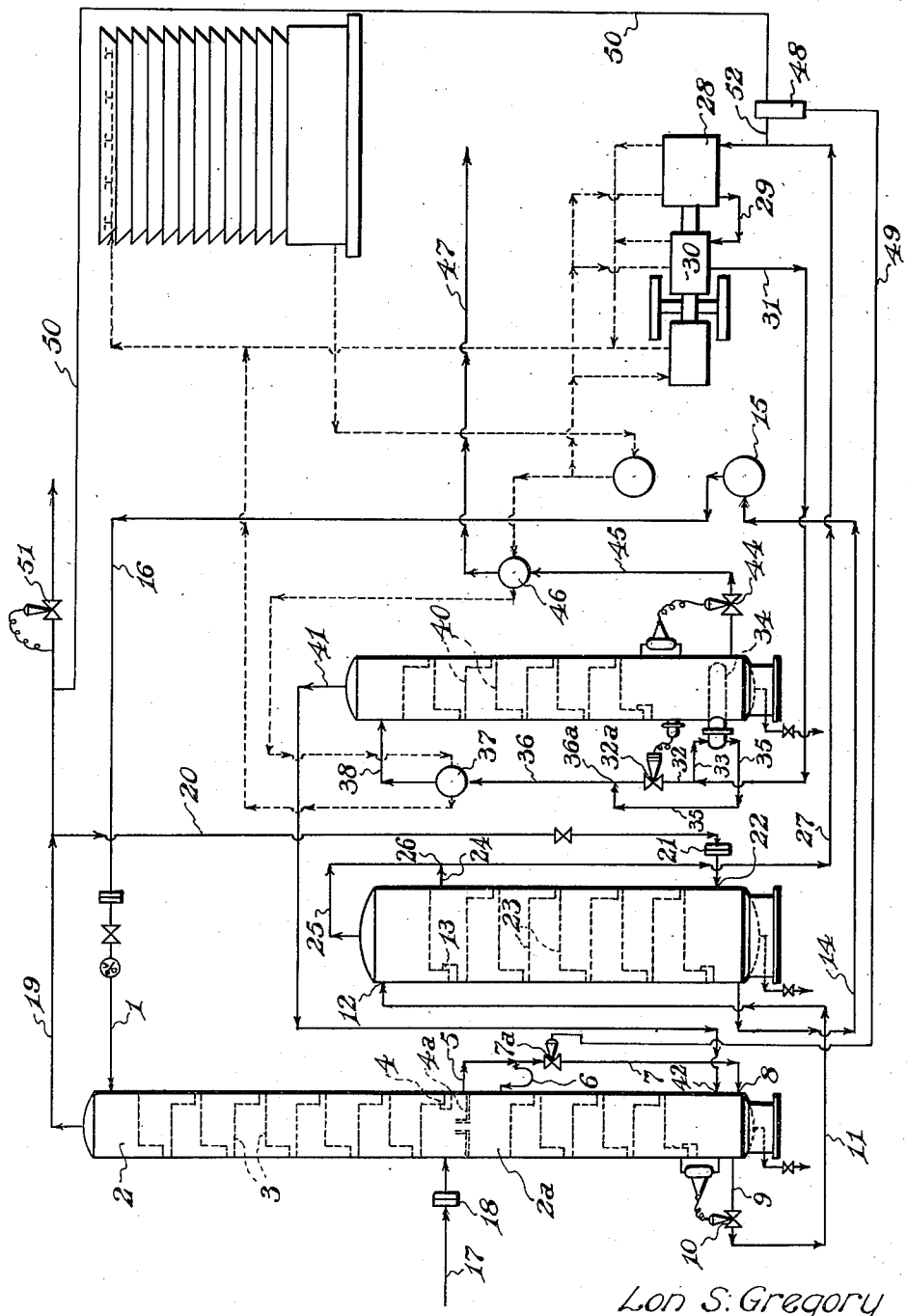
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GASOLINE PLANT

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GASOLINE PLANT

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The invention relates to gasoline plants of the character wherein natural gas from wells or any other gas containing valuable condensible constituents is passed into the system with the result of maximum recovery without the use of an outside source of heat.

A further object is to provide a gasoline recovery system which may be operated at a low initial cost and which has high salvage value.

Another object of the invention is to provide a device of this character which will minimize the operating costs by utilizing a minimum of labor.

Another object is to simplify the construction of the plant in order that the assembling or dismantling thereof may be quickly accomplished for transportation purposes.

Another object is to provide a comparatively inexpensive unit adapted to be used in areas of small production wherein the installation of expensive units would not be justified.

Another object is to provide an inexpensive recovery unit which may be installed as a unit at each well without the necessity of an expensive network of gathering lines.

A further object of the invention is to provide a device of this character, so constructed that the unit may be semi automatic and self operating over long periods of time without the necessity of an attendant.

A further object is to provide an automatic control system for a device of this character to prevent the overloading of the compressor.

A further object is to control the recycle system by means of double absorption, whereby the enriched oil carrying gasoline from the field gas is contacted with recycle vapor for further absorption, and wherein control of the amount of absorption of these recycled vapors is obtained by a control valve, actuated by the low stage suction pressure.

A further object is to flash the enriched oil under pressure conditions existing in the stripper, but without contacting the oil with the stripping gas in the flash chamber and further countercurrently stripping the flashed oil by means of lean residue gas from the absorber which acts as the stripping medium.

A further object is to utilize the hot enriched vapor from the discharge of the high stage compressor cylinder to furnish heat in the base of the fractionator by means of indirect contact.

A further object is to provide an automatic valve control in the hot vapor line to by-pass the hot vapors around the reboiler, in the bottom of the fractionator, for maintaining predetermined temperature of the gasoline in the lower end of the fractionator.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth shown in the drawing, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawing:

The single figure is a view in elevation of the system showing the oil and gas lines in full lines and the water cooling system in dotted line.

Referring to the drawing, lean oil of suitable molecular weight and boiling range characteristics is introduced into the top of the absorber 2 through pipe line 1, and this oil overflows the bubble trays 3 in counter-current contact with virgin gas, containing valuable constituents, which is introduced through pipe line 17 and meter 18 into the bottom end of the main absorber 2. By contact with the counter-current flow of the oil, this virgin gas is stripped of the greater part of its valuable volatile constituents, and this stripped gas passes out of the absorber 2 through pipe line 19 as residue gas, suitable for fuel use or any other satisfactory means of disposal.

The back pressure valve 51 on line 19 maintains proper pressure in the absorber 2. The enriched oil containing the gasoline removed from the virgin gas, overflows down spout 4 onto separator plate 4a. The enriched oil leaves the separator plate 4a through pipe line 5, and passes in part through pipe line 6 or pipe line 7, depending on the setting of the valve 7a. If, by action of the valve 7a, oil is diverted through line 6 into the top of the secondary absorber 2a, this laden oil, by its counter-current flow will absorb desired fractions from the recycled gas introduced into the secondary absorber at point 42. The oil passing through pipe line 7 is introduced into the secondary absorber at point 8 in the bottom end thereof, and mixes in the base of the secondary absorber with the laden oil which is introduced through pipe line 6 in the upper end of the secondary absorber, and which has flowed through the bubble trays. The combined streams of oil leave the secondary absorber through pipe line 9, and valve 10, which valve is liquid level controlled, and these combined oils then pass through line 11 to the top of the stripper at point 12. Part of the gasoline constituents are flashed off the oil, at this point, due to the low pressure existing in the stripper over that which exists in the absorber.

The flashed oil overflows at 13 and passes over bubble trays 23, in the stripper, where it is counter-currently stripped by means of stripping gas introduced into the stripper at point 22. This stripping gas is residue gas drawn from pipe line 19 through pipe line 20 and meter 21. The stripped or denuded oil leaves the base of the stripper through pipe line 14, and by means of a pump 15, is returned to the top of the main ab-

sorber through pipe line 16 and pipe line 1, thereby completing the oil cycle.

The vaporized gasoline from the flash operation, in the top of the stripper, leaves through pipe line 25, into pipe line 27, and is conveyed to the low-stage compressor cylinder 28. The vaporized gasoline removed from the oil, below the flash chamber, by means of stripping gas and including the stripping gas leaves through pipe line 24. Pipe lines 24 and 25 combine at 26 and the resultant mixture passes through pipe line 27 to the suction of the low-stage cylinder 28 of the compressor, and here the combined vapors are compressed in the low stage cylinder 28 and discharged through pipe line 29 to the suction of the high stage cylinder 30 of the compressor.

At this point, if economy of operation demands it, intercooling with separation of condensate may be practiced in pipe line 29. However, for simplicity sake, it is preferable that no inter-cooling take place between cylinder 28 and 30. Vapors are further compressed in the high-stage cylinder 30 and discharged hot through pipe line 31, where they, in part, pass through pipe line 33 into reboiler 34 and out to pipe line 35. The part that does not pass through reboiler 34 passes through pipe line 32, and control valve 32a, where they combine vapors from pipe line 35 at 36a, thence through pipe line 36 to cooler 37.

The proportion of the vapors that pass through pipe line 33 or 32 is controlled by the setting of the valve 32a, and this valve, in turn, is controlled by the temperature in the base of the fractionator. The vapors combined at 36a pass through pipe line 36 to water cooler 37, where they are partially condensed, and the condensate and uncondensed vapors leave cooler 37 and are introduced through pipe line 38 into the top of the fractionator. The uncondensed vapors from the fractionator leave at the top through pipe line 41, and are introduced into the base of the secondary absorber at 42.

The condensate from pipe line 38 passes down over bubble trays 40, where it is counter-currently contacted with vapors arising, due to reboiling, and are thereby fractionated. The fractionated gasoline collects in the base of the fractionator, where a proper liquid level is maintained by a liquid level control valve 44. This stabilized gasoline passes from the liquid level control valve 44 through pipe line 45 to cooler 46. The cool stabilized gasoline passes from the cooler 46 through pipe line 47 to storage or other suitable source of discharge.

Proper setting of the control valve 7a is assured by pilot 48, acting through pipe line 49, and motive power is furnished the pilot through pipe line 50, connecting the gas residue line 19 above back pressure valve 51. Proper setting of the pilot is determined by the suction pressure of low-stage cylinder 28, conveyed to pilot 48 through pipe line 52. The proper setting of valve 7a is important, for, if this setting is not correct and too much oil is introduced through pipe line 6 to the secondary absorber, excessive recycle will be produced, and the suction pressure on cylinder 28 will become excessively high, thereby overloading and shutting down the compressor. If insufficient oil, due to improper setting of valve 7a, is introduced through pipe line 6 to the secondary absorber, insufficient recycling will be set up and it will be impossible to obtain desired recovery of the more volatile constituents of gasoline.

The pilot 48 is actuated by pressure in pipe line 27 and forms a control means from power source pipe line 50 to pipe line 49, thence to diaphragm of valve 7a, therefore any change of pressure in pipe line 27 resets pilot 48 and transmits more or less gas from power source line 50 into pipe line 49, thereby resetting valve 7a by means of the changing pressures against its diaphragm.

In the event stabilized gasoline is not desired, the fractionator may be converted to the simpler accumulator tank; and the reboiler 34, control valve 32a, and cooler 46 may be dispensed with.

The unstabilized gasoline is then withdrawn to liquid level control 44 and sent through pipe lines 45 and 47 to storage. The uncondensed vapors from the accumulator are then returned through pipe line 41 to the secondary absorber at 42.

From the above it will be seen that a semi-automatic gasoline plant is provided, which may be cheaply manufactured, and one which has a high salvage value, and being semi-automatic requires very little supervision of an attendant. Also, a device of this character can be utilized in fields of small production where a more expensive plant would not be justified.

The invention having been set forth what is claimed as new and useful is:

1. A recycling gasoline recovery apparatus comprising a main absorber, a secondary absorber, a virgin gas line discharging into the main absorber, a pipe line connecting both of said absorbers and through which enriched oil passes to the secondary absorber, a stripper having a flash chamber therein, a pipe connecting the secondary absorber and the upper end of the stripper for passage of enriched oil to the stripper, a lean oil pipe connecting the stripper and the main absorber for discharging the lean stripped oil into the main absorber, a fractionator, a low stage compressor, a high stage compressor, a pipe connecting the stripper and the low stage compressor for conveying vaporized gasoline to the low stage compressor, a pipe connecting the compressors, a hot vapor pipe connecting the high stage compressor and the fractionator, a pipe connecting the fractionator and the secondary absorber for conveying uncondensed vapors to the absorber, a control valve in the pipe connecting the absorbers, a pressure responsive device, a pipe line connecting said control valve and the pressure responsive device, said control valve determining whether the laden oil will pass into the upper or lower end of the secondary absorber, a discharge line from the fractionator for stabilized gasoline, a stripped gas discharge line from the main absorber to the pressure responsive device, a reboiler in the fractionator, said reboiler having branch pipe connection with the hot vapor pipe connecting the high stage compressor to the fractionator, and a pipe connecting the stripped gas line to the stripper.

2. An apparatus as set forth in claim 1 including means whereby the enriched oil is flashed under pressure conditions existing in the stripper without contacting the oil with the stripping gas in the stripper and means for further counter-currently stripping the flashed oil by means of lean residue gas from the main absorber.

3. An apparatus as set forth in claim 1, including a cooler in the pipe line connecting the high stage compressor in the fractionator.

4. An apparatus as set forth in claim 1 including a pump in the lean oil line connecting the stripper to the main absorber.

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