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(54) Transfer line exchanger for ethylene production plants

Wärmetauscher für Ethylenanlage

Echangeur de chaleur pour installation de production d'éthylène

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US-A- 3 114 415 **US-A- 3 367 414**
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- **PATENT ABSTRACTS OF JAPAN vol. 1998, no. 02, 30 January 1998 (1998-01-30) & JP 09 257392 A (KAWASAKI HEAVY IND LTD), 3 October 1997 (1997-10-03)**

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Description

[0001] The present invention relates to a Transfer Line Exchanger (TLE) used for cooling gasses output from furnaces of ethylene production plant furnaces, a particular type of a tube nest heat exchanger with shell under pressure and input tube plate of the thin type.

[0002] In the prior are the problems of corrosion and erosion of the input tube plate in heat exchangers with shell under pressure are well known.

[0003] In exchangers of the so-called "thin plate" type, i.e. in which the plate is realized to be relatively flexible and help internal pressure of the exchanger, to obviate this it has been proposed to arrange a plate termed "sacrificial" in front of the tube plate. The sacrificial plate thus bears the shock of the hot fluid entering the tube nest and protects the tube plate. Since the input manifold can be dismantled the sacrificial plate can be replaced when it is excessively deteriorated. Such a heat exchanger is for instance known from document WO-01/48434 A1.

[0004] The sacrificial plate must however operate under particularly hostile conditions at for example input gas temperature to the exchanger capable of reaching 850-900°C and it is important that it not undergo abnormal deterioration since its unexpected loss of efficiency could compromise the underlying tube plate.

[0005] Particularly critical use conditions prevail in thin plate heat exchanges used for cooling gasses output from furnaces of ethylene production plant furnaces commonly called Transfer Line Exchangers (TLE) where high pressure water vapor is produced on the outside of the tubes. The critical point in such exchangers is the hot tube plate and more particularly the welded jointing of the tube to the tube plate. This weld is exposed to the impact of the process gas coming out of the furnace and hence to erosion owing to the coke particles entrained at high speed by the gas. It is known that the weld and the associated thermally altered zone are much more subject to erosion than the base metal. In particular this phenomenon is magnified by the high temperatures to which the weld is exposed. In addition, due to the effect of the deposits which unavoidably form on the shell side, the welding temperature rises to set off a corrosion process.

[0006] In the prior art various types of sacrificial plate and various types of fastening of this plate have been proposed. The sacrificial plates, however they are made and fastened, are obviously members destined to deteriorate and be replaced due to their very nature. To this is added the fact that the speed of consumption of the sacrificial plate depends very much on the specific operating conditions under which the exchanger operates. Without visual inspection it is however impossible to estimate accurately when the plate has reached a condition where its replacement is advisable. Periodical opening of the exchanger and inspection of the plate are therefore necessary but involve various operational problems, plant shutdown and relatively high maintenance costs.

[0007] US 4,401,153 discloses a heat exchanger for effluent gases in ammonia production plants, wherein a nitriding-resistant cladding is applied to the tube plate to chemically protect the plate from corrosion caused by nitrogen and/or nitrogen compounds contained in the gas.

[0008] The general purpose of the present invention is to remedy the above mentioned shortcomings by making available an innovative tube plate structure in an exchanger which would allow unusual resistance and long duration of the tube plate avoiding the necessity of a sacrificial plate despite the thin tube plate.

[0009] In view of this purpose it was sought to provide in accordance with the present invention a Transfer Line Exchanger as claimed in claim 1.

[0010] To clarify the explanation of the innovative principles of the present invention and its advantages compared with the prior art there is described below with the aid of the single diagrammatic drawing annexed a possible embodiment thereof by way of non-limiting example applying said principles.

[0011] With reference to the figure, it shows diagrammatically a partially cross sectioned view of a tube nest heat exchanger indicated as a whole by reference number 10. Only in the inlet zone is it completely visible since the rest of the exchanger is virtually prior art and therefore readily imaginable by those skilled in the art.

[0012] The exchanger 10 has a shell under pressure 11 with inlet tube plate 12 separating the interior of the shell from a manifold 13 for inlet of fluid to be cooled. The tube plate 12 has passages 14 in it for communication with the interior of tubes 15 forming the tube nest.

[0013] In accordance with the present invention the tube plate has on the manifold side a hardening layer 16 made up of a welding deposit of material harder than the plate and on the opposite side a projecting neck 17 around each passage 14 on which a corresponding tube 15 of the nest is welded at a distance from the internal surface of the plate.

[0014] Advantageously the plate 12 is realized with a solid forged disk from which all the necks on which to weld the tubes are made by removal of material. Thus is obtained a very smooth surface.

[0015] The necks are sized in such a manner that the welding of the tube to the neck is located at a distance from the plate which is approximately equal to at least the thickness of the plate. The tubes are welded to the necks by the system known as 'internal bore welding'.

[0016] The weld deposit 16 covering all the surface to be protected is created with material compatible with the tube plate and with the characteristics of high resistance to the impact of the coke particles and a thermal expansion such as to have acceptable stress between the two different layers of material. The plate is made of steel lightly alloyed with molybdenum or chromo-molybdenum while the deposit is realized of nickel-chrome alloy (Alloy 625).

[0017] The deposit is used here as an anti-erosion lay-

er.

[0018] Surprisingly it was found that the combination of the layer formed from the weld deposit 16 and the high necks 17 ensures long duration of the tube plate without the need of using prior art sacrificial plates.

[0019] Thanks to the fact that the plate is thin the temperature of the plate is kept low by the cooling fluid inside the exchanger. In addition the welds of the tubes to the plate are not exposed to impact with the gases and are kept cool because they are immersed in water at a certain distance from the plate.

[0020] The completely smooth plate surface does not retain the deposits and, even with very dirty water and therefore with considerable deposits the welds are free from corrosion because they are in a zone far from the plate and not covered by the deposits.

[0021] Naturally the above description of an embodiment applying the innovative principles of the present invention is given by way of non-limiting example of said principles within the scope of the exclusive right claimed here. For example the exact conformation and sizing of the various parts can vary depending on the specific practical use requirements.

Claims

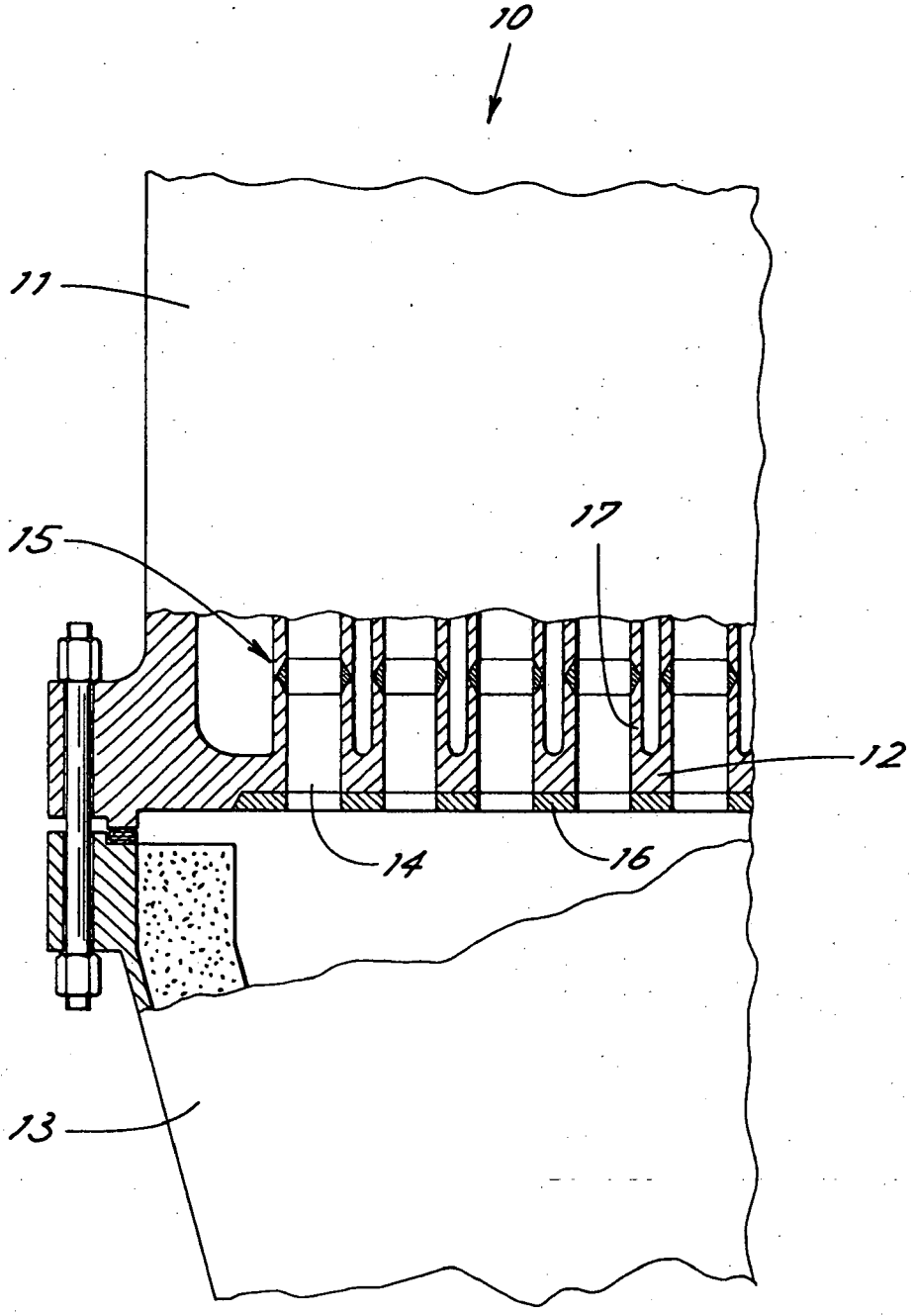
1. Transfer Line Exchanger (TLE) used for cooling gasses output from furnaces of ethylene production plant furnaces where high pressure water vapor is produced on the outside of tubes (15), with shell under pressure (11) and with an inlet tube plate (12) separating the inside of the shell (11) from an inlet manifold (13) of the fluid to be cooled, with the tube plate (12) having on the manifold side an anti-erosion layer (16) and the tube plate (12) having passages (14) in it for communication with the interior of the tubes (15) of the tube nest and around each passage (14), on the opposite side of the tube plate (12) relative to the manifold, there being a projecting neck (17) on which is welded a corresponding tube (15) of the nest, **characterized in that** the plate (12) is made of steel lightly alloyed with molybdenum or chromo-molybdenum and the anti-erosion layer (16) is made of a weld deposit of Nickel-Chrome Alloy 625, harder than the plate (12), and **in that** the tubes (15) are welded to the respective necks (17) by means of an "internal bore welding" at a distance from the plate surface which is approximately equal to at least the thickness of the plate.

Patentansprüche

1. Wärmetauscher (TLE) für den Auslass von Kühlgasen aus Öfen von Anlagen für die Ethylenherstellung, in denen Hochdruckwasserdampf außerhalb von Rohren (15) erzeugt wird, mit einem unter Druck stehenden Behälter (11) und einer Einlassrohrplatte (12), die das Innere des Behälters (11) von einem Einlasssammelrohr (13) der zu kühlenden Flüssigkeit trennt, wobei die Rohrplatte (12) auf der Sammelrohrseite eine Erosionsschutzbeschichtung (16) besitzt und die Rohrplatte (12) Durchgänge (14) für die Verbindung mit dem Inneren der Rohre (15) des Rohrbündels und um jeden Durchgang (14) herum besitzt, wobei auf der in Bezug auf das Sammelrohr gegenüberliegenden Seite der Rohrplatte (12) ein auskragender Hals (17) vorhanden ist, auf dem ein entsprechendes Rohr (15) des Bündels angeschweißt ist, **dadurch gekennzeichnet, dass** die Platte (12) aus einem leicht mit Molybdän oder Chrom-Molybdän legierten Stahl hergestellt ist und die Erosionsschutzbeschichtung (16) aus einem Schweißgut aus Nickel-Chrom-Legierung 625 besteht, die härter als die Platte (12) ist, und die Rohre (15) mittels "internem Bohrschweißen" in einem Abstand von der Plattenoberfläche an die jeweiligen Hälse (17) angeschweißt sind, der ungefähr mindestens der Dicke der Platte entspricht.

Revendications

1. Echangeur de chaleur (TLE) utilisé pour refroidir les gaz émis à partir des fours d'installations de production d'éthylène où de la vapeur d'eau sous haute pression est produite à l'extérieur de tuyaux (15), avec enveloppe sous pression (11) et avec une plaque tubulaire d'entrée (12) séparant l'intérieur de l'enveloppe (11) d'un collecteur d'entrée (13) du fluide à refroidir, avec la plaque tubulaire (12) ayant sur le côté du collecteur une couche anti-érosion (16) et la plaque tubulaire (12) ayant des passages (14) en elle pour la communication avec l'intérieur des tuyaux (15) du faisceau tubulaire et autour de chaque passage (14), sur le côté opposé de la plaque tubulaire (12) par rapport au collecteur, un col saillant (17) s'y trouvant sur lequel est soudé un tuyau correspondant (15) du faisceau, **caractérisé en ce que** la plaque (12) est faite d'acier faiblement allié avec du molybdène ou chromo-molybdène, et la couche anti-érosion (16) est faite d'un dépôt de soudure d'alliage Nickel-Chrome 625, plus dur que la plaque (12), et **en ce que** les tuyaux (15) sont soudés aux cols respectifs (17) au moyen d'une « soudure d'alésage interne » à une distance de la surface de la plaque qui est approximativement égale à au moins l'épaisseur de la plaque.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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0148434 A1 **[0003]**
- US 4401153 A **[0007]**