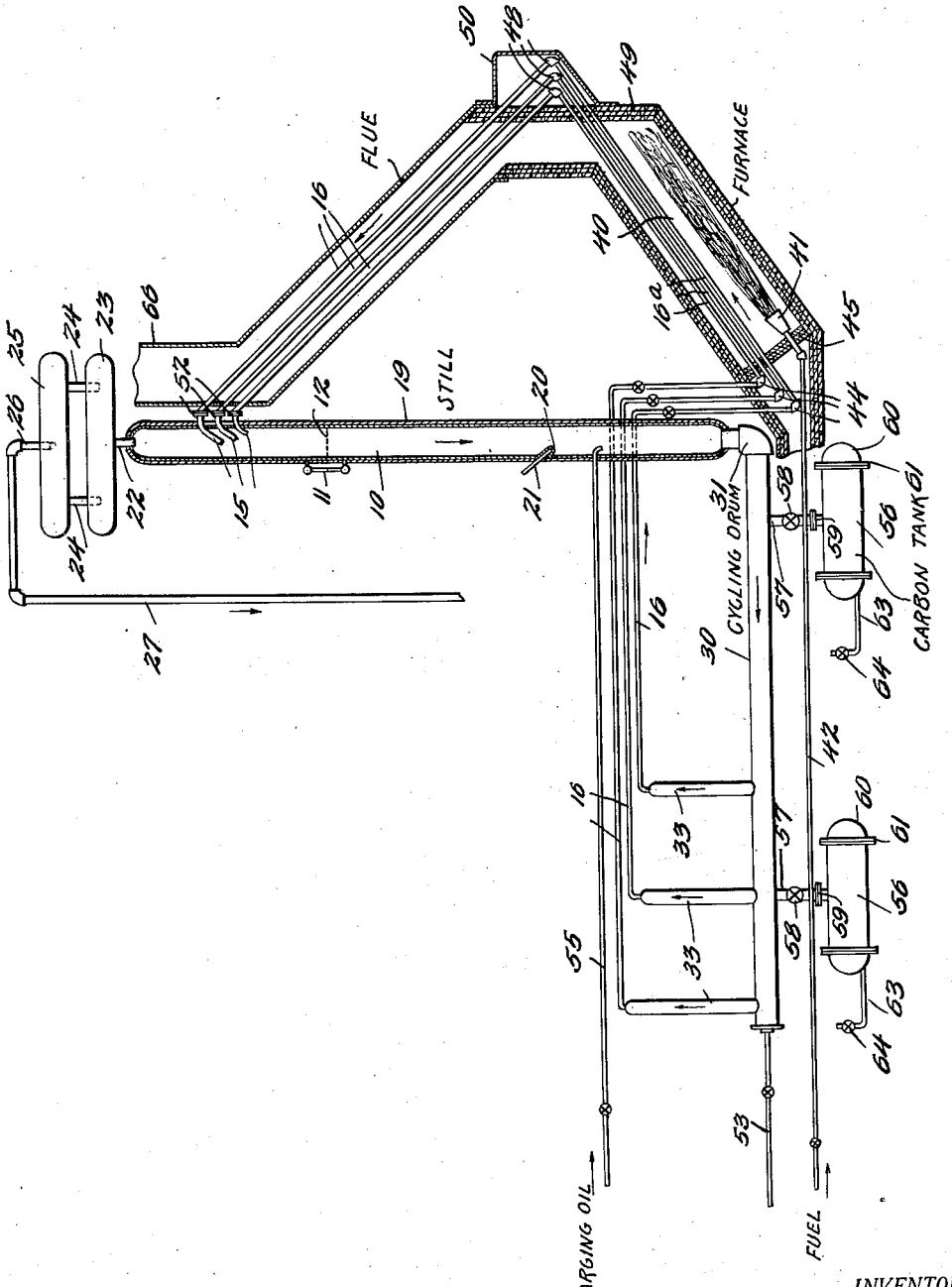
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METHOD AND APPARATUS FOR CRACKING OIL

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METHOD AND APPARATUS FOR CRACKING OIL

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This invention relates to the cracking of oil and has for its principal object the provision of a method and apparatus for carrying out a process of cracking oil which eliminates all cycling pumps and gives a higher yield of gasoline with the heavier topped oils.

The invention relates particularly to the convenient recovery of gasoline from lower grade oils more especially to natural crudes which have already been passed thru a process which has removed practically all of the natural gasoline content of the crude oil. The drawings are rather diagrammatical as the exact configuration of the equipment would depend quite largely upon the size of the main still which in turn is dependent upon the desired number of barrels per day capacity per unit installation.

The drawing represents a view of an apparatus which has been used in carrying out the process.

The main still 10 is vertical, fairly small in diameter and quite tall in proportion. As we increase the diameter of the still we increase its height but not in a constant ratio. In our early still the diameter was 12 inches and we found the correct height to be about 24 feet, but increasing the diameter to five feet we found that about 32 feet was the best height and on doubling this latter diameter we have selected a height of 50 feet as being the most suitable. About two-thirds of the way up we provide a gage glass 11 so as to maintain the oil level at a point such as indicated at 12 which gives us a drop of at least four feet from the downwardly directed discharge ends 15 of the circulating pipes 16 which are preferably quite small, four inches having been found to be the best size and increasing in number with the size of the still. With a 5 ft. still we use fourteen pipes staggered and clustered so as to receive the heat evenly.

The still is heavily insulated as indicated at 19 and has a heat well 20 to receive a heat thermometer 21 to indicate the temperature under which the still is operated, this temperature running from 800° F. to 900° F. with a pressure of 100 to 200 pounds corresponding to a cracking temperature of 1400° F. to 1500° F., this being suitable for a heavy topped oil. At the top the still receives a sleeve 22 from the lower fractionating drum 23 which in turn receives two sleeves 24 from a similar fractionating drum 25 above, the latter having an outlet pipe 27 leading the gasoline vapors to a condenser not shown and of any one of the commercial types. The object of having the sleeves 22 and 24 in the design indicated is so that when the liquid creeps up the walls of the drum or still as it tends to do, it will drop back into the drum or still as the case may be and thus insure that only vapors shall pass to the condenser pipe 27, this action also being very materially aided by the staggering of the sleeves 24 with respect to the sleeve-like end 26 of the pipe 27 and the sleeve 22. While we have shown but two fractionating drums, with the larger sizes of still we would naturally increase the number of these, preserving however, the staggered relation of the sleeves. We have found however, that for sizes up to a thousand barrels per day two drums are ample.

At the bottom the still connects with a cycling drum 30 by means of an elbow 31 preferably about the same diameter as the cycling drum itself which drum has a diameter of about ¾ the diameter of the main still, but in the larger sizes of still may be somewhat less in diameter. The cycling drum 30 has a plurality of risers 33 each of approximately half the cross sectional area of the cycling drum, and each communicating independently with a circulating pipe 16 all of which, staggered and clustered as before mentioned lead to the cracking chamber 40. Heat is furnished by a burner 41 receiving fuel oil from the fuel feed line 42, the burner being so arranged that the flames shall not touch the pipes 16. We try to place the pipes just as near as we possibly can to the flame but insuring absolutely that the flame shall not touch the pipes as this would cause a rapid deterioration of the pipe and also a rather harmful effect on the oil.

It will be noted that the sections 16a of the pipe, which are slanted at an angle of about 45°, are single pieces and that the

couplings 44 at the lower end are outside of the furnace wall 45 and that the elbows 48 or return bends at the upper end of the pipe section 16*a* are also outside of the furnace wall 49, a cover 50 preferably of cast iron shielding the exposed sections of the pipes while rendering them very convenient of access. The construction just recited renders it very simple to remove a section 16*a* of the circulating line since the flanges 44 and the elbows 48 are both in a convenient location to work upon. The elbows 48 or return bends have flanges to make it still simpler to remove the pipe sections and it is also somewhat more convenient to clean the pipes either above or below the return bends at this point as by means of a turbine cleaner, for example, if they are appreciably corroded.

From the return bends or elbows 48 the pipes continue in the stack upward at an angle of 45° passing entirely thru the stack just beyond which are located the flanges 52 which bolt the sections to the discharge ends 45 which are directed downward so as to discharge the frothy liquid against the far wall of the still which thus acts as a baffle, the better to release the gases. At the liquid level in the still the oil is in a highly agitated foamy condition entering the still in the form of a spray from the various circulating pipes, aiding in the separation of the liquid oil from the vapor.

The oil in the still 10 gradually is drawn down thru the cycling drums up thru the separating towers 33 and back thru the circulating pipes 16. If desired a fuel oil may be withdrawn from the cycling drum 30 thru the pipe 53 if such fuel oil is wanted but generally we prefer that the oil be entirely divided into gasoline and carbon to the limit of recovery which naturally varies with the oil that is being handled. With a heavy Smackover oil for example, the gravity of which runs from 17° to 21°, we can recover 65% pressure distillate or better, while with a higher gravity oil we can recover up to 90% pressure distillate, which of course must be carefully treated and deodorized in order to have it of commercial grade.

We very much prefer that the oil supplied to this unit shall be topped, that is, an oil which has already been treated in the ordinary topping or skimming still. The residue from such operation is delivered to the still 10 thru the pipe 55 under pressure and at a temperature of about 400° F. for best results. As will be noted the intake is near the bottom of the still. The oil gradually increases in carbon content and this free carbon passes into the carbon tanks 56 each of which communicates thru a pipe 57 with the cycling drum. The carbon tanks are readily removable by closing the valve 58 and unfastening the flanges 59 whereupon the tank after cooling may be cleaned by removing one of the heads 60 at its flange 61. We also provide an outlet pipe 63 having a valve 64 so that we can draw off the carbon without detaching the tank entirely, accomplishing this purpose by admitting cold water to the carbon tank so as to blow off the carbon. This particular procedure is somewhat dangerous and while we use it ourselves, we would recommend that the drums be emptied and cleaned by being removed from the system as this procedure is quite simple.

It is however, very essential that the carbon be removed before the tanks overflow as when this happens the carbon will remain in the cycling drums passing with the lighter oil to the pipes 16 and in spite of the very high velocity of the oil in these pipes the carbon will coke and very seriously affect the life of the circulating line. With reasonable care in keeping the carbon tanks empty and clean at all times the speed of the oil thru the pipes 16 keeps them clean since the flame is all spent before it strikes the circulating line and thus except under very unusual conditions there is no clogging at all in the pipes 16. The stack 66 is of such size as conveniently to receive the cluster of pipes. We prefer that the carbon drums shall be of the same diameter as the main still altho obviously this is not at all important but the tanks should however be of reasonably great capacity to insure the smooth running of the apparatus.

What we claim is:

1. The process of cracking oil which consists in delivering small quantities of a heated topped oil to a large body of oil, flowing a portion of the body of oil continuously thru a horizontal lower drum and past carbon settling chambers, then up thru towers of smaller diameter, heating this latter portion of the oil to a cracking temperature, discharging the partially cracked oil at an angle to the larger body of oil so as to create a froth at the oil level, and condensing the vapors arising from the main body of oil.

2. The process of cracking oil which consists in heating a small quantity of topped oil to a cracking temperature between 1400° F. and 1500° F., discharging the heated oil while passing it through cracking pipes to a larger body of oil at an angle thereto to form a froth at the oil level, drawing oil from the large body, progressively increasing the speed of travel of the drawn off oil as it passes back to the cracking pipes, collecting carbon from the system by settling, condensing the vapors from the larger body of oil while holding the larger body of oil at a pressure of from 100 to 200 pounds and at a temperature of from 800° F. to 900° F. so

that the speed of travel of the oil thru the cracking pipes will scour the pipes.

3. In a device of the character described, a vertical still at least five times as high as its diameter, a plurality of fractionating drums directly above the still, a sleeve extending from the lower drum into the still, a plurality of sleeves projecting from the upper drum into the lower drum, a pipe line extending into the upper drum for the carrying away of vapors therefrom, and means for discharging partially cracked oil into the unobstructed still with a baffle effect.

4. In a device of the character described, a plurality of cracking pipes arranged at an angle of 45° to horizontal and vertical, a furnace surrounding said pipes, a stack leading upward from the furnace, a plurality of pipes extending upward at an angle to horizontal thru the stack, and return bends located outside of the stack and furnace for connecting the two sets of pipes.

5. In a device of the character described, a vertical still, a horizontal cycling drum connected to the still and of smaller diameter, a plurality of settling towers rising vertically from the cycling drum and of smaller diameter than the cycling drum, a cluster of cracking tubes and means for conveying oil from the tops of the towers thru the cracking tubes and delivering such oil to the still.

6. In a device of the character described, a sloping furnace, a stack communicating with the furnace and extending upward substantially at right angles thereto, a vertical stack extending upward from the sloping stack, a cluster of circulating pipes extending thru the furnace, a corresponding cluster of pipes extending thru the sloping stack, and means located outside of the stack and furnace for connecting the pipe sections.

7. In a device of the character described, a sloping furnace, a sloping flue communicating therewith, circulating pipes extending thru the furnace and flue and having junctions outside of the flue and furnace, a still, angular discharge sections secured to the pipes between the flue and still, a plurality of fractionating drums above the still, a cycling drum, of smaller diameter than the still communicating with the bottom of the still, a plurality of readily detachable carbon tanks communicating with the cycling drum and at a lower level, a plurality of towers rising from the cycling drum, means connecting the towers and pipes, and means for withdrawing carbon from said tanks without detaching said tanks from the system.

In testimony whereof we affix our signatures.

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