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(72) Inventors:
• Dutescu, Cornel
2200 Brasov (RO)
• Filip, Tiberiu
2200 Brasov (RO)
• Marcu, Vasile
2200 Brasov (RO)
• Dutescu, Galin
2200 Brasov (RO)
• Ursu, Cornel
2200 Brasov (RO)
• Versteeg, Gijsbert
NL-8071 CK Nunspeet (NL)

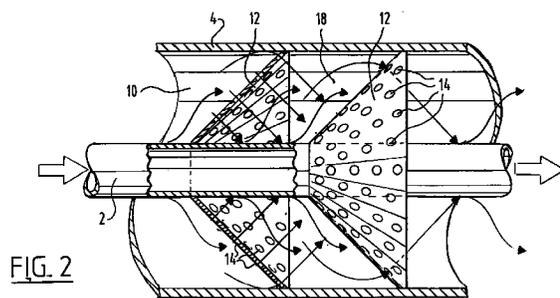
(71) Applicants:
• Dutescu, Cornel
2200 Brasov (RO)
• Filip, Tiberiu
2200 Brasov (RO)
• Marcu, Vasile
2200 Brasov (RO)
• Dutescu, Galin
2200 Brasov (RO)
• Ursu, Cornel
2200 Brasov (RO)
• Versteeg, Gijsbert
NL-8071 CK Nunspeet (NL)

(74) Representative:
Land, Addick Adrianus Gosling
Arnold & Siedsma,
Advocaten en Octrooigemachtigden,
Sweelinckplein 1
2517 GK Den Haag (NL)

(54) Turbulator for a concentric-tube heat exchanger

(57) The invention relates to a heat transfer system for transferring heat from a primary fluid, such as gas yielded from the gassification of solid waste into a secondary fluid, said system comprising:

- a pipeline for transporting the primary fluid;
- a tube arranged around the pipeline to yield an annular space between the pipeline and the tube for transferring the secondary fluid, so that this secondary fluid comes into contact with the pipeline for transporting the primary fluid, said tube having an inlet wherethrough the secondary fluid is admitted into the tube, and an outlet wherethrough the secondary fluid is emitted from the tube; and
- deflection means arranged in the annular space between the pipeline and the tube for deflecting the secondary fluid between the pipeline and the tube and vice versa, during the secondary fluid's passage between the inlet and outlet of tube.



Description

The present invention relates to a heat transfer system, to a heat transfer assembly and to a process for transferring heat.

The transfer of heat into fluids flowing over hot surfaces is a known phenomenon.

This phenomenon is used in heat transfer systems.

In many heat transfer systems, the radial heat stored on surface bodies such as flue gas ducts, exhaust tubes and the like, is removed by process fluids, which pass over these surfaces.

An object of the present invention is to provide a heat transfer system.

According to the present invention there is provided a heat transfer system for transferring heat from a primary fluid, such as gas yielded from the gassification of solid waste into a secondary fluid, said system comprising:

- a pipeline for transporting the primary fluid;
- a tube arranged around the pipeline to yield an annular space between the pipeline and the tube for transferring the secondary fluid, so that this secondary fluid comes into contact with the pipeline for transporting the primary fluid, said tube having an inlet wherethrough the secondary fluid is admitted into the tube, and an outlet wherethrough the secondary fluid is emitted from the tube; and
- deflection means arranged in the annular space between the pipeline and the tube for deflecting the secondary fluid between the pipeline and the tube and vice versa, during the secondary fluid's passage between the inlet and outlet of tube.

Since the secondary fluid does not simply flow straight from the inlet, through the annular space flow passage created by the tube and the pipeline, and out of the outlet, but is rather deflected along this flow-passage, the distance that a secondary fluid particle, such as a gas particle, has to travel between the inlet and the outlet is increased.

Accordingly the residence time of a secondary fluid particle in the tube is increased, for example by a factor of upto 3 to 4 compared with known heat transfer systems. The deflection of the secondary fluid towards the hot pipeline furthermore substantially eliminates the possibility of the existence of a stationary secondary fluid film on the hot pipeline, so that a very efficient heat transfer is yielded.

The deflection means preferably comprise one or more cone-like elements which preferably in turn are provided with one or more openings extending there-through.

On travelling through the annular space created by the tube and the pipeline, the cone-like elements deflect the secondary fluid, the openings on the cone splitting the secondary fluid into elementary streams. In this

manner the cone-like elements and their openings provide an extended heat transfer area for the secondary fluid, the cone-like elements receiving radiant heat from the hot pipeline. The cone-like form of the deflection means ensure that these cone-like elements receive optimum radiant heat being emitted from the hot pipeline.

The cone-like deflection means are preferably regularly spaced apart in the annular space between the pipeline and the tube. Accordingly the secondary fluid is forced to reside for periods of up to seconds inside chamber-like spaces created by adjacent cone-like elements and the respective segments of the tube and pipeline whereby a very good heat transfer is yielded.

In order to maximize heat transfer, the pipeline is preferably made from a heat resistant alloy and the tube is preferably provided with a layer of insulation around its outer surface.

The invention also relates to a heat transfer assembly for arranging around a pre-existing hot fluid transfer pipeline, said assembly comprising a fluid transfer tube with a fluid inlet and fluid outlet and deflection means, for arranging around a pre-existing hot fluid transfer pipeline.

Accordingly the benefits to be obtained from the present invention can also be obtained by arranging the assembly according to the present invention around hot fluid transfer pipelines already in place, such as flue ducts, in waste incinerating plants. Furthermore in the situation when hot fluids are needed but there is no waste heat available and a burner is used to yield the required hot fluid, the present invention can be used to provide the advantage of good heat transfer, whereby a relatively low burner fuel consumption and lower quantities of heat being discharged into the atmosphere are accompanying benefits.

Furthermore the present invention relates to a process for transferring heat to a fluid, comprising directing said fluid through an annular space created between a heat fluid transfer pipeline and a tube arranged there about, wherein the passage of the fluid through the tube is deflected, so that the fluid travels in a substantially zigzag manner through this annular space.

Since less plant space can be used for transferring heat utilizing the system according to the present invention, lower investment results. The secondary fluid can be air, water or steam for example, whereby the primary gas can be gas produced through pyrolysis and/or gas-sification of solid waste for example.

The invention will now be described by way of the following description and experimental results which refer to the figures 1 and 2, wherein

- figure 1 shows a cut away side view of the system according to the present invention, and
- figure 2 shows an enlarged side view of a section of figure 1.

A system 1 (figure 1) of the invention comprises a pipeline 2 and a tube 4 mounted thereabout. The tube 4 is equipped with an inlet 6 and an outlet 8. Since both the pipeline 2 and the tube 4 are circular in section, an annular space 10 is created between the tube 4 and the pipeline 2.

Both the pipeline 2 and the tube 4 are preferably made of metal, whereby the pipeline 2 is preferably made from a heat resistant alloy and is preferably completely sealed off from the annular space 10 in order to provide good heat transfer characteristics and to ensure that no mixing can occur between the fluids in respectively the pipeline 2 and the tube 4.

A plurality of metallic deflection cone-like elements 12 are attached to the pipeline 2 and extend out towards the inner surface of the tube (see also figure 2). These deflection cone-like elements 12 are provided with openings 14.

A layer of insulation 16 is provided on the outer surface of the tube 4.

In use, hot primary fluid, such as flue gas from waste incinerating plants and the like is transported through the pipeline 2.

A secondary fluid is fed into the tube 4 through the inlet 6 to flow through the annular space 10, before exiting the tube 4 through the outlet 8.

On entering the annular space 10 the secondary fluid is forced through the openings of the first cone and directed into a first chamber 18, created by the outer surface of the pipeline 2, the inner surface of the tube 4 and the inclined surface of the first cone, and against the hot pipeline 2.

The secondary fluid is then deflected upwards on the inclined surface of the subsequent cone, whereby the fluid will again pass through the openings thereof to be deflected in a zigzag manner through the chambers 18 of the annular passage 10.

The invention is not limited to the above embodiment, the requested rights being determined by the claims.

Claims

1. Heat transfer system for transferring heat from a primary fluid, such as gas yielded from the gassification of solid waste into a secondary fluid, said system comprising:
 - a pipeline for transporting the primary fluid;
 - a tube arranged around the pipeline to yield an annular space between the pipeline and the tube for transferring the secondary fluid, so that this secondary fluid comes into contact with the pipeline for transporting the primary fluid, said tube having an inlet wherethrough the secondary fluid is admitted into the tube, and an outlet wherethrough the secondary fluid is emitted from the tube; and
 - deflection means arranged in the annular space between the pipeline and the tube for deflecting the secondary fluid between the pipeline and the tube and vice versa, during the secondary fluid's passage between the inlet and outlet of tube.
2. System according to claim 1, wherein the deflection means comprise one or more openings extending therethrough.
3. System according to claim 1 or 2, wherein the deflection means comprise one or more cone-like elements.
4. System according to any of the previous claims, wherein the deflection means are regularly spaced apart.
5. System according to claim 4, wherein an inclined edge of the cone-like elements is arranged in the system to face the secondary fluid inlet.
6. System according to any of the previous claims, wherein the pipeline is made from a heat resistant alloy.
7. System according to any of the previous claims, wherein the tube is provided with a layer of insulation around its outer surface.
8. System according to any of the previous claims further comprising a burner.
9. Heat transfer assembly said assembly, comprising a fluid transfer tube, having a cold fluid inlet and a hot fluid outlet and deflection means, for arranging around a pre-existing hot fluid transfer pipeline.
10. Process for transferring heat to a fluid, comprising directing said fluid through an annular space created between a heat fluid transfer pipeline and a tube arranged there about, wherein the passage of the fluid through the tube is deflected, so that the fluid travels in a substantially zigzag manner through this annular space.
11. Process according to claim 10, carried out in a system according to the claims 1-8 or an assembly according to claim 9.
12. Use of a system according to any of the claims 1-8 for transferring heat into a fluid.
13. Use of an assembly according to claim 9 for transferring heat into a fluid.

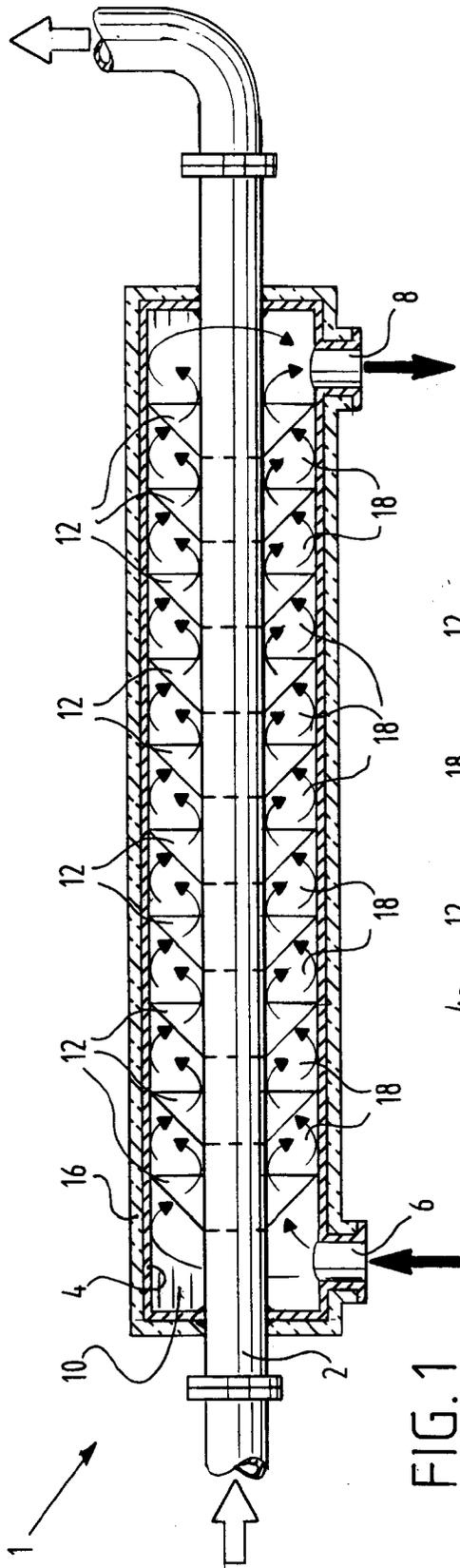


FIG. 1

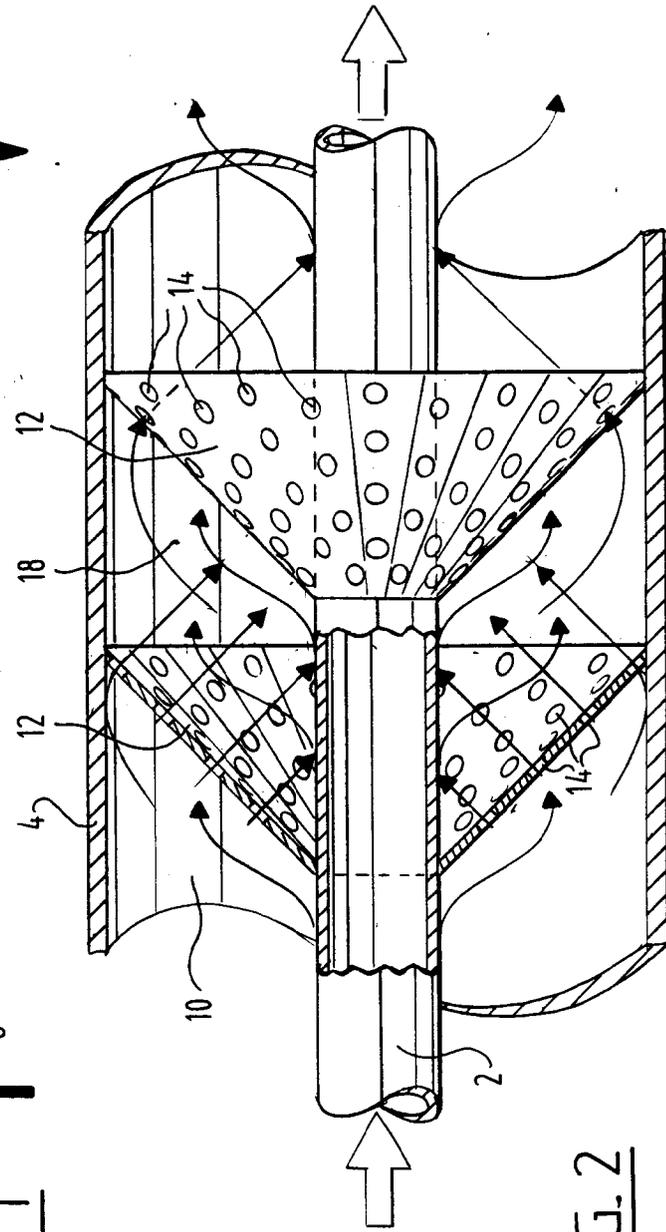


FIG. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 2219

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.6)
X	US 2 549 687 A (DURIRON CO.) 17 April 1951 * column 3, line 74 - column 4, line 12; figures 1-3 *	1,2,4,9, 10	F28F13/12
X	GB 2 059 042 A (DUNHAM BUSH INC) 15 April 1981 * page 1, line 130 - page 2, line 110; figures 1,2 *	1,2	
A	US 4 794 980 A (RAISANEN NIILLO A A) 3 January 1989 * column 5, line 11 - line 26; figures 2,3 *	3	
A	EP 0 030 483 A (COMMISSARIAT ENERGIE ATOMIQUE) 17 June 1981 * abstract; figure 2 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F28F
Place of search	Date of completion of the search	Examiner	
THE HAGUE	13 December 1996	Zaegel, B	
CATEGORY OF CITED DOCUMENTS		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 L : document cited for other reasons & : member of the same patent family, corresponding document	
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