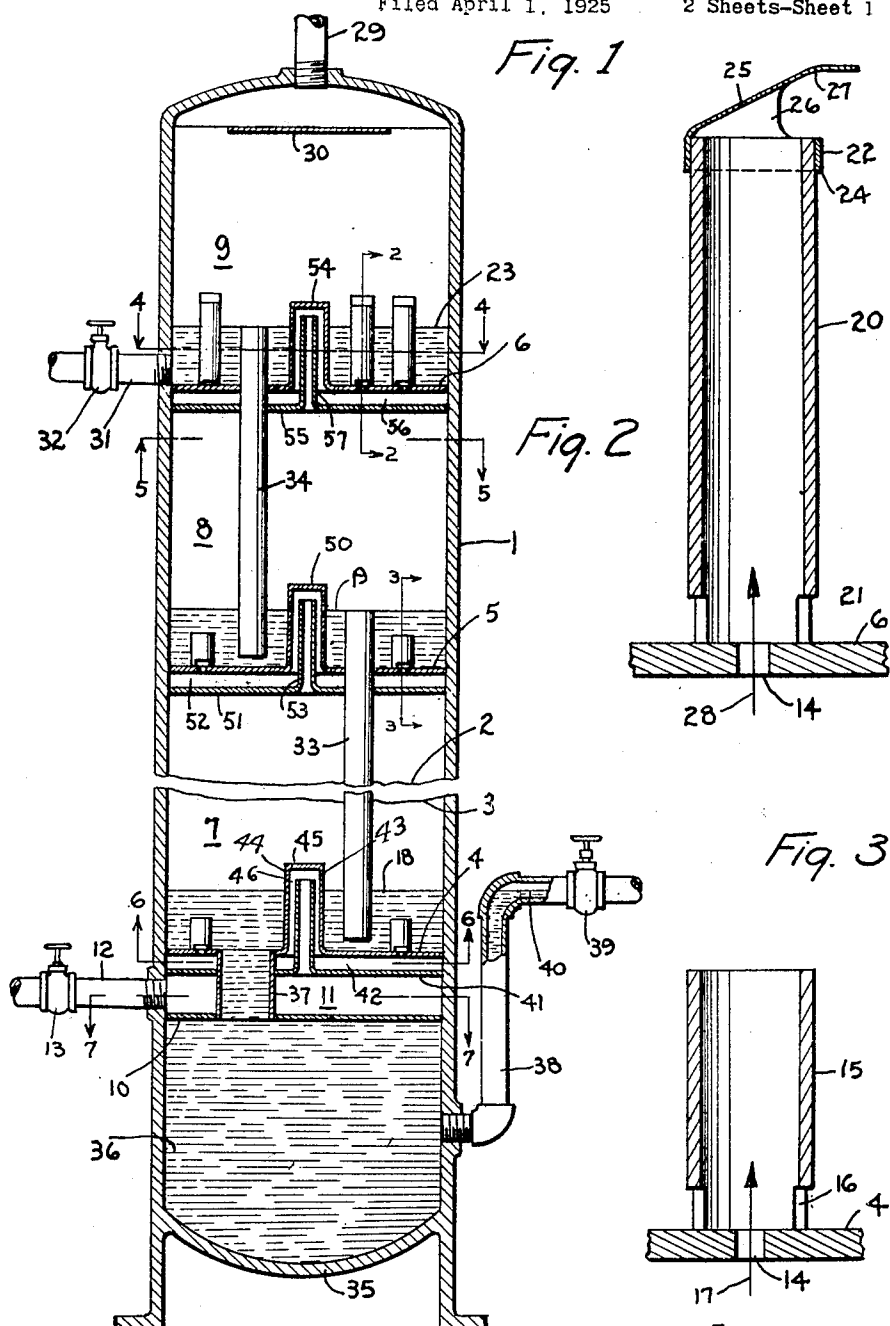
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1,613,352

APPARATUS FOR TREATING HYDROCARBONS

Filed April 1, 1925

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4

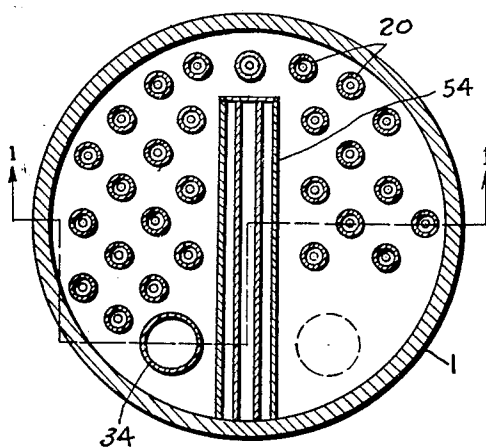


Fig. 5

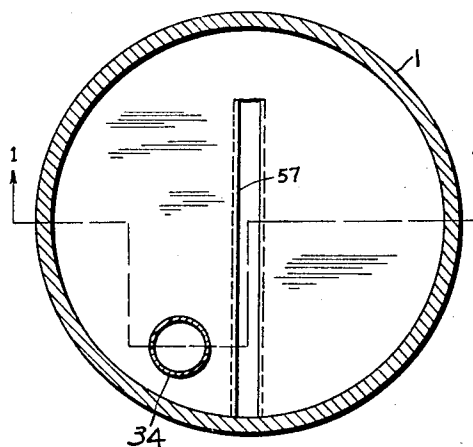


Fig. 6

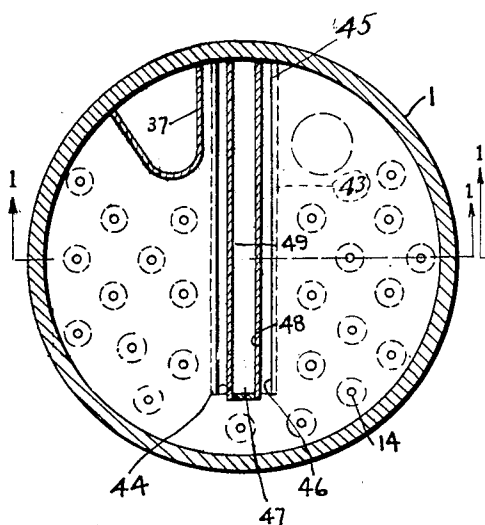
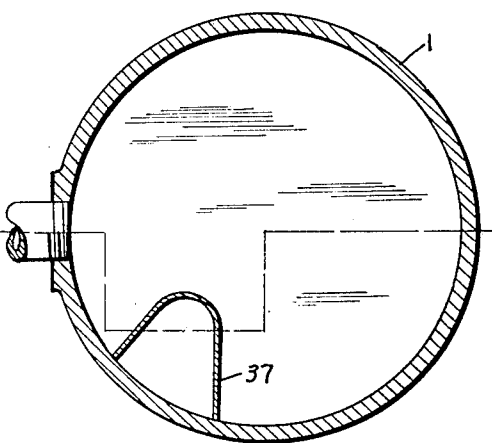


Fig. 7



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TREATING HYDROCARBONS.

Application filed April 1, 1925. Serial No. 19,834.

My invention relates to an apparatus for absorbing light hydrocarbons from casing head gas, especially for the purpose of taking the gasoline out of natural gas by continuous process, in which the absorbing medium runs in at the top and out at the bottom and the natural gas runs in at the bottom and out at the top.

Heretofore in an apparatus of this kind having successive chambers one above the other, it has been usual for the absorbing medium to run out of the chambers when the gas pressure stops so that when the gas pressure comes again there is no absorbing medium in the chambers and the process will not commence until the chambers are refilled with absorbing medium, the absorbing medium being held in the chambers solely by the gas pressure.

It is the object of this invention to form a trap construction to hold the absorbing medium from running out of the chambers when the gas pressure fails.

Another object of this invention is to form a trap to hold the gas from blowing the absorbing medium out of the lower chamber by an excess pressure of gas.

Another object is to place a large baffle in front of the gas outlet to catch the flying particles of absorbing medium and vapor.

Another object is to place circulating tubes upon the upper partition that are higher than the proposed level of the absorbing medium and place baffles upon the upper ends of the tubes.

Other objects and advantages may appear from the drawings and specifications. The invention consists of the novel features herein shown, described and claimed.

Figure 1 is a sectional elevation of an apparatus for absorbing light hydrocarbons from casing head gas, the view being foreshortened by breaking away to indicate that it may be of any desired height with any desired number of mixing chambers, the view being taken on the lines 1—1 of Figs. 4, 5, 6 and 7 and looking in the direction indicated by the arrows.

Fig. 2 is an enlarged sectional detail on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional detail on the line 3—3 of Fig. 1.

Fig. 4 is a horizontal section on the line 4—4 of Fig. 1 and looking downwardly as indicated by the arrows.

Fig. 5 is a horizontal section on the line 5—5 of Fig. 1 and looking downwardly as indicated by the arrows.

Fig. 6 is a horizontal section on the line 6—6 of Fig. 1 and looking upwardly as indicated by the arrows.

Fig. 7 is a horizontal section on the line 7—7 of Fig. 1 and looking downwardly as indicated by the arrows.

The details of construction and operation are as follows:

The vertical cylindrical shell 1 is of considerable size in horizontal cross section and of considerable height, the black lines 2 and 3 being intended to indicate that a considerable portion of the shell is broken away to foreshorten the view and that several missing chambers may be in this broken away portion. Horizontal partitions 4, 5, and 6 are inserted into the shell 1 and welded or otherwise suitably secured and evenly spaced apart to form mixing chambers 7, 8, and 9.

A partition 10, is inserted a short distance below the partition 4 to form the initial gas supply chamber 11, and the gas pipe 12 having a valve 13 is tapped through the wall of the shell 1 into the chamber 11. The partitions 4, 5 and 6 are provided with a plurality of perforations 14 and above each perforation there is a recirculating jet tube 15 in the shape of a short vertical cylinder open at the top and having slots 16 at the bottom, immediately above the partition.

The tubes 15 are set concentric to the perforations 14, so that the gas pressure passing through a perforation as indicated by the arrow 17 in Fig. 3 will shoot straight through the tube and produce an injector action to draw liquid in through the slot 16 and pass it upwardly and outwardly over the upper end of the tube, thereby causing a continuous circulation of the absorbing element and the gas.

The partition 5 is provided with recirculating tubes 15 in the same way as the partition 4. The recirculating jet tubes 15 upon the partitions 4 and 5 are comparatively short and are intended to be covered with the layers of absorbing liquid 18 and 19.

The partition 6 may be provided with the recirculating jet 15, but I prefer to use the jet tubes 20 mounted concentric to the perforations 14 upon the partition 6 and having slots 21 at their lower ends immediately above the partition and the baffle deflectors 22 upon their upper ends. The tubes 20 are substantially twice as long as the tubes 15 and will extend some distance above the level 23 of the absorbing medium in the chamber 9, the object being to prevent the absorption of the non-condensable gases by the clean absorbing medium and to discharge the lean gas clear of the absorbing medium into the chamber 9.

A baffle 22 comprises a ring 24 fitting tightly upon the upper end of the tube 20, and inclined cover 25 is formed integrally with the ring and extends substantially half way around, sides 26 connecting the cover to the ring and a horizontal projection 27 extending from the cover 25 beyond the sides 26 as shown in Fig. 2, the object being to break up the stream of gas as it passes through the absorbing medium in the tube 20 in the direction indicated by the arrow 28 and to catch any absorbing medium that may pass upwardly through the tube and return it to the layer 23. The pipe 29 leads the lean gas from the top of the chamber 9. A baffle plate 30 is mounted in the top of the chamber 9 below the end of the pipe 29 to catch as much as possible of the flying absorbing medium and prevent this absorbing medium from passing through the pipe 29 with the gas.

The absorbing medium is introduced into the shell 1 by the pipe 31 controlled by a valve 32 and tapped through the wall of the shell immediately above the partition 6.

An overflow pipe 33 is fixed through the partition 5 and extends to near the partition 4 and the upper end of the overflow pipe 33 extends substantially twice as far above the partition 5 as does the tube 15 and the height of this pipe above the partition 5 determines the level of the layer 19 of absorbing medium.

A similar overflow pipe 34 is fixed through the partition 6 to determine the level of the layer 23 of absorbing medium. The overflow pipe 33 extends into the layer 18 of absorbing medium and the overflow pipe 34 extends into the layer 19 of the absorbing medium.

The apparatus which I am improving stops at this point in the construction and usually has a free outlet for the absorbing medium, leading from the lower layer in the lower chamber, and the operation is as follows:

The level of the layer 18 of absorbing medium will constantly vary with the changing gas pressure and excessive pressure may blow this layer entirely out.

The absorbing medium which is prefer-

ably seal oil or an oil heavier than distillate or kerosene and adapted to absorb the vapors contained in natural gas, passes through the pipe 31 and forms the layer 23 upon the partition 6 and overflows through the pipe 34 until it forms the layer 19 upon the partition 5 and overflows the pipe 33 until it forms the layer 18 upon the partition 4 and fills the chamber 36 and pipe 38 to the level 40 and flows through the valve 39 according to the regulation of the valve. The valve 32 is adjusted to substantially correspond with the adjustment of the valve 39 to make a continuous flow of the absorbing medium.

The casing head gas flows into the chamber 11, through the pipe 12 and is regulated by the valve 13 and the gas passes upwardly through the perforations 14 in the partition 4 and through the recirculating jet tubes 15, causing a continuous circulation of the layer 18 to absorb the vapors from the gas and the gas escaping from the layer 18 passes upwardly through the perforations 14 in the partition 5 and through the recirculating tubes 15 and the layer 19 of absorbing medium and the escaping gas passes upwardly through the perforations 14 in the partition 6 and through the tubes 15 or 20 into the chamber 9 and the lean gas finally passes outwardly through the pipe 29.

The trouble with this construction is that the flow of gas is spasmodic and every time the gas flow stops the absorbing medium in the layers 18, 19 and 23 will flow backwardly through the perforations 14, until the chambers are depleted of absorbing medium, the outlet formed by the collection of perforations 14 being greater than the inlet through the valve 32 as adjusted. Then when the gas flow starts again there is no absorbing medium and the gas will flow freely and be wasted until the gas pressure has continued long enough to retard the absorbing medium and reform the layers 18, 19 and 23. The only thing that holds the absorbing medium upon the partitions 4, 5, and 6 in this construction is the upflow of gas through the perforations 14.

The object of my invention is to overcome these defects and for that purpose I have provided a trap for the first or lower chamber to hold the absorbing medium at a constant level, under excess gas pressure, and I have provided traps for each chamber 7, 8 and 9 to prevent the absorbing medium from running out of the chamber when the gas pressure fails.

The details of construction and operation of the traps are as follows:

The shell 1 has a bottom 35 a considerable distance below the partition 10, thus forming the trap chamber 36.

A conduit 37 leads through the partition 4, through the chamber 11 and through the partition 10.

A pipe 38 leads through the wall of the shell 1 from the chamber 36 and upwardly and then outwardly through the valve 39. When the valve 39 is properly adjusted the level 40 of the absorbing medium will determine the level of the layer 18 in the chamber 7. The chamber 7 is the first gas chamber and the final absorbing medium chamber and it would be objectionable to place an overflow pipe to regulate the depths of the layer 18 for the reason that the chamber would then become a settling basin and the bottom of the absorbing medium would never run out of the chamber through the overflow pipe.

The upflowing column of absorbing medium in the pipe 38 counter-balances the gas pressure at its highest and will hold the oil in the trap and maintain a practically constant level of the layer 18. The gas pressure and volume are regulated by the valve 13.

A partition 41 is mounted immediately below the partition 4 and fixed to form a tight chamber 42 above the chamber 11. Parallel walls 43 and 44 extend upwardly from the partition 4 across the center and are connected by a top 45, thus forming a slot 46 through the partition 4. The top 45 is some distance above the level 18 of the absorbing medium.

An opening or slot 47 is formed through the partition 41 in vertical alinement with the slot 46 and walls 48 and 49 extend upwardly from the edges of the slot 47 loosely into the space between the walls 43 and 44, the upper edges of the walls 48 and 49 being above the level of the layer 18 of absorbing medium.

In a like manner a baffle 50 is formed upon the partition 5, a partition 51 is inserted below the partition 5 to form a chamber 52 and the conduit 53 extends upwardly into the baffle 50.

In a like manner a baffle 54 is formed upon the partition 6. A partition 55 is inserted below the partition 6 and forms the chamber 56 and the conduit 57 extends upwardly from the partition 55 into the baffle 54.

The operation of the trap is as follows: When the gas pressure fails, the absorbing medium 18 will run downwardly through the perforations 14 into the chamber 42 until the chamber is filled to the remaining level of the layer and the absorbing medium is held in this position. When the gas pressure is restored the gas flows upwardly through the conduit formed by the walls 48 and 49 into the baffle formed by the walls 43, 44 to a point above the normal level of the layer 18 and overflows downwardly to the chamber 42 and then upwardly through the perforations 14 as be-

fore. The baffle 50 in the chamber 8 and the corresponding parts work in the same way and so does the baffle 54 in the chamber 9.

Thus I have provided means for holding the absorbing medium at a constant level against the gas pressure in the first gas mixing chamber, which is the final absorbing medium chamber and for holding the absorbing medium in its respective chambers when the gas pressure fails. Obviously this will save considerable time and considerable waste of gas, because the apparatus is always ready to start the absorbing process when the absorbing medium is flowing downwardly and the gas flowing upwardly.

The baffle 30 and the long circulating tubes 20 with baffles upon their upper ends are also a part of my invention.

Various changes may be made without departing from the spirit of my invention as claimed.

I claim:

1. In an apparatus for absorbing light hydrocarbons having a vertical shell divided by horizontal partitions into a series of mixing chambers and a series of perforations through the partitions, a trap combined with each partition to admit gas to the perforations and hold absorbing medium from running backwardly through the perforations when the gas pressure fails, each of said traps comprising a trap partition mounted below the mixing chamber partition, a baffle extending upwardly from the mixing chamber partition, to a point above the desired level of absorbing medium and open at the bottom and a conduit extending upwardly from the trap partition into the baffle to a point above the level of the absorbing medium so that when the gas pressure fails the absorbing medium will simply run into the chamber between the mixing chamber partition and the trap partition.

2. In an apparatus for absorbing light hydrocarbons, having a vertical shell divided by horizontal partitions into a series of mixing chambers and having an absorbing medium intake at the top and an outlet at the bottom having a gas intake at the bottom and an outlet at the top, a trap chamber at the bottom, a conduit connecting the trap chamber with the lowermost mixing chamber, whereby the said lowermost mixing chamber, the conduit and the trap chamber will be filled with absorbing medium, and means connected with the trap chamber to resist the gas pressure and maintain a constant level in the lowermost mixing chamber.

3. In an apparatus for absorbing light hydrocarbons as claimed in claim 2, in which the means to resist the gas pressure comprises a pipe extending upwardly from

the trap chamber, having provision for a liquid level on the level with the absorbing medium in the lowermost mixing chamber.

4. In an apparatus of the class described, 5 having a first gas chamber forming a final absorbing medium chamber, a gas supply chamber below the first gas chamber, means to pass gas from the supply chamber through the final absorbing medium chamber, a trap 10 chamber below the gas supply chamber, a conduit connecting the final absorbing medium chamber and the trap chamber, and means connected with the trap chamber to resist the pressure of gas and hold the ab- 15 sorbing medium in the final absorbing medium chamber at a constant level.

5. In an apparatus as claimed in claim 4, in which the means to resist the gas pressure comprises an upwardly extending pipe con- 20 nected to the trap chamber, having a part thereof on a level with the absorbing medium in the final absorbing medium chamber.

6. In an apparatus for absorbing light hydrocarbons, a shell having a perforate 25 partition therein adapted to form an absorbing medium and mixing chamber above the said partition, a partition below the perforate partition, the space between the said parti- 30 tions forming a gas passage, a baffle extending upwardly from the perforate partition, and means forming a passage through the partition from the baffle into the said baffle and into the said gas passage.

7. In an apparatus for absorbing light hydrocarbons, having a vertical shell with a horizontal perforate partition therein, the said partition and shell forming an absorb- 35 ing medium and mixing chamber, a baffle having side and top walls extending upwardly from the perforate partition and forming a slot in said partition, a partition below the perforate partition, having a slot form- 40 ing a gas passage therebetween, walls extending upwardly from said slot into the said baffle, whereby the said walls retain the absorbing medium in the gas passage when it flows downwardly through the per- 45 forations.

8. In an apparatus for absorbing light hydrocarbons having a vertical shell, a hori- 50 zontal first partition therein having perforations and a slot extending transversely across the partition, recirculating jet tubes 55 extending upwardly over the perforations and having openings at the base, side walls extending upwardly from the said slot, a top connecting the side walls, a second partition positioned below the first partition hav- 60 ing a slot therethrough, second side walls extending through said second slot into the

first slot and between the side walls extend- ing upwardly from the first partition, the said second side walls extending above the first partition and adapted to form a trap 65 with the second partition to retain absorbing medium flowing down through the said perforations.

9. An apparatus for absorbing light hydrocarbons, comprising a shell having a se- 70 ries of transverse partitions having perforations the said partitions having a transverse slot, side walls and a top extending upwardly from the slot, additional parti- 75 tions positioned below the first mentioned partitions having an upwardly extending passage into the said slots, the said passage leading above the level of the first mentioned partitions, the first mentioned partitions forming absorbing medium mixing cham- 80 bers, and means to conduct the overflow from an upper chamber through the parti- tions to the chamber next below.

10. In an apparatus for absorbing light hydrocarbons, a mixing chamber having a 85 horizontal partition with perforations there- through, a recirculating jet tube concentric with each of the perforations and having openings at the base of each tube and in- 90 clined baffles on the top of each of the said tubes.

11. An apparatus for absorbing light hydrocarbons, having a vertical shell, a hori- 95 zontal partition having perforations there- through, the shell and the partition forming a mixing absorbing medium chamber above the partition, the partition having an elon- gated opening with upwardly extending walls and a cap for said walls, a second partition below said first partition having a 100 slot with upwardly extending walls extend- ing between the first mentioned walls, the said partitions forming a gas passage there- between, a third partition positioned below the second partition forming a gas supply 105 chamber therewith and a gas inlet pipe connected through the shell to said chamber.

12. An apparatus for absorbing light hydrocarbons as claimed in claim 11, having 110 in addition a trap chamber in the shell below the third partition, a conduit passing through all the partitions whereby the absorbing medium fills the trap chamber, the conduit and the absorbing medium chamber, and a pipe extending upwardly from the 115 trap chamber, adapted to maintain the absorbing medium at a substantially constant level in the said absorbing medium chamber.

In testimony whereof I have signed my name to this specification.

JULIUS EDWARD KOBERNIK.