

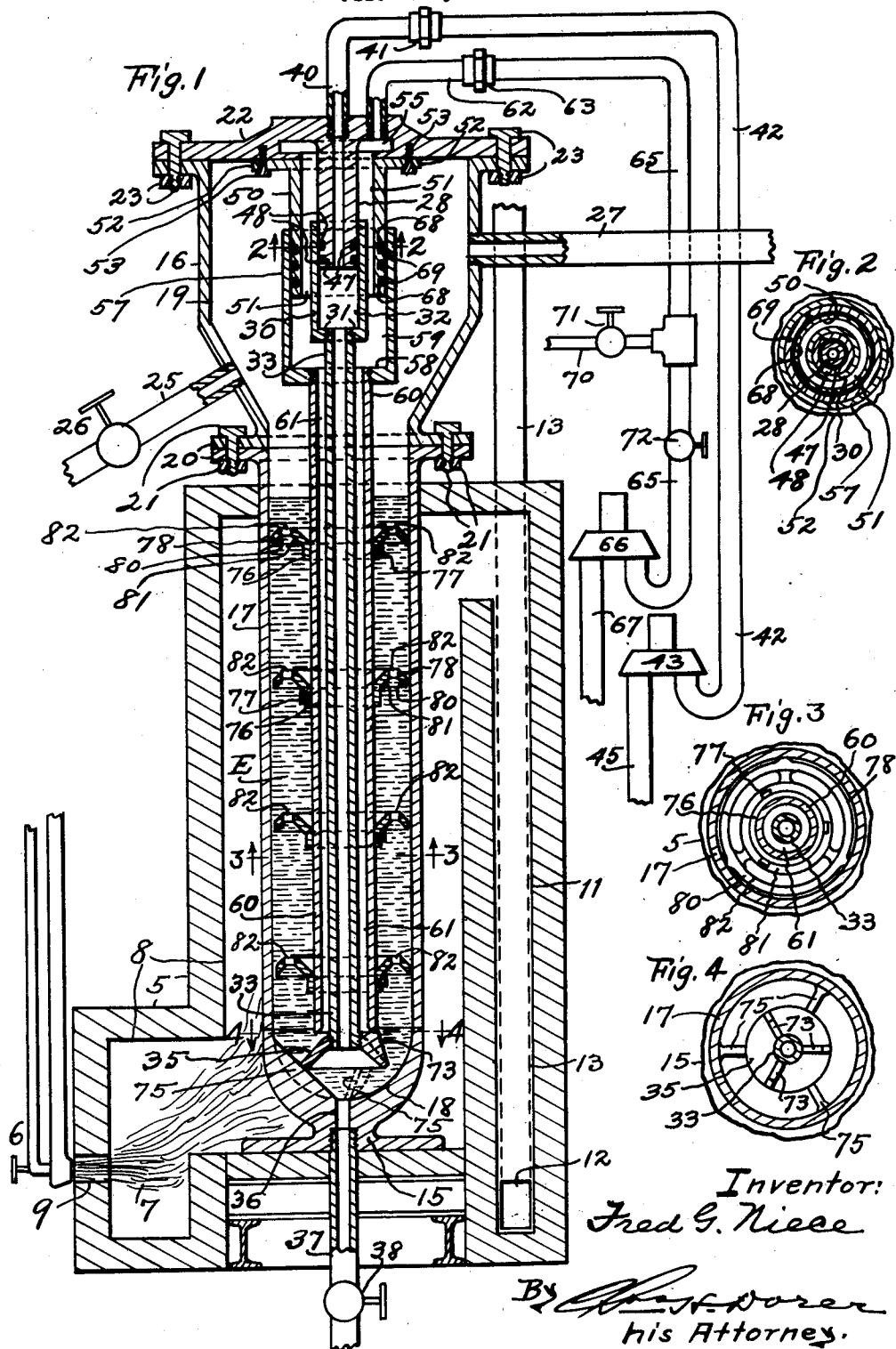
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F. G. NIECE

APPARATUS FOR TREATING HYDROCARBONS

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TREATING HYDROCARBONS.

Application filed July 17, 1922. Serial No. 575,617.

To all whom it may concern:

Be it known that I, FRED G. NIECE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Apparatus for Treating Hydrocarbons, of which the following is a specification.

This invention relates to improvements in apparatus for treating hydrocarbons, and more especially to an apparatus in which hydrocarbons to be treated are fed into a molten body which is penetrable by hydrocarbons and heated to but not vaporizable at the desired hydrocarbon-cracking temperature and contained in a receptacle in which hydrocarbons are to be subjected to the heat of and within said molten body.

In feeding liquid hydrocarbon heavier than gasoline, or hydrocarbon vapors heavier than gasoline vapors, into said molten body by an upright pipe arranged internally of said receptacle and materially directly exposed to the molten body it is found that, with a conversion as high or higher than twenty per cent of said liquid hydrocarbon or vapors into gasoline, said pipe soon becomes choked with carbon deposited or accumulating on the interior surfaces of the pipe, and that, when said internal pipe is covered with heat-resisting material such, for instance, as asbestos, to prevent overheating of the oil or vapors being fed by the pipe, the pipe-covering becomes soaked with or penetrated by molten material and soon disintegrates whereupon the pipe becomes excessively heated by the molten body to such an extent as to overheat said oil or vapors and thereby result in the deposition or accumulation of carbon on the aforesaid surfaces.

Also, it is found that, when hydrocarbon gases only, or hydrocarbon gases and accompanying vapors which have passed uncondensed through a condenser of the hydrocarbon-cracking system comprising the hereinbefore mentioned receptacle, are fed through an upright internal pipe exposed to the heat of said molten body, no appreciable carbon is deposited on the interior surfaces of the pipe.

Also, in the use of a receptacle supplied with said molten body and a stationary hydrocarbon-feeding pipe or pipes extending from above and into said molten body it has

been found that, when the heating of said receptacle and contents are interrupted as required for an interruption in the operation of the apparatus preparatory to making repairs, or for any other reason such, for instance, as a temporary exhaustion or stoppage in the supply of hydrocarbons, said molten body cools and becomes a solid body by which said pipe or pipes are tightly embraced and, when said receptacle and contents are again being heated as required for a resumption of the operation of the apparatus, there may be such an abnormal rise in the pipe-embracing cooled and solidified material as to result in a detrimental, if not ruinous, buckling, crumpling or distortion of said pipe or pipes.

One object of my present invention is not only to dispense with a heat-resisting covering for the hereinbefore first-mentioned internal feed-pipe, but to prevent overheating of the oil or oil-vapors being fed by said pipe by having said pipe arranged internally of and spaced from the interior surfaces of and extending up and down an upright pipe employed in the feeding, into the molten body, of steam, or gases and vapors which have passed uncondensed through a condenser of the hydrocarbon-cracking system, or said vapors and gases together with steam.

Another object is to positively prevent buckling, crumpling or distortion of said upright internal pipes.

Another object is to have the outer of said upright internal feed-pipes movable endwise and arranged normally in its lowermost position, to have the inner internal feed-pipe movable upwardly during upward movement of the outer internal feed-pipe and arranged in its lowermost position in the lowermost position of the last-mentioned pipe, and to utilize each of said pipes in feeding matter into the molten body from an associated stationary external pipe outside of the molten-body-containing receptacle without interrupting communication between said external pipe and the associated internal feed-pipe during endwise movement or in any position of the last-mentioned pipe.

Another object is to insure lowering of said inner internal feed-pipe, by and during the descent of the outer internal feed-pipe upon the rise of both of said pipes from their lowermost position.

Another object is to prevent backing up, within the inner internal feed-pipe, of gases generated in said pipe, and to effect a lateral distribution of hydrocarbons discharged
5 at the lower end of said pipe.

Another object is to effect said lateral distribution of hydrocarbons by an annular downwardly flaring member connected to the lower end of the internal feed-pipe, and
10 to seat said flaring member on spaced projections of the bottom of the molten-body-containing chamber so as not to materially obstruct the discharge of matter through said flaring member into the molten body.

Another object is to seat the outer internal feed-pipe on said flaring member in such a manner that material obstruction to the discharge of matter from said pipe into the molten body, and a detrimentally material
15 exposure of the inner internal feed-pipe directly to the molten body, are successfully prevented.

Another object is to prevent undue lateral swaying of the outer internal feed-pipe and to provide, internally of the hereinbefore mentioned receptacle and next externally of
20 said pipe at different heights, improved means for deflecting hydrocarbons ascending within the molten body between said pipe and the surrounding wall of the molten-body-containing chamber.

With these objects in view, and to attain any other object hereinafter appearing, this invention consists in certain features of construction, and combinations and relative arrangements of parts, hereinafter described in this specification, pointed out in the claims, and illustrated in the accompanying
25 drawings.

In said drawings, Figure 1 is a side elevation, largely in section and partly diagrammatic, of my improved apparatus. Fig. 2 is a transverse section taken along the line 2—2, in Fig. 1. Figs. 3 and 4 are transverse sections taken along the line 3—3 and
30 line 4—4, respectively, in Fig. 1, with the molten body omitted.

Referring to said drawings, 5, indicates the casing of a heating furnace comprising an oil-burner 6 the flames or fire 7 issuing from which, during the operation of the furnace, enter the combustion and heating chamber 8 through an aperture 9 in the furnace-front. Said chamber extends rearwardly from said aperture and thence upwardly and discharges at its upper end into a flue 11 communicating at its lower end, as at 12, with a stack 13. Surrounded by
35 said chamber is a hydrocarbon-cracking receptacle preferably consisting of a steel base 15, a top steel section 16 and an intermediate section 17. The base 15 is secured in place in any approved manner, and the top section 16 is arranged above the furnace-casing 5. The intermediate section 17 con-
40

sists of a vertical steel tube which is circular in cross-section and has suitable dimensions such, for instance, as a diameter of from twelve to fifteen inches and a height of from ten to fifteen feet. Said
45 tube forms the surrounding wall of the main portion of the hydrocarbon-cracking chamber, and the base 15 has a cavity 18 forming the lower end of said chamber. The tube 17 communicates with the chamber 19 formed interiorly of the top section 16 and forming the upper end portion of the hydrocarbon-cracking chamber. Preferably adjacent ends of the base 15 and tube 17 are welded together, and adjacent ends of the
50 top section 16 and tube 17 have external flanges 20 secured together, as at 21, by bolts and nuts. The chamber 19 in the top section 16 is closed at its upper end preferably by a steel head 22 removably secured to the body of said section by bolts and nuts, as at 23. Preferably the chamber 19 measures in diameter at its lower end substantially the same as the internal diameter of the tube 17 and is diametrically
55 larger above its lower end portion and shown provided with an outwardly and downwardly extending pipe 25 having a normally closed valve 26.

A vapor-conducting pipe 27, forming the vapor-outlet of the hereinbefore mentioned hydrocarbon-cracking receptacle, communicates with the diametrically larger portion of the chamber 19 and is employed in conducting gases and vapors from said receptacle to a condenser not shown.
60

Said receptacle contains the hereinbefore mentioned molten body, and E in Fig. 1, indicates said molten body. Said molten body consists of a low-melting metal or material such, for instance, as lead which has a melting point lower than the temperature required to be established and maintained in said receptacle during the operation of the apparatus and is readily penetrable, in a molten condition, by hydrocarbon fluids and not vaporizable at said temperature. Preferably said molten body has its level or surface adjacent the top of the furnace-casing 5.
65

The head 22 is provided, at its inner side and preferably centrally, with a vertically downwardly projecting integral tubular member 28 which is therefore arranged in and centrally of the upper end portion of the hydrocarbon-cracking receptacle and consequently above the molten body E. Said member 28 is therefore stationary and preferably circular in cross-section.
70

Said tubular member 28 is slidably embraced and surrounded by the upper portion of a vertical cylinder 30 preferably of steel and movable endwise of said member 28. Said cylinder is spaced, in its lowermost and normal position, downwardly from the upper extremity of and extends below the
75

member 28 and is arranged above the molten body E. Said cylinder has a head 31 at its lower end, and said head is spaced downwardly from the lower extremity of the tubular member 28, and 32 indicates the cylinder-chamber between the cylinder-head 31 and the lower end face of the member 28.

A vertical pipe 33, for feeding hydrocarbon oil heavier than gasoline, or hydrocarbon oil vapors heavier than gasoline vapors, is arranged wholly within and centrally of the hydrocarbon-cracking receptacle and threaded at its upper end into the head 31 and communicates with the chamber 32 and consequently with the tubular member 28. The feed-pipe 33 extends from the head 31 into the lower portion of said receptacle but is not detrimentally exposed, as will hereinafter appear, to the molten body E. Said feed-pipe 33 is provided, at its lower end, with a downwardly flaring annular member 35 preferably of steel, and said pipe discharges through said flaring member into the molten body E. The flaring member 35 is adapted to distribute the discharge from the feed-pipe 33 and helpful in preventing the backing up, within said pipe, of gases generated in the pipe.

The base 15 is shown provided centrally with a hole 36 extending downwardly from the bottom of the molten-body-containing chamber, and a pipe 37, for draining molten material from said chamber when desired, is secured to said base and communicates with said hole and therefore with said chamber. The drain-pipe 37 extends downwardly from the base 15 and below the hereinbefore mentioned furnace and is provided with a normally closed valve 38.

A pipe 40, for conducting fuel oil, or other liquid hydrocarbon heavier than gasoline, or hydrocarbon oil vapors heavier than gasoline vapors, from a point externally of the hydrocarbon-cracking receptacle, is secured, adjacent the upper end of the tubular member 28, to the head 22 and communicates with said member 28 and is therefore in communication with the feed-pipe 33. The pipe 40 extends upwardly from the head 22 and then laterally and is detachably connected, by a union 41, to and communicates with a pipe 42, and a diagrammatically illustrated pump 43 is interposed between the pipe 42 and a pipe 45 by which liquid hydrocarbon or hydrocarbon oil vapors to be treated are supplied. Said pump is employed in forcing said oil or vapors from the pipe 45 into the pipe 42 and through the pipe 40 into the tubular member 28 and thence through the chamber 32 and oil-feeding pipe 33 to the molten body.

Preferably the lower end portion of the member 28 (see Figs. 1 and 2) is provided, at its outer circumference, with vertically spaced annular grooves 47, and each groove

47 is engaged by a split resilient steel packing ring 48 embraced by the cylinder 30 and participating in the formation of a substantially fluid-tight joint between said cylinder and the member 28.

The head 22 is provided, at its inner side and externally of the tubular member 28 and externally of the cylinder 30, with a vertically downwardly projecting integral tubular member 50 which is therefore stationary and arranged in the upper end portion of the hydrocarbon-cracking receptacle and surrounds and extends endwise of the members 28 and 30. The tubular member 50 is preferably circular in cross-section and measures enough more in internal diameter than the external diameter of the cylinder 30 to effect the formation, between the member 50 and members 28 and 30, of a passage 51 which extends endwise of and surrounds said members 28 and 30. Preferably the members 28 and 50 are concentric in relation to each other, and the member 50 is shown provided at its upper end with an external annular flange 52 secured, by bolts or screws 53, to the head 22. The passage 51 is in communication with an annular chamber 55 formed in the head 22 and surrounding the upper end portion of but out of communication with the member 28.

The tubular member 50 is slidably embraced and surrounded by the upper end portion of a cylinder 57 preferably of steel and movable endwise of the member 50, and said cylinder, in its lowermost position, is spaced downwardly from the under side of the flange 52 and extends not only below said member 50 but below the cylinder 30 and is arranged above the molten body E. The cylinder 57 has a head 58 at its lower end, and said head 58 is spaced downwardly from the lower extremity of the cylinder 30, and 59 indicates the cylinder-chamber between the heads 31 and 58 and extending around the lower portion of the cylinder 30. By the hereinbefore described construction and relative arrangement of parts it will be observed that the cylinders 30 and 57 are substantially concentric in relation to each other.

The feed-pipe 33 is arranged internally and substantially centrally of a vertical feed-pipe 60 arranged wholly within and centrally of the hydrocarbon-cracking receptacle. The outer internal feed-pipe 60 therefore surrounds the inner internal feed-pipe 33 and is threaded at its upper end into the cylinder-head 58 and communicates with the cylinder-chamber 59 and passage 51. The feed-pipe 60 is therefore in communication with the tubular member 50 externally of the tubular member 28 and cylinder 30 and in open relation with the chamber 55. Preferably the feed-pipes 33 and 60 are concentric in relation to each other, and the

pipe 60 measures enough more in internal diameter than the pipe 33 measures in external diameter to effect the formation, between said pipes, of a suitable passage 61 which surrounds the pipe 33 and extends from end to end of the pipe 60. The pipe 60 extends from the cylinder 57 into the lower portion of the molten body E and is shown discharging at its lower end, into said molten body. The pipe 60 is movable endwise and shown in its lowermost position.

A pipe 62, for conducting hydrocarbon gases only, or hydrocarbon gases and accompanying vapors which have passed uncondensed through a condenser (not shown) of the hydrocarbon-cracking system comprising the hereinbefore mentioned hydrocarbon-cracking receptacle, or steam with or without the last-mentioned vapors and gases, from a point externally of said receptacle, is secured at the chamber 55 to the head 22 and communicates with said chamber and is therefore in communication with the passage 61 formed in the outer internal feed-pipe 60 and externally of the inner internal feed-pipe 33. The pipe 62 extends upwardly from said head 22 and then laterally and is detachably connected, by a union 63, to and communicates with a pipe 65, and a diagrammatically illustrated gas-pump 66 is interposed between the pipe 65 and a pipe 67 by which hydrocarbon gases only, or hydrocarbon gases and accompanying vapors which have passed uncondensed through a condenser (not shown) of the hereinbefore mentioned hydrocarbon-cracking system is supplied. The pump 66 is employed in forcing hydrocarbon gases, or hydrocarbon gases and accompanying vapors, from the pipe 67 into the pipe 65 and through the pipe 62 into the chamber 55 and thence through the tubular member 50 externally of the members 28 and 30, and therefore through the passage 51 and cylinder-chamber 59 to and through the pipe 60 externally of the pipe 33 into the lower portion of the molten body E.

Preferably the lower end portion of the member 50 is provided, at its outer circumference, with vertically spaced annular grooves 68, and each groove 68 is engaged by a split resilient steel packing ring 69 embraced by the cylinder 57 and participating in the formation of a substantially fluid-tight joint between the members 50 and 57.

The packing rings 48 and 69, and also the opposing vertical surfaces of the members 28 and 30 and the opposing vertical surfaces of the members 50 and 57, are lubricated in any approved manner as, for instance, by graphite.

A steam-pipe 70 communicates with the pipe 65 and is provided with a normally closed valve 71, and the pipe 65 is provided, between said steam-pipe and the pump 66,

with a normally open valve 72. Obviously therefore, steam may be supplied to the feed-pipe 60, when desired, upon opening the valve 71.

By the hereinbefore described relative arrangement of the parts it will be observed that the inner internal feed-pipe 33 is adapted to feed matter to the molten body adjacent the lower end of the outer internal feed-pipe 60, and that the last-mentioned pipe, surrounding and extending substantially from end to end of and being spaced from the pipe 33, and the matter passing through the passage 61 into the molten body E, prevent overheating of the pipe 33 and matter fed by said pipe 33, so that there is no liability of troublesome deposition of carbon in said pipe 33 during the feeding of liquid hydrocarbon heavier than gasoline, or hydrocarbon oil vapors heavier than gasoline vapors, through said pipe 33 into the molten body.

Preferably the downwardly flaring member 35 of the inner internal feed-pipe 33 not only extends under the lower end of the outer internal feed-pipe 60, but laterally beyond said pipe 60, and is preferably somewhat larger diametrically at its lower end than the lower end of said pipe 60. Said flaring member 35 is provided under the pipe 60 with projections 73 spaced circumferentially of the pipe 33 and arranged to form seats for the pipe 60 in the lowermost position of said pipe 60. The seating of the pipe 60 on the projections 73 in said position of said pipe prevents material obstruction to the discharge from said pipe into the molten body E, and insures the retention of the pipe 33 in its lowermost position in the lowermost position of the pipe 60. That is, the projections 73 and the lower end face of the pipe 60 constitutes means whereby, should both pipes rise from their lowermost position, descent of the pipe 33 is positively effected during descent of the pipe 60. As already hereinbefore indicated, the pipe 60 has limited endwise movability, and the pipe 33 is movable upwardly during upward movement of the pipe 60. The limited movability of the pipe 60 in an upward direction in the lowermost position of said pipe, and the movability of the pipe 33 in said direction during upward movement of the pipe 60, serve to prevent distortion of said pipes.

During the operation of the apparatus the pumps 43 and 66 are simultaneously operated as required to force the matter to be fed by the pipes 33 and 60 under substantially the same pressure into the cylinders 30 and 57 and under a pressure greater than the pressure exerted at its base by the molten body E per se, and the upwardly facing inner surface of the head 58 of the cylinder 57 is large enough to cause the

pressure exerted thereon, during the operation of the pump 66, to positively retain the pipe 60 and the pipe 33 in their lowermost position so that, upon interruption of the operation of the apparatus, enough pressure remains on the upper surface of said cylinder-head to retain the cylinder 57 and connected pipe 60 in their lowermost position until the molten body has cooled enough to become solidified the extent required to retain the pipe 60 in its lowermost position independently of said pressure. Should the pipes 33 and 60 ascend during the heating of the hydrocarbon-cracking receptacle and contents for a resumption of the operation of the apparatus, the recurrence of pressure on the inner face of the cylinder-head 58, by the resumption of the operation of the pump 66, insures the descent of the pipe 60 and pipe 33 into their lowermost position and thereupon their retention in said position during the operation of the apparatus.

Preferably the base 15 is provided at the bottom of the molten-body-containing chamber with several ribs or projections spaced circumferentially of the hole 36, and the downwardly flaring member 35 of the feed-pipe 33 is seated, in the lowermost position of said pipe 33, on said projections so that the discharge of matter from said pipe is not materially obstructed during the operation of the apparatus.

The outer internal feed-pipe 60 is shown provided externally with several annular deflectors preferably of steel and arranged at different heights respectively between the level of the molten body E and the flaring member 35 of the feed-pipe 33 and each comprising a central annular body 76 surrounding and adjustable endwise of said pipe and secured in the desired adjustment by suitably applied set-screws 77. Said body 76 is provided at its upper end with a laterally and outwardly projecting annular member 78 the under side of which comprises two oppositely arranged inclined surfaces 80 and 81 which extend circumferentially of the pipe 60 and face downwardly and toward each other. The member 78 of each deflector has passages 82 spaced circumferentially of the pipe 60 and extending vertically through the deflector between the surfaces 80 and 81 of the deflector. The surfaces 80 and 81 of the deflectors are materially helpful in effecting an intimate relation between hydrocarbons or matter ascending in the molten body and in facilitating the cracking or desired treatment of said hydrocarbons in the molten body and the production of the desired resulting product.

What I claim is:—

1. Hydrocarbon-treating apparatus comprising a closed receptacle which has a vapor-outlet and contains a molten body

penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, two upright feed-pipes arranged in said receptacle and adapted to be employed in feeding matter into said molten body and disposed the one in and spaced from the other, means for supplying matter to the inner of said pipes, and means for supplying matter to the outer of said pipes, said pipes having limited endwise movability.

2. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, two endwise movable upright feed-pipes arranged in said receptacle and adapted to be employed in feeding matter into said molten body and disposed the one in and spaced from the other, means for supplying matter at the upper end of and to the inner of said pipes, means for supplying matter at the upper end of and to the outer of said pipes, and means whereby the outer of said pipes, when both pipes are in their lowermost position, is caused to move upwardly during upward movement of the inner of said pipes.

3. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an upright pipe arranged to feed matter into said molten body, an inner pipe arranged internally and extending endwise of and spaced from the first-mentioned pipe and adapted to feed matter to the molten body, means for supplying matter to said inner pipe, and means for supplying matter to said first-mentioned pipe, said first-mentioned pipe having limited endwise movability independently of the aforesaid inner pipe.

4. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an endwise movable upright feed-pipe discharging into said molten body, and an upright feed-pipe arranged internally of and spaced from the first-mentioned pipe and movable upwardly during upward movement of said first-mentioned pipe.

5. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an upright feed-pipe internally of said receptacle and extending and discharging into said molten body, and an upright feed-pipe arranged internally of the

first-mentioned pipe and provided with a downwardly flaring member extending under said first-mentioned pipe.

6. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an upright feed-pipe internally of said receptacle and extending and discharging into said molten body, and an upright feed-pipe arranged internally and extending endwise of the first-mentioned pipe and provided with a downwardly flaring annular member which extends under and laterally beyond said first-mentioned pipe and is larger diametrically at its lower end than the lower end of said first-mentioned pipe.

7. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an endwise movable upright feed-pipe internally of said receptacle and extending and discharging into said molten body, an upright feed-pipe arranged internally and extending endwise of the first-mentioned pipe and movable upwardly during upward movement of the first-mentioned pipe, and means whereby, when both pipes have risen, descent of the second-mentioned pipe is positively effected during descent of the first-mentioned pipe.

8. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an endwise movable upright feed-pipe arranged internally of said receptacle and discharging into the molten body, and an upright feed-pipe arranged substantially centrally and extending endwise of the first-mentioned pipe and provided at its lower end with a downwardly flaring member which extends under said first-mentioned pipe, said flaring member being provided under said first-mentioned pipe with spaced projections forming seats for said first-mentioned pipe in the lowermost position of said first-mentioned pipe.

9. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature and is provided at its bottom and internally with spaced projections, an endwise movable upright feed-pipe arranged substantially centrally of said receptacle and discharging into the molten body, an upright feed-pipe arranged substantially centrally and extending endwise of the first-mentioned pipe and provided at its lower

end with a downwardly flaring annular member which extends under said first-mentioned pipe, said first-mentioned pipe in its lowermost position being seated on said flaring member, the second-mentioned pipe being movable upwardly during upward movement of the first-mentioned pipe, and said flaring member being seated on the aforesaid projections in the lowermost position of the second-mentioned pipe.

10. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an upright endwise movable feed-pipe arranged in said receptacle and discharging at its lower end into said molten body, and a perforated deflector submerged in said molten body and arranged externally and extending circumferentially of said pipe and spaced upwardly from the lower extremity of the pipe, said deflector being carried by and movable with said pipe.

11. Apparatus of the character indicated, comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an endwise movable upright-feed-pipe arranged in said receptacle and discharging at its lower end into the molten body, means for supplying matter to said pipe, a feed-pipe arranged in and extending endwise of the first-mentioned pipe and discharging at its lower end, means for supplying matter to the second-mentioned pipe, and a perforated deflector submerged in the molten body and spaced upwardly from the lower extremity and arranged externally and extending circumferentially of and movable with the first-mentioned pipe.

12. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body penetrable by hydrocarbons and not vaporizable at the required hydrocarbon-cracking temperature, an endwise movable upright pipe extending and discharging into the molten body, an inner upright pipe arranged centrally of the first-mentioned pipe and adapted to be employed in feeding matter into the molten body and movable upwardly during upward movement of the first-mentioned pipe, an external pipe for conducting matter to be supplied to said inner pipe from a point externally of the receptacle, means establishing and maintaining communication between said inner pipe and said external pipe in any position and during endwise movement of said inner pipe, an external pipe for conducting matter to be supplied to the first-mentioned pipe from a point externally of the receptacle, and means establishing and maintaining communication

between said first-mentioned pipe and the last-mentioned external pipe in any position and during endwise movement of said first-mentioned pipe.

5 13. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body
penetrable by hydrocarbons and not vapor-
10 izable at the required hydrocarbon-cracking temperature, an endwise movable upright pipe discharging into said molten body, and an inner upright pipe arranged
substantially centrally of the first-mentioned
15 pipe and movable upwardly during upward movement of said first-mentioned pipe, the
aforesaid receptacle being provided at its
upper end with a head which at its inner
20 side has two substantially vertically downwardly projecting tubular members arranged
the one internally of and spaced from the
other, the inner of said tubular members
25 of said head being in communication with the aforesaid inner pipe in any position
of and during endwise movement of said inner pipe and adapted to be employed
in conducting matter to said inner pipe, and
the outer of said tubular members of said
head being in communication with the
first-mentioned pipe externally of said inner
pipe in any position of and during end-
wise movement of said first-mentioned pipe
and adapted to be employed in conducting
matter to said first-mentioned pipe.

35 14. Apparatus of the character indicated comprising a closed receptacle which has a vapor-outlet and contains a molten body
penetrable by hydrocarbons and not vapor-
40 izable at the required hydrocarbon-cracking temperature, an upright feed-pipe internal-
ly of said receptacle and extending and dis-
charging into said molten body and having
a limited endwise movement, an upright
45 feed-pipe arranged internally and extending
endwise of the first-mentioned pipe, an
endwise movable cylinder connected to and
communicating with said first-mentioned
pipe and adapted to receive matter to be
fed to said first-mentioned pipe, and means
50 for supplying said matter to said cylinder under pressure.

15. Apparatus of the character indicated comprising a closed receptacle which has a
vapor-outlet and contains a molten body
55 penetrable by hydrocarbons and not vapor-
izable at the required hydrocarbon-cracking
temperature, an endwise movable upright
feed-pipe arranged internally of said recep-
tacle and extending and discharging into said
60 molten body, an upright feed-pipe arranged
internally and extending endwise of the first-
mentioned pipe and movable upwardly dur-
ing upward movement of said first-men-
tioned pipe, a substantially vertically mov-
able cylinder connected to the upper end
of and communicating with said first-

mentioned pipe, said cylinder being adapted
to receive matter to be supplied under
pressure to said cylinder to serve in retain-
ing the cylinder and connected feed-pipe in
their lowermost position. 70

16. Apparatus of the character indicated comprising a closed receptacle which has a
vapor-outlet and contains a molten body
75 penetrable by hydrocarbons and not vaporiz-
able at the required hydrocarbon-cracking
temperature, an upright feed-pipe arranged
internally of said receptacle and extending
and discharging into said molten body and
80 having limited endwise movability, an up-
right feed-pipe arranged endwise of the first-mentioned pipe
and movable upwardly during upward
movement of said first-mentioned pipe, a
substantially vertically movable cylinder
85 connected to and communicating with said
first-mentioned pipe, and means whereby,
when both pipes are above their lowermost
position, the second-mentioned pipe is posi-
tively lowered during descent of the first-
90 mentioned pipe, the aforesaid cylinder be-
ing adapted to receive matter to be supplied
under pressure to said cylinder and therein
operate to retain the cylinder and con-
95 nected feed-pipe in their lowermost posi-
tion.

17. Apparatus of the character indicated comprising a closed receptacle which has
a vapor-outlet and contains a molten body
100 penetrable by hydrocarbons and not vaporiz-
able at the required hydrocarbon-cracking
temperature, an endwise movable upright
cylinder at the upper portion of said recep-
tacle, an upright pipe arranged in said re-
105 ceptacle and discharging into the molten
body, an endwise movable pipe arranged in
and extending endwise of the first-mentioned
pipe and adapted to be employed in feeding
a hydrocarbon to the molten body, an end-
wise movable upright cylinder connected to
110 the upper end of and movable and in com-
munication with the second-mentioned pipe,
means for supplying matter under pressure
to the second-mentioned cylinder, the first-
mentioned pipe being connected to and in
115 communication with the first-mentioned cyl-
inder, and means for supplying matter under
pressure to said first-mentioned cylinder.

18. Apparatus of the character indicated comprising a closed receptacle which has a
vapor-outlet and contains a molten body
120 penetrable by hydrocarbons and not va-
porizable at the required hydrocarbon-crack-
ing temperature and is provided at its
upper end with a head which at its inner
125 side has two substantially vertically down-
wardly projecting stationary tubular mem-
bers arranged internally of the receptacle
and the one internally of and spaced from
the other, means for supplying matter un-
130 der pressure to the inner stationary tubular

member from a point externally of said receptacle, means for supplying matter under pressure to the outer stationary tubular member externally of the inner stationary tubular member, two upright feed-pipes internally of the receptacle and arranged the one internally and extending endwise of and spaced from the other, a cylinder slidably embracing the inner stationary tubular member and connected to the inner pipe of said feed-pipes and establishing communication between said inner pipe and said stationary tubular member, and a cylinder slidably embracing the outer stationary tubular member and connected to the outer pipe of said feed-pipes and establishing communication between said outer pipe and said stationary tubular member.

In testimony whereof, I sign the foregoing specification, this 10th day of July, 1922.

FRED G. NIECE.