Aug. 11, 1964 F. VOLLHARDT 3,144,080

HEAT EXCHANGER FOR THE COOLING OF FRESHLY CRACKED GASES OR THE LIKE

Filed Feb. 27, 1962

3 Sheets-Sheet 1

Fig. 1

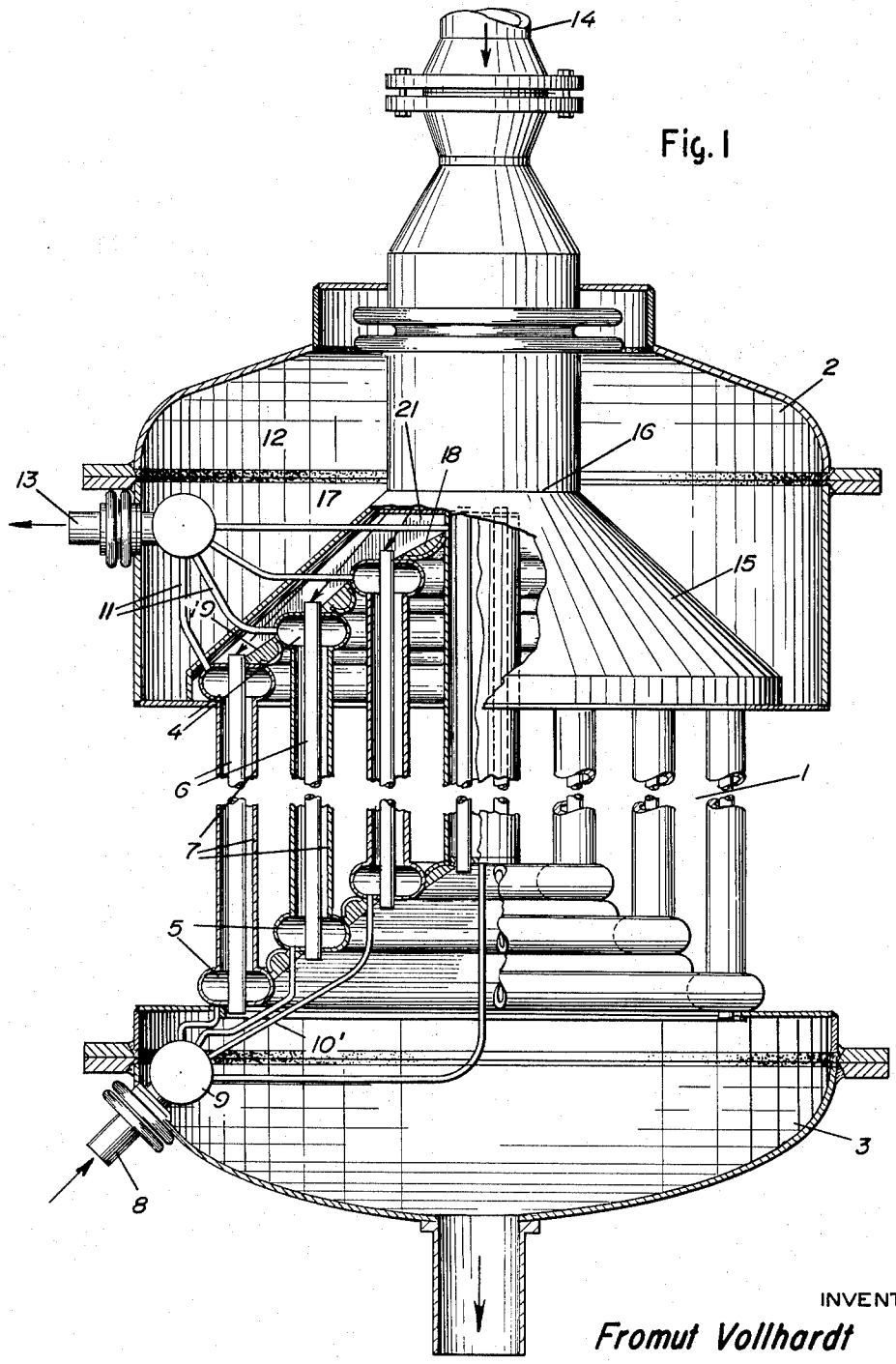

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Fig. 2

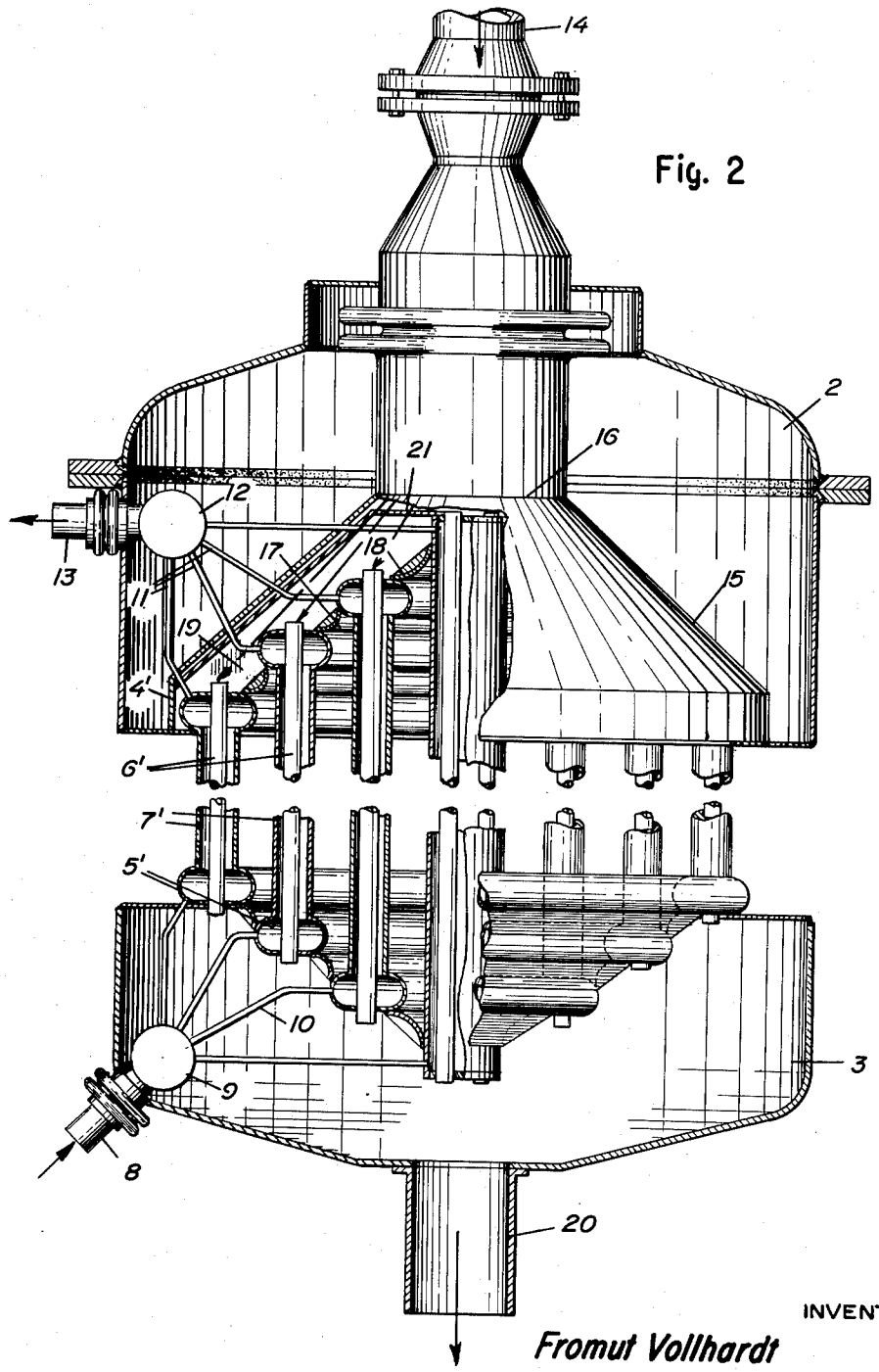

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Fig. 3

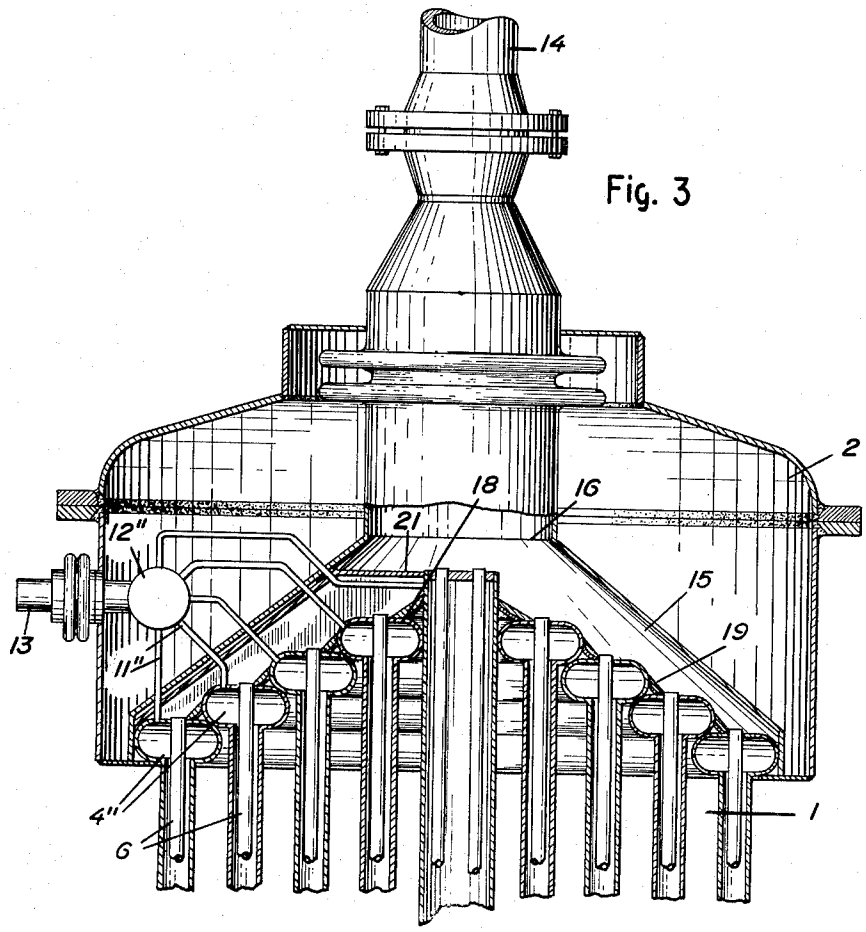
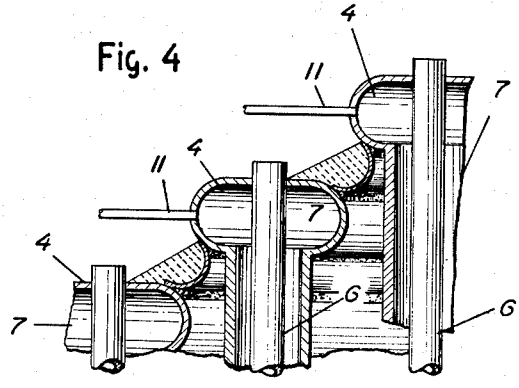


Fig. 4



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3,144,080

HEAT EXCHANGER FOR THE COOLING OF FRESHLY CRACKED GASES OR THE LIKE

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4 Claims. (Cl. 165—159)

This invention relates to a heat exchanger, in particular for the cooling of freshly cracked gases or the like, made of essentially straight pipes mounted with their ends in chambers and with heating pipes extending therethrough.

When cracked gases are cooled by means of heat exchangers or condensers of conventional structure in which the freshly cracked gas to be cooled is conducted through flues surrounded by the coolant, the flues are mounted with their ends in flat bottom plates or tube bottoms. This causes a re-combination of the cracked gases and a precipitation of coke dust from the gases begins in due course. This, in turn, leads in a short time to fouling of the flues of the condenser by the coke dust which deposits on the inner walls of the flues so that the cooling effect of the condenser soon decreases considerably, and the condenser requires cleaning. It is an object of the invention to remove this disadvantage.

It is also an object of this invention to provide a condenser for the cooling of freshly cracked gases in such a manner that the condenser can better fulfill its task of cooling taking into account the special properties of the medium to be cooled than has been the case in heat exchangers of conventional structure that have been used heretofore for this purpose.

It has been found that a reason for the rapid fouling of the flues of heat exchangers of known structure lies in the fact that the freshly cracked gas subsequent to its entry into the gas intake head of the condenser remains too long in such head before flowing off into the cooled flues, i.e. the duration for which the cracked gas remains in the gas intake head has a great influence on the beginning and the extent of the process of coke separation from the cracked gases. A further object of the invention therefore is to provide a special embodiment of the gas intake head which permits, in combination with correspondingly arranged cooling surfaces, shortening substantially the time of stay of the freshly cracked gases in the gas intake head and the flowing-off of the gases into the flues.

A still further object of the invention consists in that the chambers which are located in the condenser casing in the direction toward the gas entry port, are arranged in stepwise ascendency from the outside toward the interior, and that a guiding hood is provided in the interior of the gas intake head as a gas guiding means for feeding and distributing the gas to the flues which penetrate from the chambers outwardly. This guiding hood covers the chambers in such a manner that the wall of the guiding hood which extends from the gas entry to the lowermost chamber, forms an acute angle with the mean ascending gradient or slope of the stepwise chamber arrangement.

A still further object is to provide a structural embodiment of the gas intake head so that the cracked gas, upon its entry into the gas intake head, is forcefully guided to the flues and flows off substantially more rapidly into the latter, whereby coke dust precipitation from the gases is strongly reduced and the cooling surfaces remain clean for a much longer time than is the case in cooling with a cracked gas condenser of conventional

structure. As a consequence, the interval between two necessary cleaning operations is extraordinarily lengthened when cooling with a cracked gas condenser according to the invention.

In order to impart a certain elasticity to the cooling surface assembly of the heat exchanger, which consists of chambers, water cooling pipes and smoke flues, two successively arranged chambers are always so arranged relative to each other that an interspace is provided between them which is hermetically gas-tight sealed by means of a half of a tube such as a half-cylindrical tube section connected by welding with each of its longitudinal rims to one of the two adjacent chambers and the groove thus formed is filled with a heat-resistant plastic mass.

A further embodiment according to the invention may consist of an arrangement wherein the chambers at the gas exhaust end are disposed stepwise in the same manner as the corresponding chambers located toward the gas intake. Thereby, the advantage is obtained that the tubes connecting the chambers with each other are of equal length. An embodiment of this type thus permits a simple and inexpensive construction of the condenser.

In certain cases it can be advantageous to provide the stepwise arrangement of the chambers at the gas exhaust end in a manner opposite to that of the chambers at the gas entry end, so that the length of the tubes which interconnect the opposed chambers with each other, increases from step to step from the outside toward the interior. This measure makes it possible to offer to the core of the cracked gas flow an increased cooling surface, so that an even distribution of the cooling surface area available over the entire cross sectional area of the cracking gas stream is achieved.

The upper and the lower chambers are equipped in a known manner with feed and discharge conduits for the coolant, which end in a collector or distributor which in turn is housed in the gas intake head or the gas discharge head. The collector or distributor are, in turn, connected to feed and discharge tubes which lead out of the condenser casing.

In order to protect the discharge tube, and, as the case may be, the feed tube for the coolant against direct heating by the heating medium, it is advantageous to shield the covering hood.

An especially advantageous embodiment of the heating surface arrangement may consist in arranging two successively disposed chambers in such a manner relative to each other that the same overlap each other with their rims or edges. This construction permits a compact arrangement of the cooling surfaces, so that it becomes possible to achieve smaller building dimensions for a condenser of the same given cooling effect.

Instead of providing individual chambers it is also possible to provide a single stepped chamber at the intake and discharge ends.

With the above and other objects in view which will become apparent from the detailed description below, some preferred embodiments of the invention are shown in the drawings in which:

FIGURE 1 shows a heat exchanger in partial central longitudinal section,

FIGURE 2 shows a heat exchanger in partial central longitudinal section having a different arrangement of the chambers on the gas discharge side,

FIGURE 3 shows the head of a heat exchanger in central longitudinal section with chambers which overlap each other, and

FIGURE 4 is a view of a portion of FIGURE 1 on an enlarged scale.

The heat exchanger 1 consists of the gas intake head

2 and the gas outlet end 3. Within the gas intake head 2, the chambers 4 are disposed so that they ascend stepwise relative to each other from the outside toward the interior. They are ring-shaped and are disposed concentrically relative to each other.

The chambers 5 which are arranged at the gas discharge end 3, are connected to the chambers 4 in the gas intake head 2 by means of the internal flues 6 and the surrounding tubes 7. The coolant is fed by way of an inlet tube 8 to a distributor 9 which is arranged in the gas discharge end 3, from which distributor it is conducted via distributing conduits 10 to the individual chambers 5. The coolant rises in the annular space between the flues 6 and the surrounding tubes 7 to the chambers 4 and is conveyed by way of the discharge pipes 11 to a collector 12 which is provided in the gas intake head 2, from which collector it is discharged from the gas intake head 2 by way of the outlet tube 13.

The cracked gas to be cooled flows through the feed pipe 14 to the gas intake head 2. The guiding hood 15 serves for conveying the gas to and distributing the same over the flues 6 which extend through the chambers 4 to the outside thereof. The hood 15 covers the chambers 4 in such a manner that the wall of the guiding hood which extends from the gas entry port 16 to the lowermost chamber 4 forms an acute angle with the central ascending plane of the stepwise chamber arrangement. Every two successively disposed chambers 4 or 5 respectively, are so arranged relative to each other that an interspace or gap 17 is provided between them. This gap as shown in FIGURE 4 is sealed hermetically in a gas-tight manner by a tube half section 18 which is welded at each of its longitudinal rims to the two adjacent chambers. The groove thus formed is filled with a heat-resistant plastic mass 19. The cracked gas which flows through the flues 6 and is cooled therein, is led off at the gas discharge end 3 by way of a gas outlet tube 20 for further use.

In order to protect the discharge conduits 11 and, in given cases, also the distributing conduits 10 from direct heating by the heating medium, the same may be shielded by a covering hood 21.

In the heat exchanger shown in FIGURE 1, the stepwise arrangement of the chambers 5 at the gas discharge end 3 is the same as that of the chambers 4 which are located in the gas intake head 2. Thereby, all the tubes 6 and 7 which connect the chambers 4 and 5 with each other, are of equal length.

In the FIGURE 2, the stepwise arrangement of the chambers 5' at the gas discharge end 3 is the opposite of that of the chambers 4' at the gas intake head 2. Thereby the length of the tubes 6' and 7' which connect oppositely located chambers 4' and 5' with each other, increases step by step from the outside toward the center.

FIGURE 3 shows the arrangement of successively disposed chambers 4'' whose rim portions overlap each other. Of course, a corresponding arrangement is also to be provided at the gas discharge end (not shown). In this way, a more compact arrangement of the cooling surfaces is possible, so that smaller dimensions of the condenser can be achieved.

By cracked gases mentioned above and in the claims below, gases are understood which comprise CO, H_2 and CH_4 and which are obtained by thermal or thermal catalytic cracking of gaseous or liquid hydrocarbons such as natural gas, gasoline or oils.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the forms hereinbefore described and illustrated in the drawings being merely preferred embodiments thereof.

I claim:

1. Heat exchanger particularly for cooling cracked gases or the like comprising a gas input head having a gas inlet port, a gas discharge head having an exhaust port, cooling chambers located in said heads in stepwise ascending relationship from the outside toward the center, filling means, said chambers being located in conjunction with said filling means to form a bottom wall of said gas input head and a top wall of said gas discharge head, cooling pipes extending between said chambers in said gas input head and said gas discharge head, flue pipes located in said cooling pipes extending through said chambers connecting said gas input head to said gas discharge head, a gas guiding hood located in the interior of said gas input head, said hood extending from said gas inlet port over said flue pipes to the lowermost chamber with said hood forming an acute angle with the central ascending plane of the stepwise chamber arrangement, thus forming a wedge-shaped gas guiding chamber in said gas input head.

2. Heat exchanger according to claim 1 wherein every two adjoining chambers have a gap between them and said gaps are covered by interwelded half tubes forming grooves, and a heat-resistant plastic mass is located in said grooves.

3. Heat exchanger according to claim 1 wherein there are provided inlet and outlet conduits to said chambers which are covered by a covering hood in the area of said guiding hood respectively in the area of said gas discharge head.

4. A heat exchanger particularly for cooling cracked gases or the like comprising a gas input head having a gas inlet port, a gas discharge head having an exhaust port, cooling chambers located in said input head in stepwise ascending relationship from the outside toward the center, means between said chambers forming a bottom wall of said gas input head, cooling chambers in said discharge head, cooling pipes extending between said chambers in said inlet head and said discharge head, flue pipes for the gas located at the interior of said cooling pipes and extending through said chambers and a cone shaped guiding hood serving as a gas guiding means for feeding the gas to, and distributing the same over said flue pipes and said hood having a guide hood wall covering said chambers in said input head and extending from said gas inlet port to the lowermost chamber in said input head and forming an acute angle with the central ascending plane defining the stepwise chamber arrangement in said input head.

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