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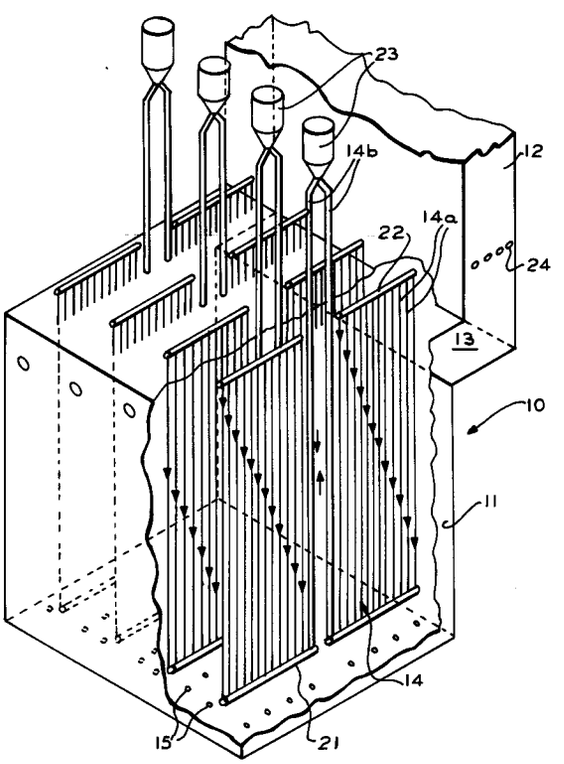
(54) Pyrolysis heater.

(57) Pyrolysis heater 10 in which vertical tubes 14 in the radiant section are provided in a plurality of parallel rows, with each row being in a plane perpendicular to a plane through the longitudinal axis of the convection section of the heater. The radiant section is preferably in the form of cube and the tubes are heated by floor burners 15 in rows parallel to the tubes.

FIG. 1



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FIELD OF THE INVENTION

This invention relates to an improved pyrolysis heater for the breaking apart of complex hydrocarbon molecules into simpler units.

PRIOR ART

An Example of a pyrolysis heater in the prior art is U.S. Patent No. 3,274,978 to E.H. Palchik et al., which includes two parallel radiant heating zones, with a single convection zone disposed above the radiant heating zones. The plurality of vertically disposed coils are heated by a plurality of vertical rows of high intensity radiant burners on each wall of the radiant heating zones.

SUMMARY OF THE INVENTION

In accordance with an aspect of the present invention, there is provided a pyrolysis heater which includes a radiant heating section and a convection heating section, positioned above and offset from the radiant heating section, which is in gas flow communication with the radiant heating section.

The radiant heating section is provided with at least two rows of vertical tubes, with the tubes in each row being in a single plane which is perpendicular to a vertical plane through the longitudinal axis of the convection section.

The radiant section is provided with radiant burners positioned in the floor thereof, with each row of tubes having one row of burners on each side of the row.

The radiant section is preferably shaped in a manner such that the width of the radiant section is substantially equal to the length of the radiant section; i.e. , the width is from 80% to 120% of the length of the radiant section and preferably 90% to 110% of the length.

In a particularly preferred embodiment, the height of the radiant section is also substantially equal to the length thereof whereby the radiant section has essentially a cube shape.

The tubes in each row may be arranged to provide one or more passes for a feed introduced into the tubes (tubes which provide one or more passes are referred to as a "coil") and each row of tubes may include one or more coils.

Thus, for example, in one embodiment, two tubes in a single row are interconnected to form two vertical passes through the radiant section (a double pass coil) and such row can include a plurality of double pass coils. Similarly three or more tubes may be interconnected to provide for three or more passes through the radiant heating section and each row may have one, two or more of such coils. In forming a coil having two or more pases, a plurality of tubes providing a first pass may be interconnected with a single tube forming a second pass.

The tubes in each row may have the same inside diameter or different inside diameters.

The coils in the radiant section are designed to provide for short residence time cracking to produce ethylene (residence time of less than 0.5 sec). In general, the residence time is not less than 0.07 second, with the coil preferably being designed for a residence time of no greater than 0.2 second.

The total length of a coil in the radiant section is generlaly at least 30 feet and generally does not exceed 80 feet and the coil may be formed from one or more tubes of a suitable length. The overall length of the coil, the inside diameter and other conditions are coordinated to provide a short residence time as hereinabove described.

In accordance with a preferred embodiment, the height of the heater (direction parallel to tubes) is from about 20 to 45 feet, with the length and width of the heater having related dimensions, as hereinabove described.

In a particularly preferred embodiment, the radiant section has at least sixteen coils therein (each coil can be formed from one, two or more tubes).

The vertical tubes used in teh pyrolysis heater generally have a nominal inside diameter of from 1" to 4" with 1" to 2" being preferred for theinlet tubes. The inside of the tubes may be smooth or may include fins. The outlet tubes of the coil can have larger diameters.

The tubes when arranged into coils for providing multiple passes can be arranged in a manner such that a plurality of tubes are each provided with feed, with such plurality of tubes providing a single pass through the radiant section and exiting into a manifold conected to a single tube of a larger diameter for providing a second pass through the radiant section.

The invention shall be further described with respect to an embodiment illustrated in the drawings wherein:

Figure 1 is a simplified schematic of a pyrolysis heater; and

Figure 2 is a simplified schematic of a single row of tubes in the pyrolysis heater.

The coil outlets are preferably connected to a suitable transfer line exchanger for rapidly cooling the effluent to below cracking temperatures.

In preferred embodiments, the temperature of the effluent withdrawn from the coils is in the order of 1400 ° F to 1750 ° F.

As known in the art, the feed to the coils is generally diluted with steam.

Referring now to the drawings, there is shown

a pyrolysis heater, generally designated as 10 comprised of a radiant section, generally designated as 11 and a convection section 12 above and laterally offset from radiant section 11 with the interior of the radiant section 11 being in gas flow communication with the convection section 12 through a horizontal passage 13.

The radiant section 11 includes a plurality of rows of vertical tubes 14, with each row of tubes 14 being in a single plane substantially perpendicular to a plane through the longitudinal axis of the convection section 12. As shown in Figure 1 there are four rows of vertical tubes 14.

The radiant section includes a plurality of radiant burners 15 which are positioned in the floor of the radiant section 11. The burners 15 are arranged in rows parallel to the rows of vertical tubes 14, and each row of tubes 14 is provided with two rows of floor burners 15 with one row of burners 15 being on each side of a row of vertical tubes 14. The burners on each side of the vertical tubes are preferably spaced from the vertical tubes by the same distance. The vertical tubes 14 in each row are interconnected to provide radiant coils for pyrolyzing a feed.

As shown in Figures 1 and 2, the tubes 14 in each row are arranged to provide two passes for each feed stream of hydrocarbon to be pyrolyzed. More particularly, a plurality of tubes 14a, in one row are connected to a horizontal manifold 21 which is connected to a vertical tube 14b having an inside diameter greater than the tubes 14a. The upper ends of tubes 14a are connected to an inlet manifold 22 for providing a hydrocarbon feed to the tubes 14a and the tops of tubes 14b are connected to a transfer line exchanger 23 for receiving pyrolysis effluent. Thus, as shown, hydrocarbon to be pyrolyzed is introduced into the tops of tubes 14a, passes downwardly through tubes 14a into manifold 21 and then upwardly through tubes 14b for introduction into a transfer line exchanger 23. As known in the art, a feed to be pyrolyzed may be preheated in convection tubes 24 located in convection section 12, with the preheated feed being introduced into tubes 14a through manifolds 22.

Thus, for example, a single row of vertical tubes may be divided into two sets of tubes, with each set forming one coil. Each coil is comprised of twelve tubes 14a providing a first pass, with each of the twelve tubes 14a being connected to a single tube 14b which provides the second pass.

In a preferred embodiment, the height, length and width of the radiant section 11 are equal to each other.

Although the heater is shown with a single radiant section the heater could be constructed with two radiant sections, each of which is in gas flow communication with the convection section.

Claims

1. A pyrolysis heater, comprising:
   a radiant section; convection section in gas flow communication with the radiant section; at least two rows of vertical tubes positioned in the radiant section, said radiant section containing at least two rows of vertical tubes being parallel to each other in a plane perpendicular to a plane through the longitudinal axis of the convection section, a plurality of radiant burners positioned in the floor of the radiant section in rows parallel to the vertical tubes, each row of vertical tubes having a first row of burners on one side of the vertical tubes and a second row of burners on a second side of the vertical tubes, said radiant section having a width which is substantially equal to the length of the radiant section.

2. The heater of Claim 1 wherein the tubes in a single row are interconnected to form a plurality of coils.

3. The heater of Claim 2 wherein the tubes in a coil have different diameters.

4. The heater of Claim 3 wherein the tubes in a coil are interconnected to provide two vertical passes through the radiant section.

5. The heater of Claim 3 wherein a coil has a length of from 30 feet to 80 feet.

6. The heater of Claim 2 wherein the height of the radiant section is substantially equal to the width thereof.

7. The heater of Claim 6 wherein a coil has a length of from 30 feet to 80 feet.

8. The heater of Claim 7 wherein the tubes in a coil are interconnected to provide two vertical passes through the radiant section.

FIG. 1

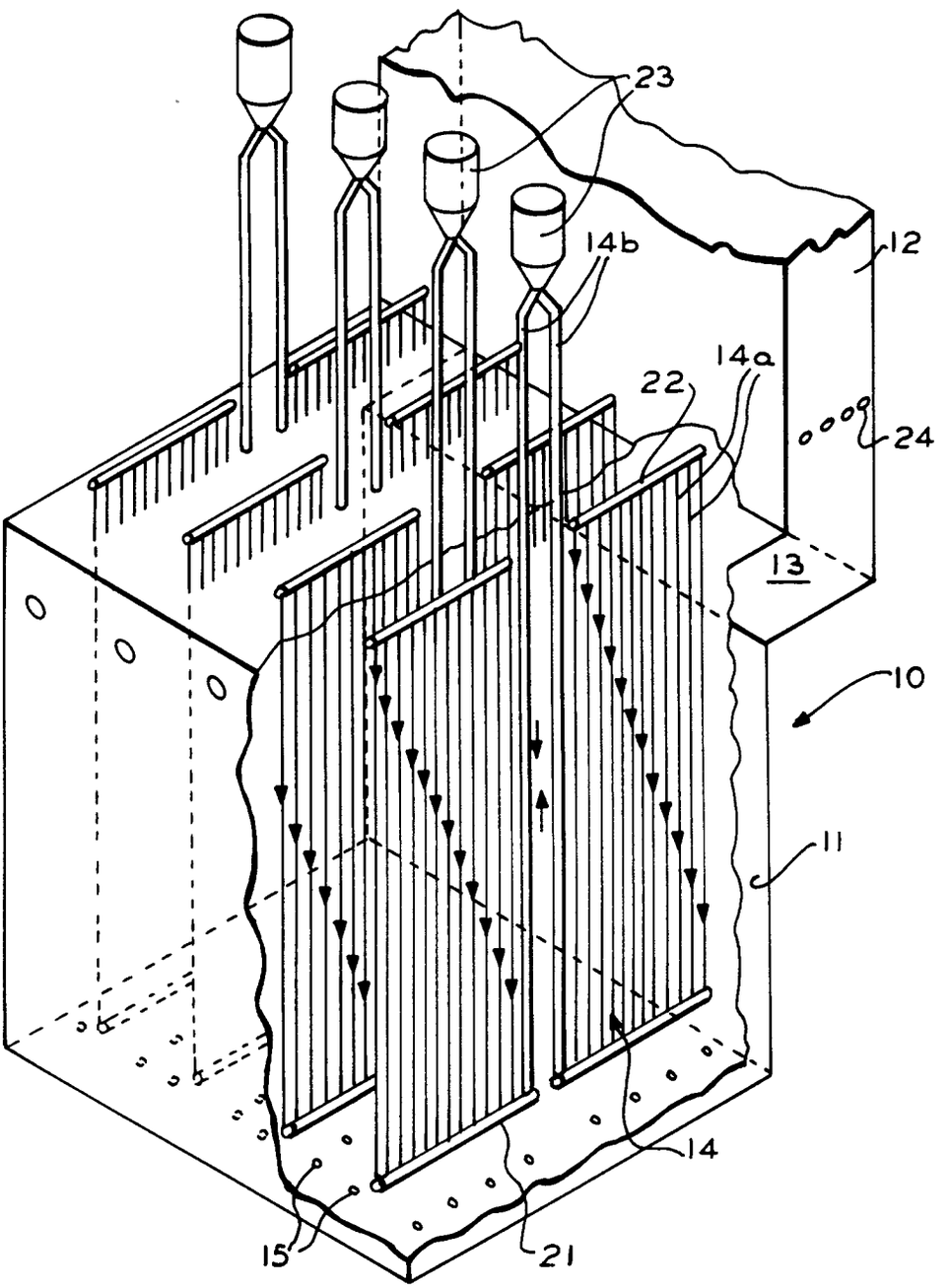
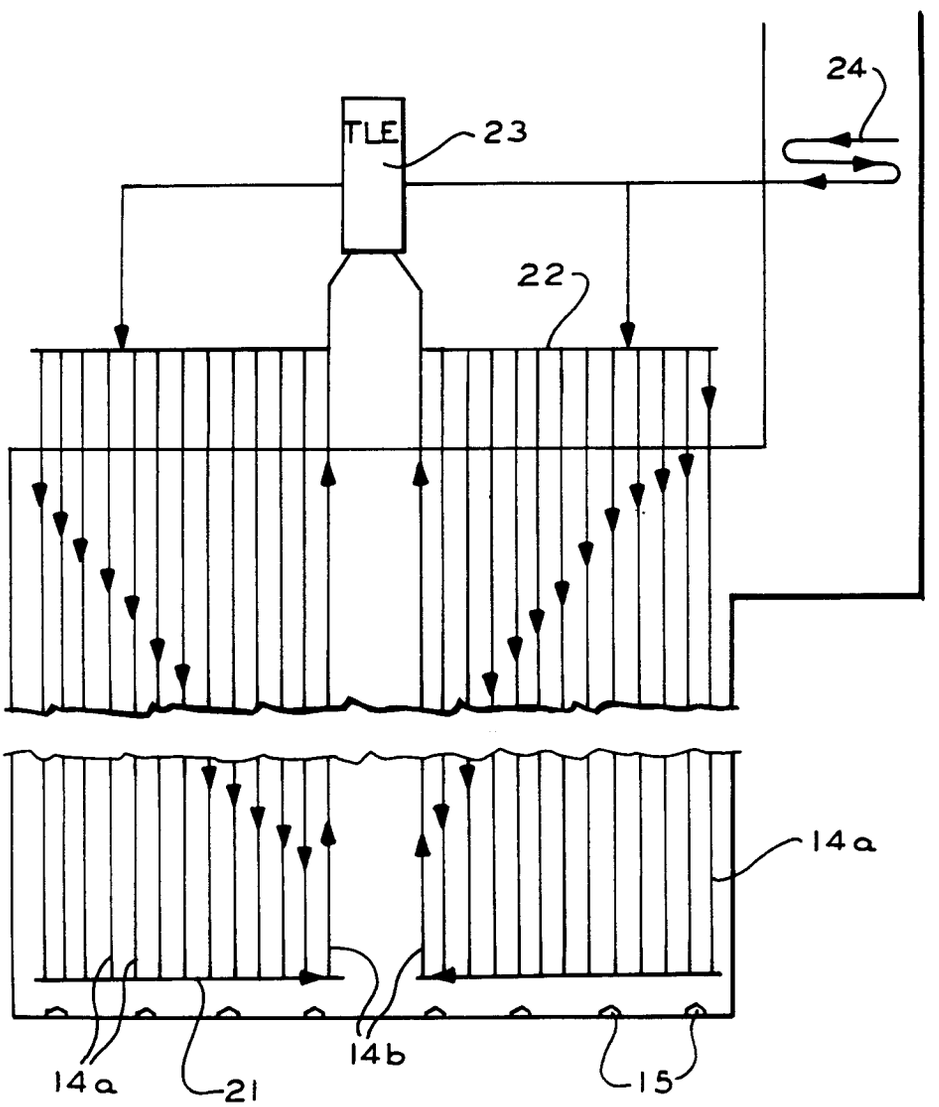


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 8658

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-3 630 850 (SHELL OIL) * claims 1-7; figures 1,3 *	1-4,8	C10G9/20
Y		5,7	
Y	EP-A-0 305 799 (LUMMUS CREST) * page 5, line 22 - page 6, line 30 *	5,7	
A	GB-A-1 194 733 (PULLMAN)		
D,A	US-A-3 274 978 (LUMMUS)		
A	EP-A-0 252 355 (NAPHTACHEMIE) * claim 1 *	3	
A	EP-A-0 252 356 (NAPHTACHEMIE) * claim 1 *	3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C10G
B01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 SEPTEMBER 1992	MICHIELS P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

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