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[54] FEED SYSTEM FOR COKING UNIT

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[52] **U.S. Cl.** **239/8,** 239/400, 239/403, 239/422, 239/424
[51] **Int. Cl.** **A01n 17/02**
[58] **Field of Search** 239/400, 403, 405, 424, 424.5, 239/8, 132, 132.1, 132.3, 422

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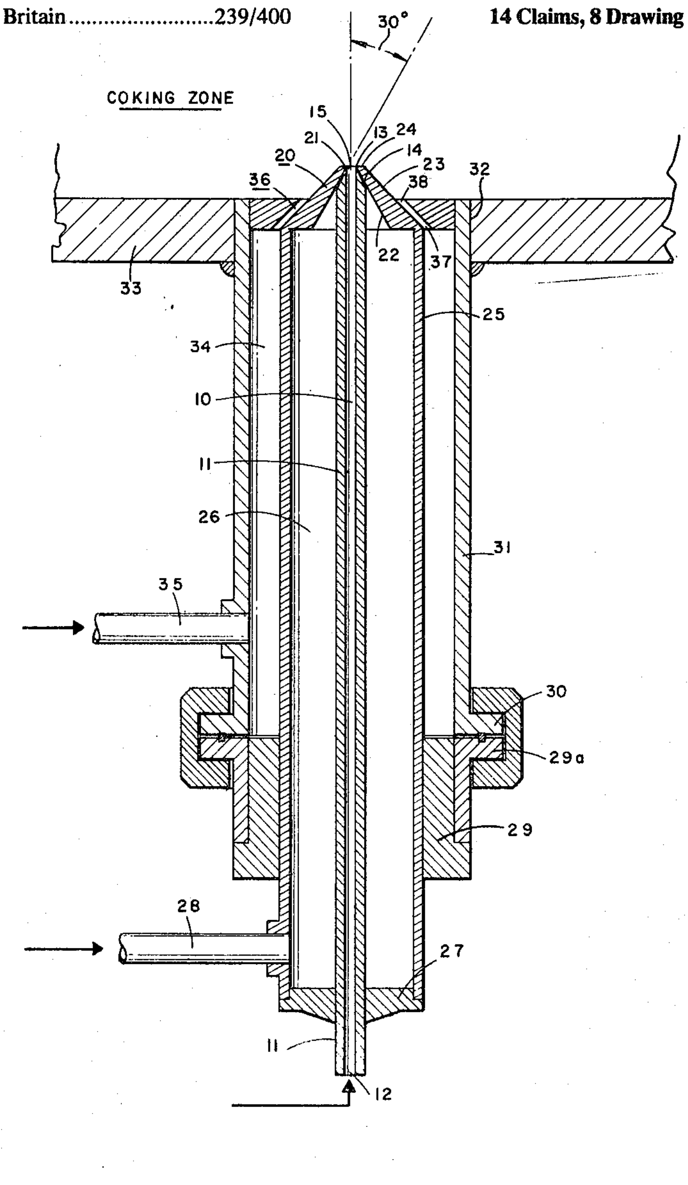
[57] **ABSTRACT**

A mist of atomized hydrocarbonaceous feed material is sprayed through a nozzle into a fluid coking zone without disruption due to coke buildup in and on the nozzle by discharging the hydrocarbonaceous feed through the orifice of a temperature-regulated axial passageway into a confluence of several high-velocity gas jets issued from separate ports spaced about the periphery of the feed passageway orifice. Preferably, the several gas jets are tangentially impinged upon the feed stream so as to shearingly whirl the feed stream about the axis of the feed passageway to produce the mist. Before issuance to produce the mist, the gaseous material forming the jets are preferably deployed in an annulus stream about the axial passageway to cool the feed passageway to prevent coking of the feed in the passageway. An apertured shield coaxially surrounds the ports and orifice to peripherally protect the ports and the orifice from hot fluidized solids in the coking zone. Gaseous materials separate from the gaseous materials forming the jets are streamed along the exterior of the apertured shield to wipe the shield free of solids from the coking zone. The stream of wiping gas aids the atomization of the hydrocarbonaceous feed.

14 Claims, 8 Drawing Figures



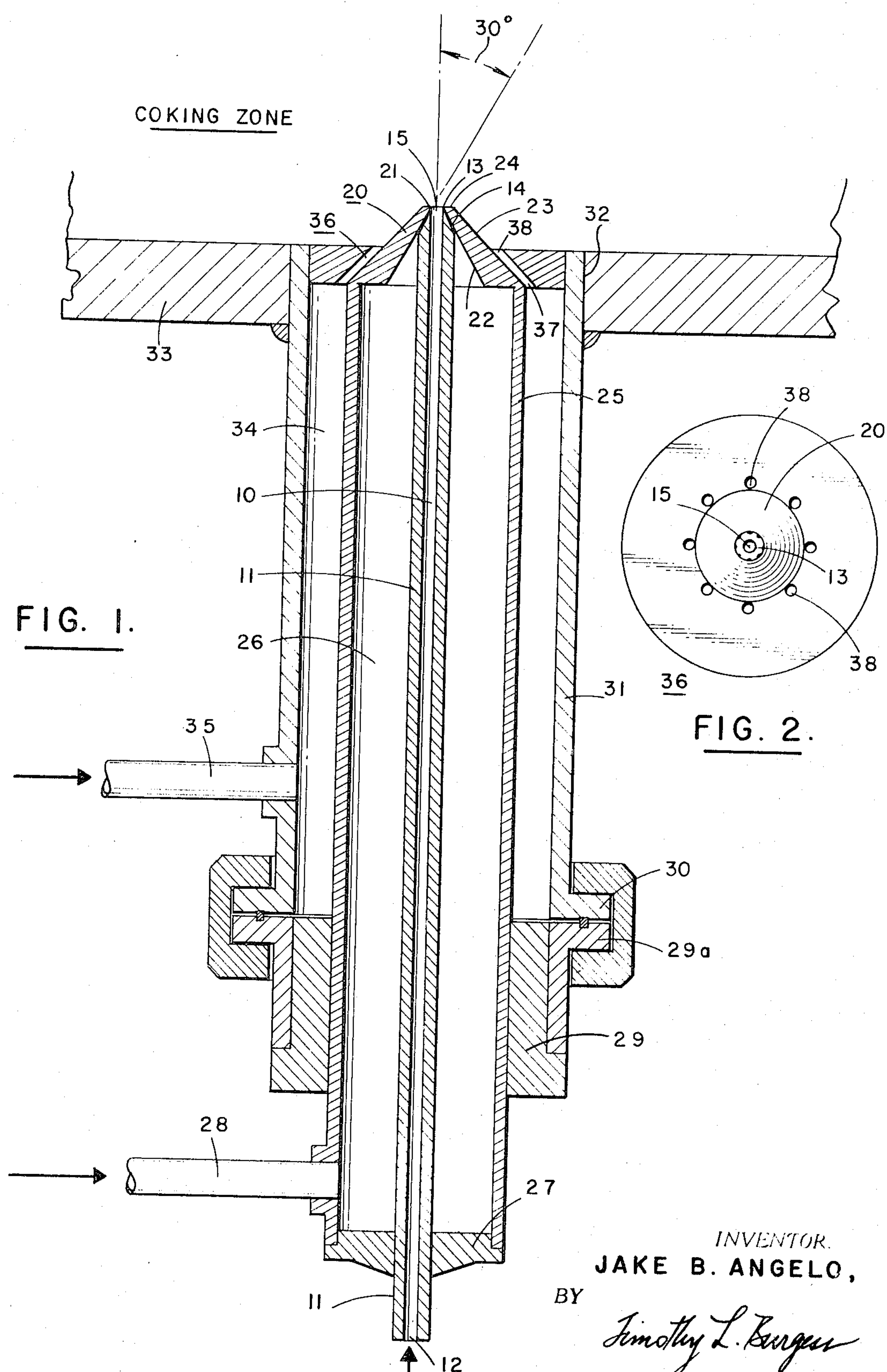


FIG. 1.

FIG. 2.

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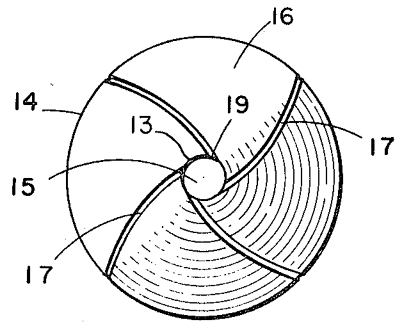

FIG. 4.

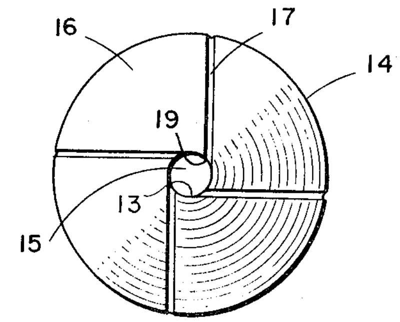

FIG. 6.

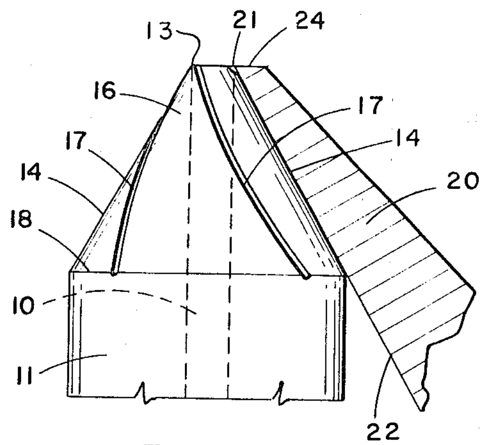

FIG. 3.

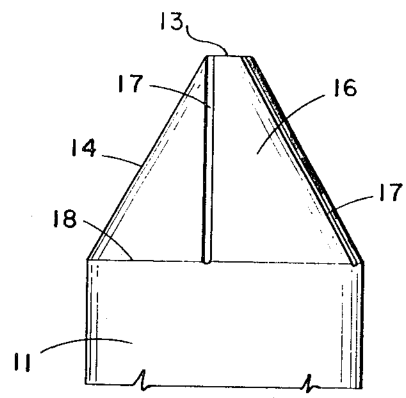

FIG. 5.

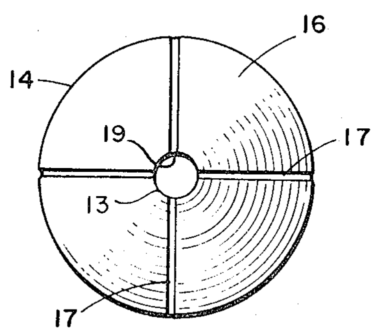

FIG. 8.

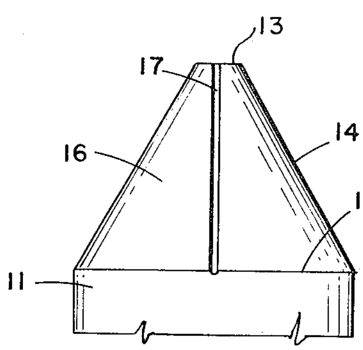

FIG. 7.

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FEED SYSTEM FOR COKING UNIT

BACKGROUND OF THE INVENTION

This invention involves a system for spraying hydrocarbonaceous feed materials such as a coal liquefaction extract or a petroleum residuum from a spray nozzle into a fluid coking zone without disruption of the spray due to clogging of the nozzle with accumulated coke.

When liquid phase or mixed solid and liquid phase hydrocarbonaceous feed materials are properly introduced into a coking zone containing a fluidized bed of hot, finely divided solids, some portions of the feed material are vaporized instantly and are recovered from the coking zone as product. Other portions, which wet the hot, finely divided fluidized particles, are thermally cracked by the heat of the particles to form coke and cracked products which are evolved as vapor from the coking zone. Fluid coking is effective so long as bogging of the bed is avoided. Bogging, for example, occurs if the hydrocarbonaceous feed is introduced into the fluid coking zone in a manner which overwets the finely divided solids, causing clumping or agglomeration of the particles. Overwetting generally occurs when a fog or mist of hydrocarbonaceous material sprayed into a fluid coking zone is so distorted that the spray into the zone is unevenly distributed, or so disrupted that, instead of a mist, a liquid jet of the feed material is injected into the bed. The prime source of spray disruption and distortion is plugging and clogging of the spraying device due to the formation and buildup of coke in and on it.

Plugging and clogging of known spray nozzles can occur in several ways. When an atomizing gas and a mixed solid and liquid phase hydrocarbonaceous feed material are contacted in a nozzle feed tube conducting the material to a coking zone, the gas can strip away the liquid portion of the feed from the solid portion, and the solids can plug the feed tube. U.S. Pat. Nos. 2,786,801, and No. 3,071,540, typify spray or mist generating apparatus plagued with another type of plugging problem. These spray devices utilize an axial tube to feed a liquid hydrocarbonaceous material through a discharge orifice into a solid annular stream of gas jetted through an annular outlet from an annular passageway formed around the axial feed tube, as by a second tube coaxially surrounding the feed tube. In these devices, when a particle of coke material deposits in a portion of the annular outlet through which the gaseous stream is jetted, the gaseous material bypasses the deposit and escapes the outlet through portions of the annular outlet which are unobstructed and which offer less resistance. The coke deposit in the annular outlet serves as a seed for coking of hydrocarbonaceous material so that coke continues to be formed in the outlet, not being dislodged because the gas continues preferentially to escape through remaining areas of lesser resistance in the outlet, until eventually the outlet is so choked with coke that the spray pattern of the nozzle is seriously distorted or insufficient gas escapes from the outlet to disperse the feed stream into a spray, with consequent bogging of the fluidized bed.

To prevent these causes of bogging in coking zone fluidized beds and to reduce coking reactor downtime to clean plugged-up feed spray nozzles, a spray system is needed in which fluid passageways and outlets do not become choked, clogged and plugged due to coke buildup and accumulation when a hydrocarbonaceous feed is sprayed into the fluid coking zone. This invention fulfills that need by providing a self-cleansing spraying system. It also provides a system for effecting an improved spray into a fluid coking zone.

SUMMARY OF THE INVENTION

A self-cleansing spraying system for spraying a mist of hydrocarbonaceous material into a fluid coking zone is provided by discharging a feed stream of the hydrocarbonaceous material from an orifice of a confined axial passageway into the fluid coking zone and jetting atomizing gaseous streams

from a plurality of separate ports spaced about the periphery of such orifice onto the feed stream as the feed stream emerges from the orifice. By jetting the gaseous material through the plurality of spaced, separate ports, the gas is forced to escape through the port it enters, causing sufficient pressure to build behind any accumulation of coke in that outlet to dislodge that coke. Before being jetted through the ports to disperse the hydrocarbonaceous stream into a spray, the gaseous material of the gas jets is preferably employed to cool the feed passageway to prevent premature coking of the feed and plugging of the passageway. In this system, the spaced ports for the gas jets and the hydrocarbonaceous material discharge orifice are peripherally protected from solids in the coking zone which promote coke formation by an apertured shield which coaxially surrounds the ports and the orifice to admit the gas and hydrocarbonaceous material into the coking zone through the aperture. Gaseous streams fluidly separated from the gas jets and emitted from a plurality of conduits spaced apart about the periphery of the apertured shield wipe the shield free of solids from the coking zone to prevent coke buildup on the external surface of the nozzle in the coking zone.

In one aspect of this invention, an improved spray of the hydrocarbonaceous feed is obtained by jetting the gaseous material tangentially upon the hydrocarbonaceous feed discharging from the feed passageway orifice so as to shearingly whirl the feed stream about the axis of the feed passageway. The stream of gas wiping the shield also aids in atomization of the hydrocarbonaceous feed.

The methods of spraying the mist of hydrocarbonaceous material into the fluid coking zone in a self-cleansing manner and a preferred form in which the system of the invention is embodied is described in connection with the drawings which illustrate the preferred embodiment.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic longitudinal section of an atomization nozzle constructed in accordance with this invention;

FIG. 2 is a top plan view of the atomization nozzle of FIG. 1, particularly illustrating the nozzle cap;

FIG. 3 is a schematic elevational view of the tip of the feed tube of the atomization nozzle of FIG. 1, with the cap of the nozzle in cross section;

FIG. 4 is a top plan view of the nozzle tip of FIG. 3;

FIG. 5 is another configuration for the channels and the nozzle tip in the embodiment of FIG. 1;

FIG. 6 is a top plan view of the nozzle of FIG. 5;

FIG. 7 is still another form of the nozzle tip embodied in FIG. 1; and

FIG. 8 is a top plan view of the nozzle tip of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, reference numeral **10** indicates a confined axial passageway in the bore of a tube **11** for introduction of a hydrocarbonaceous material, such as a mixed liquid and solid phase coal liquefaction product, into a coking zone A. The extremity of the tube **11** opposite the inlet **12** is tapered externally at an angle suitably within the range from about 30° to about 75°, here illustrated as a 30° angle taper. The axial passageway **10** defined by the bore of tube **11** is maintained at constant diameter throughout tube **11**. The perimeter of the axial passageway **10** intersects the tapering external diameter of the tube **11** to define a rim **13**. Between the rim **13** and the point of initial taper of tube **11**, a nozzle tip **14** is defined in the form of a frustum of a cone, the frustum thus having a base diameter equal to the diameter of the tube and a top diameter equal to the diameter of the bore of the tube. The rim **13** of the tip **14** delineates an outlet orifice **15** for discharge of the hydrocarbonaceous feed introduced into tube **11** through inlet **12**.

Referring to FIGS. 3–8, the face **16** of frustoconical tip **14** is channeled with a plurality of grooves **17** extending from the base of the cone, indicated by reference numeral **18**, to the rim **13** of the frustoconical tip. The grooves **17** are separated to define spaced-apart notches **19** in rim **13** of the tube tip.

Returning to FIG. **1**, reference numeral **20** indicates a tubular frustoconical cap provided with an axial aperture **21** in the top of the cap of substantially the same diameter, but in any case of no smaller diameter, than the diameter of the bore **10** of tube **11**, cap **21** being tapered along internal surface or wall **22** at the same angle of taper as the frustoconical tip **14** of tube **11**, such that cap **20** coaxially and matingly fits over frustoconical tip **14** of tube **11** and defines a plurality of confined channels under the portions of the inner surface wall **22** overlaying the grooves **17** in face **16** of the frustoconical tip. The confined channels thus extend from inlets at the base **18** of the frustoconical tip to spaced-apart ports **19** in the rim **13** of the frustoconical tip.

The ports **19** provide means by which a gaseous material may be jetted onto a feed stream of hydrocarbonaceous material emerging from orifice **15**. As illustrated, the grooves **17** are channeled in face **16** of nozzle tip **14** to equal depth from the base **18** to the rim **13** of the tip so that the ports **19** are inclined with respect to the discharge orifice at an angle within the range from about 30° to about 75°. It is preferred, but not necessary to channel the grooves **17** in face **16** to equal depth from the base **18** to the rim **13** of tip **14** so that the grooves lay in the same angle of taper as tip **14**. In addition, each of the ports **19** is axially oriented to the axis of the axial passageway **10** in the tube at an angle within the range from about 0° to about 90°. FIGS. **4** and **6** illustrate an axial orientation for ports **19** of about 45° with respect to the axis of the axial passageway **10**. FIG. **8** depicts a 0° angle between the axis of axial passageway **10** and the axes of ports **19**. The ports **19** are preferably disposed, as illustrated in FIGS. **4** and **6**, tangentially to orifice **15** so as to tangentially jet gaseous material from the ports onto the stream of hydrocarbonaceous material as it emerges from orifice **15** in order to shearingly whirl the hydrocarbonaceous material about the axis of the axial passageway in atomizing the hydrocarbonaceous material. The channels defined by the overlaying portions of the internal surface of cap **20** and the overlaid grooves **17** in the frustoconical tip may extend from the base **18** to the rim **13** in a rectilinear manner, as in FIGS. **5–8**, or in a curved manner, as in FIGS. **3** and **4**, so long as spacing is maintained between the ports in the rim. The spiral configuration depicted in FIGS. **3** and **4**, in which the grooves **17** are spiraled from base **18** to rim **13** of tip **14** through one-fourth of a turn about the axial passageway **10**, is a preferred manner of tangentially disposing ports **19** relative to rim **13** of the tip. A clockwise spiral is illustrated, but the spiral may be counterclockwise. Frustoconical cap **20** surrounds the ports **19** and the orifice **15** to shield and protect them from solids in the coking zone which might otherwise land upon the ports and the orifice from a peripheral or lateral direction.

Returning to FIG. **1**, the external surface **23** of frustoconical cap **20** is tapered at a greater angle of taper than the angle of taper of tip **14**, the angle of taper defining the width of a lip **24** at the intersection of the external wall **23** and internal wall **22**, the external wall taper angle preferably being chosen to minimize the presence of lip **24**. At the base of cap **20** between the surface **23** and internal surface **22** of the cap, an inner sleeve **25** is secured by weldments. Inner sleeve **25** surrounds tube **11**, thereby defining an inner annular passageway, indicated by reference numeral **26**, between the sleeve **25** and tube **11**. Inner annular passageway **26** terminates at the base **18** of the frustoconical tip **14** of tube **11** in fluid communication with the spaced ports **19** by means of confined channels **17**. At the end of sleeve **25** opposite its attachment to cap **20**, sleeve **25** is affixed by means of a closure flange **27** to the periphery of tube **11**. An inlet **28** is provided in sleeve **25** adjacent closure flange **27** for admission of a gaseous temperature regulating medium, preferably steam, into the inner annular passageway **26**. Inner sleeve **25** is mounted in a collar **29** fitted with an external flange **29*a*** which is assembled with a union clamp onto the base flange **30** of a fixed outer sleeve **31** coaxially surrounding inner sleeve **25** and affixed to the border of a cylindrical opening **32** in the wall **33** of the vessel in which the coking reaction is carried out. Outer sleeve **31** defines an outer annular passageway **34** between it and inner sleeve **25**. An inlet **35** is provided in outer sleeve **31** for introduction of gaseous material into the outer annular passageway **34**. Outer annular passageway **34** and inner annular passageway **26** are not fluidly communicated. In the base of the frustoconical cap **20**, a plurality of confined gas conduits **36** are provided which have inlets continuous with the outer annular passageway **34** for receiving gaseous material and axial outlets **37** spaced apart in the base of the cap around the periphery of the external surface **23** of the cap **20**. The axial outlets **37** are axially aligned, preferably at the angle of taper of the external surface **23**, to converge on the axis of passageway **10** proximate the rim **13** of tip **14**, as best viewed in FIG. **4**, thereby to stream gaseous material along the external surface **23** to wipe that surface free of solids which are deposited on that surface from the coking zone in the reactor.

Thus, in the embodiment pictured in the figures, a hydrocarbonaceous feed is introduced into a confined axial passageway **10** through an inlet **12** and passed through a temperature-regulating zone maintained at a temperature lower than the temperature of the coking zone by passage of a gaseous temperature-regulating material, preferably steam introduced through inlet **28**, through inner annular passageway **26**. The temperature regulating material maintains the temperature of the tube **11** at a temperature suitably below about 750° F., preferably between about 600° and 700° F., to prevent coking of the hydrocarbonaceous feed in its passage through tube **11** to discharge orifice **15**, where the hydrocarbonaceous material is discharged into the coking zone. The temperature regulating gaseous material in inner annular passageway **26** flows under pressure into the plurality of confined channels **17** in the nozzle tip, and thence through spaced ports **19** onto the hydrocarbonaceous feed stream emerging through discharge orifice **15** to atomize the feed stream into a mist of droplets for spray dispersion in the coking vessel. The gas jets preferably issue tangentially from ports **19** for tangential impingement upon the feed stream exiting from discharge orifice **15** to shearingly whirl the feed stream about the passageway axis, by imparting centrifugal moments to the feed stream, thereby effecting an improved spray in the coking zone. Inner annular passageway **26** and confined channels **17** and ports **19** are fluidly separated, i.e., not in fluid communication with outer annular passageway **34** and fluid conduits **36** and outlets **37** so that the gaseous temperature regulating materials cannot divert to outlets **37** if coke deposits momentarily lodge in spaced ports **19**. As a result, pressure builds in any spaced port **19** in which coke particles do become lodged until the pressure is sufficient to dislodge such particles, thereby providing self-cleaning of such ports. The external surface **23** and lip **24** of the atomization nozzle is wiped free of wetted solids from the coking zone by the play thereon of wiping gaseous streams coaxially converged upon the nozzle tip by passage through the confined conduits **36** after passage through outer annular passageway **34**, thus providing further self-cleaning.

The mixing of the gases and the hydrocarbonaceous material after the hydrocarbonaceous material emerges from the tip of the nozzle prevents plugging of the axial passageway **10** by solids when mixed solid and liquid phase hydrocarbonaceous feed is used.

The nozzle of this invention is adapted to be installed in any position in a coking zone, vertically, horizontally etc. It can be extended to any desired depth into the coking zone without coking the feed in the feed passageway, which is kept below coking temperatures by the temperature-regulating gaseous material in the inner annular passageway surrounding the feed passageway.

In operation in spraying a hydrocarbonaceous feed into a fluid coking zone, in which the hydrocarbonaceous feed rate extends over a range from about 500 bbl./day per nozzle to about **1,000** bbl./day per nozzle, a gas-to-hydrocarbonaceous feed specific volume ratio of at least 1:1 is employed, preferably from about 1:1 to about 5:1. The hydrocarbonaceous feed rate and the gas-to-hydrocarbonaceous feed specific volume ratio determine the inside diameters of the feed tube and the gaseous channels which terminate in the ports **19**. For a 500 bbl./day per nozzle hydrocarbonaceous feed rate, a 0.35-inch inner diameter may satisfactorily be used. In this instance, a hydrocarbonaceous feed velocity of from about 30 to about 100 ft./sec., e.g., about 40 ft./sec., through passageway **10** and a gaseous material velocity through ports **19** of about 125 to about 250 ft./sec., e.g., about 150 ft./sec., may be utilized. For a hydrocarbonaceous feed rate of about 1,000 bbl./day per nozzle, a 0.4-inch inner diameter for the feed tube is satisfactory, permitting oil to be fed through the tube passageway **10** at a velocity of about 110 ft./sec. and gas to be fed through the confined channels and ports at a velocity of about 250 ft./sec. The velocity ratio of the atomizing gas jets to the discharging hydrocarbonaceous feed stream is suitably from about 2 to about 4. The velocity of the spray discharged from the tip of the nozzle will range from about 100 ft./sec. to about 250 ft./sec.

The hydrocarbonaceous material introduced into the feed tube is preferably introduced at a temperature between about 600° and 700° F. and is maintained at a temperature within the tube of about 650° and 700° F. when passing through the tube. Thus, the gaseous temperature regulating material in the inner annulus is preferably steam heated to about 450° F. A steam rate of about 5–30 lbs./hr. is sufficient to maintain this temperature.

The following table, with reference to the drawing, summarizes pertinent conditions in a preferred embodiment of the present invention.

TABLE I

	Broad Range	Preferred Range
Coking Zone		
Temperature of Incoming Solids, °F.	1,000–1,350	1,150–1,200
Temperature in Coking Zone, °F.	900–1,200	950–1,000
Pressure, p.s.i.g.	5–30	10–15
Avg. Solids Size, Microns	50–500	150–200
Density of Solids Suspension in Zone	15–60	35–45
Avg. Residence Time of Solids in Zone, min.	10–60	15–30
Feed Nozzle		
Hydrocarbonaceous Feed Rate, bbl./day	5,000–60,000	15,000–50,000
Temperature of Hydrocarbonaceous Feed, °F.	500–750	600–700
Gas/Hydrocarbonaceous Feed Specific Volume Ratio.	1–5	1–3
Velocity of Hydro carbonaceous Feed, ft./sec.	25–150	50–100
Velocity of Atomizing Gas Jet, ft./sec.	100–350	200–300
Velocity of Wiping Gas Streams, ft./sec.	50–150	75–125
Forward Velocity of Spray after Discharge, ft./sec.	50–300	150–250

Having described my self-cleaning system for spraying hydrocarbonaceous materials into a fluid coking zone, and having described a preferred embodiment for carrying out that system, various embodiments for utilizing my system within the scope of the appended claims will be apparent to those in the art.

I claim:

1. Apparatus for spray feeding a mist of hydrocarbonaceous material into a fluid coking zone for coking on hot, finely divided fluidized solids, which comprises:

a nozzle having a confined passageway of constant diameter, an inlet at one end of such passageway for admission of a stream of hydrocarbonaceous material, a discharge orifice at the other end of such passageway for discharge of said hydrocarbonaceous material into said coking zone,

means immediately surrounding said passageway for maintaining the temperature of said passageway sufficiently lower than the temperature in said coking zone to prevent coking of feed passing through said passageway and

a plurality of gas jetting ports spaced apart on the periphery of said discharge orifice, equidistant from the center of said passageway, and in confined and fluid communication with means for supplying gaseous material to such ports, for jetting, effective to prevent plugging of said ports, a plurality of jets of gaseous material into said coking zone onto said hydrocarbonaceous material as such hydrocarbonaceous material discharges from said discharge orifice, so as to atomize such hydrocarbonaceous material in the coking zone.

2. The nozzle of claim **1** in which said spaced-apart gas jetting ports are disposed tangentially to said discharge orifice for tangential jetting of said gaseous material onto said hydrocarbonaceous material discharging into said coking zone to shearingly whirl and atomize said hydrocarbonaceous material.

3. Self-cleaning nonplugging apparatus for spray feeding a mist of hydrocarbonaceous material into a fluid coking zone for coking on hot, finely divided fluidized solids, which comprises:

a nozzle having a confined, axial passageway, an inlet at one end of such passageway for admission of said feed stream of hydrocarbonaceous material, and a discharge orifice at the other end of such passageway for discharge of said hydrocarbonaceous material into said coking zone,

means defining an annular passageway immediately surrounding said passageway posteriorly of said orifice and having an inlet for admitting a gaseous temperature regulating material for maintaining the stream of hydrocarbonaceous material passing through said passageway at a temperature sufficiently lower than the temperature in said coking zone to prevent coking of the feed in said passageway and clogging thereof,

a plurality of gas jetting means terminating in a plurality of ports spaced apart on the periphery of said discharge orifice and equidistant from the axis of said passageway, said gas jetting means being in confined and fluid communication with said annular passageway for jetting of said gaseous temperature-regulating material through said ports into said coking zone onto said hydrocarbonaceous material as such hydrocarbonaceous material discharges from said orifice into said coking zone, to atomize such hydrocarbonaceous material without plugging of said ports,

an apertured shield immediately surrounding said spaced-apart ports and peripherally protecting said ports and said orifice from solids in said coking zone as said gaseous temperature regulating means and said hydrocarbonaceous material pass into said coking zone through the aperture thereof, and

a plurality of gas conduits having inlets for admitting gaseous material thereinto and terminating in a plurality of outlets spaced apart about the periphery of said shield for streaming said gaseous material along the exterior of said shield to wipe said shield free of solids from said coking zone.

4. The nozzle of claim **3** in which said ports of said gas jetting means are axially oriented to the axis of said axial passageway at an angle within the range from about 0° to about 90°.

5. The nozzle of claim 3 in which said ports of said gas jetting means are inclined to said discharge orifice at an angle within the range from about 30° to about 75°.

6. A self-cleaning feed nozzle for plug-free spray feeding a mist of hydrocarbonaceous material into a fluid coking zone for coking on hot, finely divided solids, which comprises:

a tube with an axial bore having an inlet at one extremity of the tube for admitting said feed stream of hydrocarbonaceous material and an outlet at the other extremity of the tube for discharge of the hydrocarbonaceous material, said tube tapering at the outlet end thereof to an angle within the range from about 30° to about 75° to define the frustum of a cone having a base diameter equal to the diameter of the tube and a top diameter equal to the diameter of the bore of the tube, said top comprising a rim, the external surface of said frustum having a plurality of grooves extending from the base of the frustum to spaced-apart positions about said rim,

a tubular frustoconical cap to shield the tapered extremity of said tube from solids in said coking zone, said cap having an internal surface with the same taper as the taper of said frustum of said tube and an external surface with a greater angle of taper than the taper of such frustum, said cap coaxially matingly fitting over said frustum of said tube so that said internal surface of said cap over said grooves in said frustum defines a plurality of confined channels having inlets at the base of the frustum and outlet ports spaced apart about the rim of the frustum,

a sleeve surrounding said tube and attached at one end to the base of said frustoconical cap between the inner and outer surfaces thereof and defining between said tube and said sleeve an annular passageway terminating at the base of said frustum of said tube in fluid communication, through said confined channels, with said spaced outlet ports, said sleeve having at its other end inlet means for admitting a gaseous temperature-regulating material into said annular passageway for maintaining the stream of hydrocarbonaceous material fed through said axial bore at a temperature lower than the temperature in said coking zone whereby coking of said hydrocarbonaceous material in said bore and clogging of said bore is prevented, said gaseous temperature regulating material thence issuing in separate jets from said spaced outlet ports about said rim onto said hydrocarbonaceous material as it discharges into said coking zone to effect misting of said hydrocarbonaceous material in said coking zone, and

a plurality of confined shroud gas conduits fluidly separated from said annular passageway and having inlets for admitting gaseous materials and axial outlets spaced apart around the periphery of said external surface of said cap and axially aligned at the same angle of taper as the external surface of said cap for streaming said gaseous material along said external surface to wipe such surface free of solids from said coking zone.

7. The nozzle of claim 6 in which said spaced outlet ports of said confined channels are tangentially disposed to said rim for tangential jetting of said gaseous temperature regulating material onto said hydrocarbonaceous material as it discharges from the outlet in the tapered extremity of the tube so as to shearingly whirl the stream of hydrocarbonaceous material about the axis of the tube to produce the mist in said coking zone.

8. The nozzle of claim 7 in which said spaced outlet ports are axially oriented to the axis of said tube at an angle within the range from about 0° to about 90°.

9. The nozzle of claim 8 in which the angle of taper of said tube is within the range from about 45° to about 60°.

10. The nozzle of claim 9 in which said angle of taper of said tube is 30° and wherein said ports are axially oriented at a 45° angle to the axis of said tube.

11. A process for spray feeding hydrocarbonaceous material into a coking zone containing a fluidized bed of hot, finely divided solids from a spray nozzle without clogging of the nozzle, which comprises:

passing the feed stream along an axis through a temperature-regulating zone adjacent said coking zone, and thence along said axis directly through an entrance into said coking zone,

regulating the temperature of said feed in said temperature regulating zone with a gaseous temperature-regulating material maintained at a temperature lower than the temperature in said coking zone so as to prevent coking of the feed in its passage to said coking zone, and

flowing said gaseous temperature regulating material from said temperature-regulating zone and jetting said gaseous temperature-regulating material in a plurality of separate jets circumferentially convergent upon said feed stream as said feed stream enters said coking zone to atomize said feed stream into a mist in said coking zone.

12. The process of claim 11 in which said streams of gaseous temperature regulating material are tangentially jetted onto said stream of hydrocarbonaceous material so as to shearingly whirl the stream of hydrocarbonaceous material about the axis of said feed stream to produce said mist in said cooling zone.

13. The process of claim 12 in which said separate gaseous streams are jetted onto said feed stream at a velocity ratio, relative to the velocity of said feed stream, within the range from about 2 to about 4 and a gas-to-oil specific volume ratio relative to said feed stream within the range from about 1 to about 5.

14. Apparatus for spray feeding a mist of hydrocarbonaceous material into a fluid coking zone for coking on hot, finely divided fluidized solids, which comprises:

a nozzle having a confined passageway of constant diameter, an inlet at one end of such passageway for admission of a stream of hydrocarbonaceous material, a discharge orifice at the other end of such passageway for discharge of said hydrocarbonaceous material into said coking zone,

means immediately surrounding said passageway for maintaining the temperature of said passageway sufficiently lower than the temperature in said coking zone to prevent coking of feed passing through said passageway, and

a plurality of gas jetting ports spaced apart on the periphery of said discharge orifice, equidistant from the center of said passageway, and in confined and fluid communication with means for supplying gaseous material to such ports, for jetting, effective to prevent plugging of said ports, a plurality of jets of gaseous material into said coking zone onto said hydrocarbonaceous material as such hydrocarbonaceous material discharges from said discharge orifice, so as to atomize such hydrocarbonaceous material in the coking zone,

an apertured shielding means immediately surrounding said spaced-apart gas jetting for peripherally shielding said gas jetting means and said orifice from solids in said coking zone as said gaseous material and said hydrocarbonaceous material pass into said coking zone through the aperture thereof, and

a plurality of spaced-apart shroud gas conduit means surrounding said apertured shielding means for streaming gaseous materials along the exterior of said shielding means to wipe said shielding means free of solids from said coking zone.

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