March 3, 1970 E. RAHM 3,498,323

RETRACTABLE NOZZLE

Filed Nov. 9, 1967

FIG. 1.

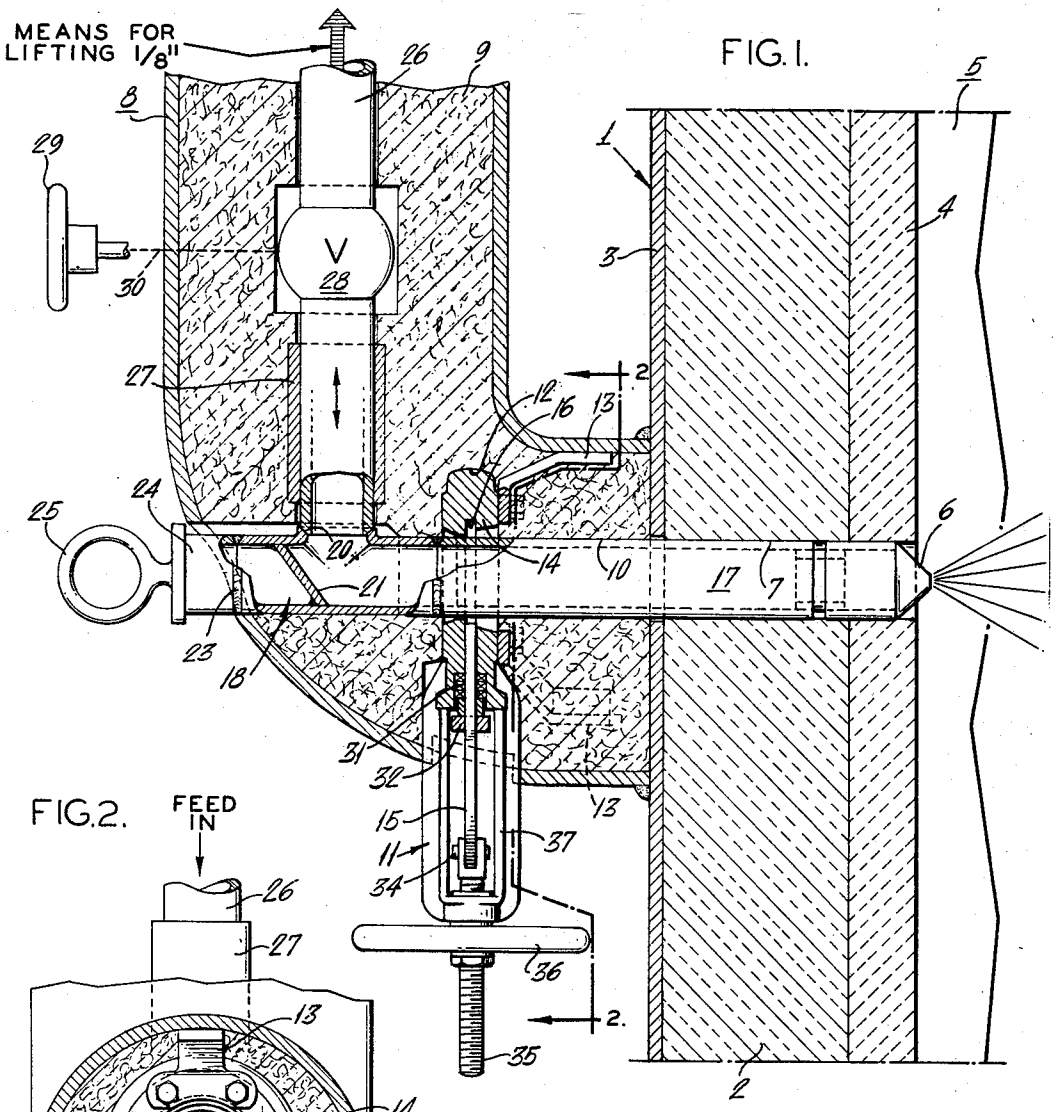


FIG. 2.

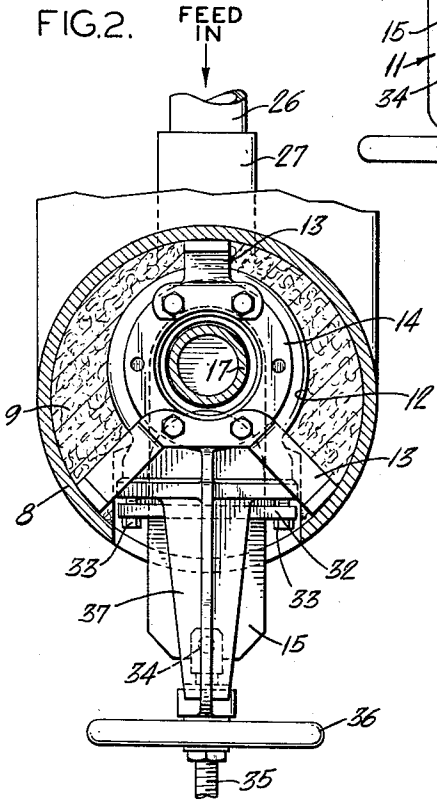
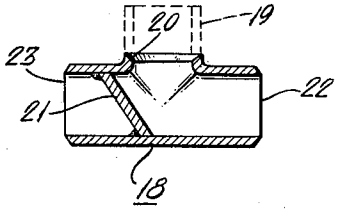


FIG. 3.



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RETRACTABLE NOZZLE

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U.S. Cl. 137—592 6 Claims

ABSTRACT OF THE DISCLOSURE

A vessel, to which fluid is to be fed by means of a conduit, has an aperture through its wall, and the conduit is mounted for axial sliding movement in a hole longitudinally aligned with this aperture, so that it can enter into and be withdrawn from the aperture. A goggle valve, located in the hole and through whose opening the conduit normally extends, is movable to provide a seal in the hole upon withdrawal of the conduit. Normally, fluid is supplied to the conduit through a branch pipe which communicates with the conduit by way of an opening in the side wall thereof, this opening being located on the opposite side of the goggle valve from the vessel.

This invention relates to a retractable nozzle construction.

One desirable field of use of this invention is in connection with the gas generation apparatus disclosed in the copending Stoops et al. application, Ser. No. 530,979, filed Mar. 1, 1966. In such apparatus, fluid (which may be superheated hydrocarbon vapor) is fed (as make oil) into a combustion chamber which in effect forms one end of an elongated generally tubular vessel or reactor, the feed into the vessel taking place by way of several nozzles whose discharge orifices are directed toward the interior of the vessel, and more particularly toward a flame produced by a burner mounted at one end of the vessel. Said flame is established in the combustion chamber to which reference was previously made. As described in said application, the fluid material injected into the vessel is treated (cracked) therein to produce a combustible gas, which may be used as a supplement or substitute for natural gas.

From time to time, during normal operation of the apparatus described, it may become necessary to maintain (i.e., inspect and/or repair, or even replace) the nozzles. Desirably, the removal (retraction) of a nozzle for maintenance purposes should be possible without the necessity of a complete shutdown of the apparatus. In this connection, it should be noted that the apparatus is inherently capable of continued operation (though of course with a somewhat reduced output) when one of the plurality of nozzles is not effective or is removed.

An object of this invention is to provide a retractable nozzle construction for feed nozzles.

Another object is to provide, for a gas generation apparatus of the type described, a nozzle construction whereby one (or more) of the nozzles may be retracted and removed while the apparatus continues to operate.

A further object is to provide a simple yet effective retractable nozzle construction for a flame-cracking reactor.

The objects of this invention are accomplished, briefly, in the following manner: An aperture is provided through the wall of a vessel, and in this aperture is positioned an elongated fluid supply conduit on the inner end of which is a feed nozzle. The conduit extends outwardly beyond the outer wall of the vessel, and is mounted for sliding movement in a hole provided in an elbowed member secured to the outside of the vessel. The hole is aligned

with the aperture, and the conduit passes through the opening in a goggle valve (sometimes termed a knife gate valve) mounted in the elbowed member and movable to seal the hole and aperture when the conduit has been removed. The outer end of the conduit is sealed, and a feed opening with beveled seat is provided in the conduit side wall, between the seal and the goggle valve. A branch feed pipe communicates with the conduit at the said feed opening.

A detailed description of the invention follows, taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is a longitudinal section through a retractable nozzle arrangement according to the invention;

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1; and

FIG. 3 is a longitudinal sectional view of a detail, showing the beveled seat.

Referring now to the drawing, a portion of the wall of an elongated vessel is illustrated at **1**. The wall illustrated may be a portion of a jacketed combustion chamber and burner assembly which is cylindrical in cross-section and which may be mounted at the upper end of a flame-cracking reactor, as described in the aforementioned application. A cylindrical wall **2** formed from heat-insulating material and an outer metal jacket **3** together bound a hollow cylindrical space in which there is placed a lining of suitable refractory material **4** to form the composite wall of a cylindrical combustion chamber **5**.

For a flame-cracking reactor of the type described in the aforementioned application, three or more stainless steel nozzles (one of which is illustrated at **6**), spaced symmetrically in a horizontal plane around the cylindrical combustion chamber and burner assembly **1**, may be used to feed the superheated vapor (derived from the make oil) which is to be cracked into the interior of the reactor vessel. According to this invention, these nozzles are all made retractable, so that they may be withdrawn for inspection and/or repair and/or replacement, while the reactor is in operation. (In the prior application mentioned, the nozzles were semi-permanently mounted in position in the reactor, such that the reactor had to be shut down in order to withdraw or retract the nozzles.) For convenience, only one retractable nozzle structure will be illustrated and described herein, but it is to be understood that this structure may be duplicated at all of the nozzles, so that all of them can be of the retractable type.

A cylindrical aperture **7** is provided through the composite wall **2–4** of vessel **1**, this aperture extending through all three of the items **2**, **3** and **4** and the inner end of this aperture opening into combustion chamber **5**. One end of an elbowed pipe **8** is secured to the outer jacket **3** of the vessel at aperture **7**, this pipe making the 90° turn called for by the elbow and then extending in a direction such that its longitudinal axis is substantially perpendicular to the axis of aperture **7**. The interior of pipe **8** is filled with an insulating-type packing material **9**.

A hole **10** is formed in pipe **8**, this hole being axially aligned with aperture **7**. Hole **10** communicates at its inner end with the outer end of aperture **7**, and said hole extends entirely through pipe **8**, from one side to the other thereof. By way of example, the diameter of hole **10** may be equal to that of aperture **7**.

A goggle valve (knife gate vale), denoted generally by numeral **11**, is mounted in pipe **8**. Valve **11** is mounted within a cavity **12** formed in pipe **8** (which cavity opens to the exterior of pipe **8**) by means of three mounting brackets **13** which are bolted to the valve body and are secured in any suitable manner (such as by bolting or welding) to the wall of pipe **8**. Valve **11** has a centrally apertured cylindrical body or frame **14** in which is mounted, for vertical sliding movement therein, an imperforate

plate or knife gate **15**. Gate **15** is slidable to open or close the central aperture in body **14**; it is illustrated in the open position in the drawing. Gate **15** is more or less rectangular in outer configuration, but its upper end is curved (arcuate), and this upper end sealingly fits within a curved (arcuate) seat **16** provided in the upper end of body **14**, when the plate is in its closed position.

An elongated body **31** of packing material is provided around plate **15**, at the lower end of the valve body **14**. This packing is tightened into sealing relation with plate **15** by means of a yoke-like gland **32**, acted upon by bolts **33** which bear against gland **32** and thread into the valve body **14**.

For operating (raising and lowering) gate **15**, the lower end of this gate is bolted at **34** to one end of a threaded stem **35**. Stem **35** threadedly engages a nut (not shown), which may be rotated by means of a handwheel **36**. The aforesaid nut is rotatably mounted in the outer end of a fixed yoke structure **37**, the yoke structure being arranged to allow rotation of the nut but to prevent longitudinal movement thereof. The inner end of yoke **37** passes through an opening in the wall of pipe **8**, and is rigidly secured to the lower end of valve body **14**. Thus, a "rising stem" type of operator is provided for the valve plate **15**, wherein rotation of handwheel **26** rotates the attached nut and causes longitudinal movement of stem **35** and its attached plate **15**.

The described vertical sliding movement of gate **15**, with respect to valve body **14**, takes place in a direction perpendicular to the common axis of hole **10** and aperture **7**. By appropriate manipulation of handwheel **36**, gate **15** may be moved up and down between two limiting positions, in one of which (illustrated in FIGS. 1 and 2) it is outside of the confines of the central aperture in valve body **14**, and in the other of which it is seated in seat **16** and thus closes or blanks off the central aperture in body **14**.

The aforementioned nozzle **6** is attached to the inner end of a stainless steel feed conduit **17** which is positioned in aperture **7** and in the aligned hole **10**, and is capable of axial sliding movement therein. In the illustrated position of the nozzle, which may be termed the inserted or operative position thereof, the conduit **17** passes through the central aperture in valve body **14** (the plate **15** then being in its lowermost or withdrawn or open position).

Beyond or outwardly from goggle valve **11** (i.e., in the direction away from combustion chamber **5**), a modified T fitting **18** (to be described further in connection with FIG. 3) is attached (as by welding) to the outer end of the conduit **17** proper, fitting **18** providing a termination and 90° turn for the feed conduit. In this connection, it may be noted that the goggle valve **11** is located in effect in the "straight" portion of elbowed pipe **8**.

Refer now to FIG. 3. The fitting **18** may be made from a standard one-inch stainless steel welding T, by way of example, by cutting off ¾" from the vertical leg of the T (as indicated by dotted lines **19**), then machining a ground joint (beveled seat) **20** at the outer end of this shortened vertical leg. The fitting **18** is completed by adding a baffle **21** to guide gas toward the nozzle **6**. Baffle **21**, which is welded inside the straight-through portion of the T at one side of the ground joint **20**, also provides a closure or seal in this straight-through portion, as will later be described. The fitting **18** is attached to the outer end of conduit **17** proper by butt-welding the straight-through end **22** thereof (end **22** being remote from baffle **21**) to the outer end of conduit **17**. Thus, the ground joint **20** of fitting **18** is located between baffle **21** and the outer end of conduit **17** (see FIG. 1); it may be said also that the ground joint **20** is located between closure **21** and goggle valve **11**. The remaining straight-through end **23** of fitting **18** is butt-welded to the inner end of a short piece **24** of pipe whose outer end extends through the outer wall of pipe **8**; a suitable hand-hold (ring) **25** is attached to the outer end of pipe **24**.

The various items **6**, **17**, **18**, and **24** of the nozzle and feed conduit assembly have a common longitudinal axis, and this assembly is axially slidable in the aperture **7** and hole **10**.

The inner (lower in FIG. 1) end of a gas feed pipe **26** is machined (beveled) to mate with the ground joint (beveled seat) **20** of fitting **18**, so as to form a fluid-tight connection therewith. If desired, a high-temperature gasket (e.g., made from a suitable type of asbestos) may be used between the lower end of feed pipe **26** and the beveled seat **20**. Pipe **26** is arranged substantially coaxially of pipe **8**, and the longitudinal axis of pipe **26** extends at right angle to the longitudinal axis of the nozzle and feed conduit assembly **6**, **17**, **18**, **24**.

A fixed cylindrical metallic sleeve **27** somewhat loosely surrounds the inner end of pipe **26**, to serve a heat-insulating function.

Beyond the outer end of sleeve **27**, a shut-off valve **28** is connected into pipe **26**, this valve being operable from outside of pipe **8** by means of a control handle **29** which is mechanically connected to the valve by means of a schematically-indicated coupling **30**. Valve **28** is manually-operable to shut off the flow of fluid in pipe **26**, when desired.

A suitable means (not illustrated) for lifting the feed pipe **26** a distance of ⅛", which means may be activated when desired, is coupled to the outer end of this feed pipe.

The mode of operation of the retractable nozzle of this invention will now be described. During normal operation of the nozzle **6** illustrated, make oil (vaporized hydrocarbon feed stock) is supplied to the outer end of pipe **26**, and valve **28** is open. The fluid then reaches nozzle **6** by way of pipe **26**, valve **28**, ground joint **20**, fitting **18**, and conduit **17**. During this operation, closure **21** seals off the interior of the retractable assembly **6**, **17**, **18**, **24** from the outside or atmosphere, and this baffle **21** also serves to guide gas from pipe **26** through ground joint **20** toward nozzle **6**.

When retraction or withdrawal of the nozzle **6** is desired, as for maintenance purposes, valve **28** is first closed, to shut off the supply of make oil to this nozzle. The means for lifting the pipe **26** is then activated, to lift the inner (lower) end of this pipe clear of the ground joint **20**. Then, by means of handhold **25** the assembly **6**, **17**, **18**, **24** is slid axially within aperture **7** and hole **10** (to the left in FIG. 1), until the nozzle **6** moves to the left of the path of travel of gate **15** of the goggle valve **11**, the assembly sliding through the central aperture in valve body **14** during this step of the operation. Then, the valve plate **15** is raised to its closed position (into seat **16**) by means of handwheel **36**, plate **15** then closing off or sealing off the aperture in the valve body from the outside. It may be noted that during this partial retraction, before the valve plate **15** is moved to its closed position, closure or baffle **21** seals off the interior of the nozzle and conduit assembly from the outside or atmosphere.

After goggle valve **11** is closed as just described, the nozzle and conduit assembly may be completely withdrawn from the vessel **1**.

It is desired to be pointed out that it is not necessary to shut down the reactor during the above-described retraction or withdrawal of nozzle **6**. All that is necessary is to close the valve **28** in the feed line of the nozzle **6** being retracted. The reactor can continue to operate (by way of its remaining nozzles, not shown) during the retraction operation, although, of course, at reduced output.

The combustion chamber **5** of the vessel **1** is sealed off from the atmosphere during the above-described retraction operation, at first by the closure plate **21** and the packing **9** (which latter closely surrounds the nozzle and conduit assembly), and the packing **31**, and then by the gate **15** (after the latter has been moved to its closed

position), in conjunction with packings **9** and **31** and valve body **14**.

What is claimed is:

1. In combination with a vessel having an aperture through its wall: a body of solid material mounted on the exterior of said vessel wall, said body providing an extended bore in axial alignment with said aperture; a feed conduit mounted for axial sliding movement in said bore, said conduit being adapted to enter into and be withdrawn from said aperture and said conduit having an opening in its side wall; a knife gate valve mounted in said body for movement between two limiting positions, in one of which the gate of said valve is out of registry with said bore and in the other of which said gate is in registry with said bore, the body of said valve being apertured to allow passage therethrough of said conduit; means operable from outside said vessel for moving said gate back and forth between its two said limiting positions, and a pipe carried by said body and arranged to mate at one end with the side wall of said conduit at said opening when said conduit is positioned within said first-named aperture, the axis of said pipe lying at substantially 90° to the axis of said conduit.

2. Combination in accordance with claim **1**, wherein said one end of said pipe is separable from said conduit to permit said conduit to be withdrawn from said first-named aperture.

3. Combination defined in claim **1**, including also a closure plate sealed into the interior of said conduit, adjacent said opening but on the side thereof away from said first-named aperture.

4. In combination, a vessel having an aperture through its wall; a supporting member mounted on the outside of said vessel, said member having therein an extended bore in axial alignment with said aperture; a feed conduit mounted for axial sliding movement in said bore, said conduit being adapted to enter into said bore and said aperture and to be withdrawn from said aperture and

said bore and said conduit having an opening in its side wall; a knife gate valve mounted in said member for movement between two limiting positions, in one of which the gate of said valve is out of registry with said bore and in the other of which said gate is in registry with said bore, the body of said valve being apertured to allow passage therethrough of said conduit and said conduit passing through said last-named aperture when the conduit is positioned in the bore; means operable from outside said vessel for moving said gate back and forth between its two said limiting positions, and a pipe carried by said member and arranged to mate at one end with the side wall of said conduit at said opening when said conduit is positioned within said first-named aperture, the axis of said pipe lying at substantially 90° to the axis of said conduit.

5. Combination in accordance with claim **4**, wherein said one end of said pipe is separable from said conduit to permit said conduit to be withdrawn from said first-named aperture and from said bore.

6. Combination defined in claim **4**, including also a closure plate sealed into the interior of said conduit, adjacent said opening but on the side thereof away from said first-named aperture.

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HENRY S. JAUDON, Primary Examiner

U.S. Cl. X.R.

110—179; 137—557.5; 431—154